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Development of a Multivariate Representative Human Model Generation Method for Anthropometric Design

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by

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ABSTRACT

Multivariate generation methods of representative human models (RHMs) that accommodate a designated percentage of the target population have been developed using data reduction techniques such as factor analysis and principal component analysis. These data reduction techniques reduce an original set of anthropometric dimensions to a smaller set while accounting for most of the variability of body sizes, say 80%. Although this distillation of anthropometric information effectively simplifies a process of RHM generation, it can reduce the validity of generated RHMs due to the unexplained variability of body sizes, say 20%.

The present study is intended to develop a novel RHM-generation method which better form a representative group of human models for a designated percentage of the target population. The specific objectives of the study include (1) developing a multivariate evaluation protocol, (2) analyzing the characteristics of existing RHM generation methods, (3) developing a new RHM generation method, and (4) evaluating the performances of the RHM generation methods in ergonomic design of a computer workstation.

First, a multivariate evaluation protocol was developed to examine the performance of a RHM generation method in a quantitative manner. The proposed evaluation protocol consists of (1) preparing anthropometric data, (2) selecting anthropometric dimensions, (3) generating RHMs by a RHM generation method, and (4) analyzing the performance of the generated RHMs. The evaluation protocol is used to analyze the performance of a RHM generation method in terms of statistical representativeness and applicability of generated RHMs.

Second, the characteristics and performances of existing RHM generation methods

(square, circular, and rectangular boundary methods) were investigated. Based on a comprehensive literature survey of RHM generation methods, unique features such as design application area and shape of accommodation envelope were identified for each method. In addition, the performances of the existing methods were compared using the proposed multivariate evaluation protocol, and factors affecting their performances were examined.

Third, a new RHM generation method, termed as boundary zone (BZ) method, was developed and its performance was evaluated. The BZ method consists of (1) forming a BZ that accommodates a designated percentage (say, 90%) of the population using normalized squared distance and (2) performing cluster analysis on the cases within the BZ to reduce the number of RHMs generated. The performance analysis showed that the multivariate accommodation percentage (MAP) of the BZ method (91%) was closest to the designated accommodation percentage while those of the existing methods showed relatively large deviations (49% for square method, 76% for circular method, and 96% for rectangular method).

Lastly, the BZ method was evaluated in the design context of a computer workstation together with the existing RHM-generation methods. A computer workstation design was prepared by applying each RHM generation method by following a custom workstation design process. The accommodation performances of the computer workstations were compared, and factors affecting the performances were investigated by multiple regression analysis. The evaluation results showed that the MAP of the BZ method (89%) closely achieved the target percentage (90%) and that those of the existing RHM generation methods (25% percentile method, 33% for square method, 63% for circular method, and 80% for rectangular method) were significantly less than the target percentage because some of the body size variability is ignored in the generation of RHMs.

The present study is of significance by identifying the characteristics and limitations of the existing RHM generation methods and developing the BZ method which overcome the identified limitations by.

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Chapter 1
INTRODUCTION

1.1. Problem statement

A small group of human models representing the target population is used for the ergonomic design and evaluation of products and workstations in a digital environment. Representative human models (RHMs) are a small group of shapes that represent the body size characteristics of a designated percentage (e.g., 90%) of the target population (HFES 300, 2004). Use of RHMs provides designers with an efficient way to apply the body size characteristics of the target population to product design and evaluation (Jung et al., 2008a). For example, You et al. (1997) evaluated the layout design of bus operator's workstation using a small group of percentile RHMs (5^{th}, 50^{th}, and 95^{th} percentiles) in terms of posture, visibility, and reach.

Percentile RHMs, one class of traditional RHMs, are generated from univariate percentiles of specified human dimensions; therefore, those RHMs are not appropriate to represent the body sizes of the target population in multivariate design problems. The body sizes of a percentile RHM are determined as the percentile values of each anthropometric dimension under consideration (HFES 300, 2004). Hence, univariate percentages accommodated by the percentile RHM meet the target percentage in that dimension. However, multivariate accommodation percentage may not meet the target percentage (Roebuck et al., 1975; Porter et al., 2004). For example, in design of bus doors for US populations, a 95^{th} percentile RHM (stature = 183.8 cm, bideltoid breadth = 41.8 cm) is used to design the height and width of the door to accommodate 95% of the population. The univariate accommodation percentages for the two dimensions both meet the designated percentage (95%); but, the bivariate accommodation percentage—the proportion of people who are smaller than the 95^{th} percentile RHM in both dimensions—is only 91.8%, which doesn't meet the target percentage. The bivariate percentage indicates that 91.8% of US populations, which is smaller than the target percentage, can appropriately use the bus doors without bending and twisting their body.

To overcome the multivariate accommodation problem in anthropometric product design, several multivariate RHM-generation methods have been developed using data reduction techniques such as Factor Analysis and Principal Component Analysis. Bittner et al. (1987) and Bittner (2000) created a 17-member set of RHMs (called CADRE) for workstation design by applying a three-step process (Figure 1.1). In the first step, the anthropometric dimensions of interest were reduced to a small number of factors (e.g., 2 ~ 3) by the statistical technique of Factor Analysis. The factors extracted in Bittner et al. (1987) explained about 75% of the total variability. In the second step, factor scores, the locations of RHMs in the space defined by the factors, were determined as the centroid and corners of a square (or cubic) boundary defined in the space of the factors. In the last step, the factor scores of RHMs were converted into the body sizes of RHMs by multiplying the factor scores by the factor loadings of Factor Analysis. Kim and Whang (1997) generated a 17-member RHM using the same process as Bittner et al. (1987), except that the boundary defined in the space of the factors was a rectangle (or prism). Meindl et al. (1993) and Hudson et al. (2006) used Principal Component Analysis (PCA) in process similar to that of Bittner et al. (1987) to generate a small number of RHMs (8 to 24) at a circular boundary formed in the space of components. Meindl et al. (1993) selected components having eigen values greater than 1 to explain about 85% of the total variability.

The existing multivariate RHM-generation methods using data reduction techniques have four limitations in their abilities to represent multivariate population. First, although data reduction techniques greatly simplify the process of generating RHMs by efficiently reducing the original set of data to a smaller set while accounting for most of the body size variability (e.g., 80%), this information distillation ignores some (e.g., 20%) of the body size variability. Therefore, the data reduction may cause a difference between the achieved accommodation percentage and targeted accommodation percentage (Meunier, 1998).

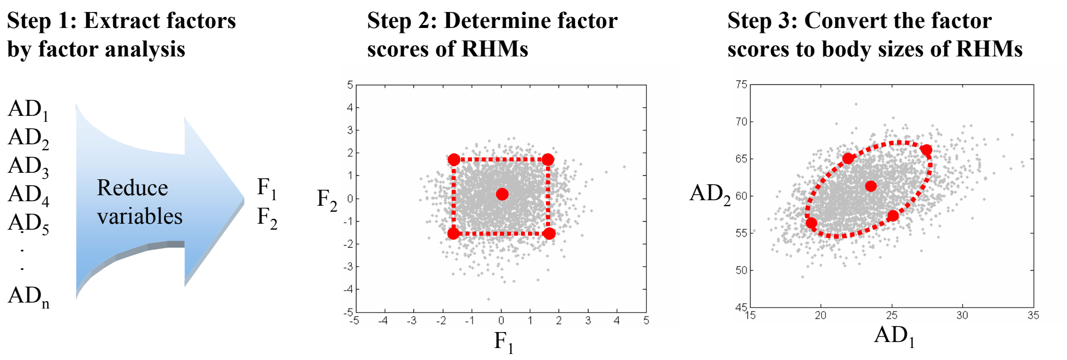


Figure 1.1. An RHM-generation process using Factor Analysis
(AD: anthropometric dimension, F: factor, n: number of anthropometric dimensions; small dot: target population, large dot: RHM)

Second, the data reduction techniques are limited to use when the anthropometric dimensions under consideration have low correlations. The number of factors (or components) extracted from anthropometric dimensions having low correlations is too large to take advantage of the data reduction techniques, because data reduction techniques group correlated dimensions together and separate them from other dimensions with low correlation (Hudson et al., 2006). In addition, conversion from the factor scores defined in the space of the factors to actual body sizes may cause estimation error if the correlations between the factors and anthropometric dimensions are low (Meunier, 1998).

Third, missing zones, nonexistent area of RHMs, occur along a boundary defined in the space of the factors (Figure 1.2). The existing multivariate RHM-generation methods seem to imply that satisfying the equidistant boundary points in the space of the factors should guarantee accommodation of the designated percentage of the population. However, Hendy (1990) showed that the combinations of eye height and functional reach are important in reaching a cockpit panel. Therefore, the missing zones along the boundary should be avoided to appropriately apply the size combinations of the dimensions in anthropometric design (Meunier, 1998).

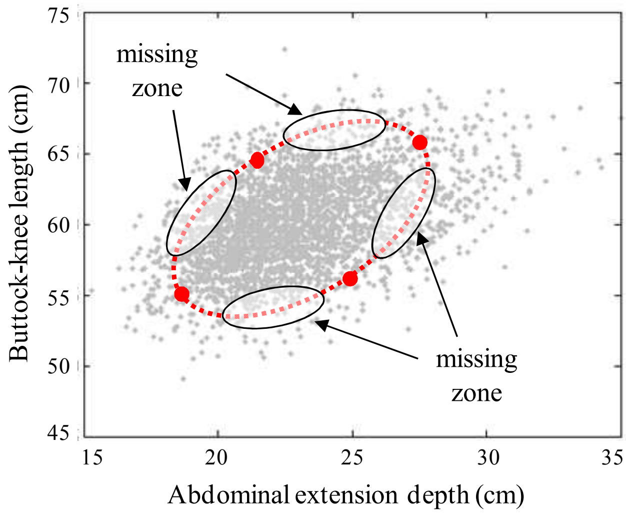


Figure 1.2. Illustration of missing zone of the existing multivariate RHM-generation methods

Finally, a comprehensive evaluation study is insufficient to compare and understand the performances of the existing multivariate RHM-generation methods. Univariate percentile ranges of RHMs were less than 90% for three of nineteen anthropometric dimensions in Bittner et al. (1987) and less than 90% for one anthropometric dimension in Bittner (2000). Meunier (1998) evaluated the multivariate accommodation performance of Meindl et al. (1993) for six anthropometric dimensions and found that the calculated accommodation percentages (39%, 59%, and 86%) were lower than the target percentages (90%, 95%, and 99%). Although previous studies evaluated the performances of existing RHM-generation methods, comprehensive comparison can't be made because of differences in evaluation conditions and dimensions used.

1.2. Research objectives

The present study is intended to develop and evaluate a new multivariate method of generating RHMs that statistically represent the body sizes of a designated percentage of the target population. The new RHM-generation method is developed based on an in-depth analysis of the characteristics and accommodation performances of the existing RHM-generation methods. Next, the new method and the existing methods are evaluated by applying them to ergonomic design of computer workstation. To achieve the study goal, this study had four detailed objectives.

The first objective is to develop a multivariate evaluation protocol to evaluate the performances of the multivariate RHM-generation methods. The evaluation protocol consists of a four-step process and includes evaluation measures to comprehensively investigate the performances. In the present study, this protocol is used to evaluate the new method and existing methods of generating RHMs.

The second objective is to investigate the characteristics and performances of the existing RHM-generation methods by a comprehensive literature survey and multivariate performance evaluation using the evaluation protocol developed in the present study. Based on the comprehensive literature survey, the characteristics of existing RHM-generation methods are examined; these factors include unique features and classification taxonomy. Next, the performances of the existing methods identified by the literature review are evaluated by applying the multivariate evaluation protocol. Finally, the characteristics of the existing methods that affect their accommodation performances are investigated using multiple regression analysis.

The third objective is to develop and evaluate a new method of generating RHMs at a boundary zone, which statistically accommodates a designated percentage of the population. To overcome the limitations of the existing RHM-generation methods, the new RHM-generation method uses normalized squared distance to identify the boundary that accommodates a designated percentage in-stead of data reduction techniques such as Factor Analysis. To investigate the new RHM-generation method, the performance of the new method is evaluated by applying the multivariate evaluation protocol and compared with those of the existing methods.

The fourth objective is to compare the performances of the proposed RHM-generation method and the existing RHM-generation methods in ergonomic design of a computer workstation. To evaluate the performances of the new RHM-generation method in ergonomic design, design values for a computer workstation are determined by an anthropometric design process developed by adapting previous design processes (HFES 300, 2004; ANSI, 2007; You et al., 1997). The performances of the new and existing RHM-generation methods are compared and some factors affecting the performances are investigated using multiple regression analysis.

1.3. Significance of the study

The present study has four significant of theoretical and practical aspects. First, the multivariate evaluation protocol developed in the present study can be used to evaluate the performances of the existing RHM-generation methods and new RHM-generation methods. In addition, the evaluation results for existing RHM-generation methods can be usefully utilized when an anthropometric designer selects an appropriate RHM-generation method to fit the design problem of interest.

Second, the characteristic information identified by a comprehensive literature review on the existing RHM-generation methods is helpful to understand the state of the art of the multivariate RHM-generation methods. Because studies on the characteristics of the existing RHM-generation methods are limited, anthropometric designers have encountered difficulties in understanding and selecting an RHM-generation method that is appropriate to a specific design problem. Therefore, the characteristic information such as classification taxonomy of the existing RHM-generation methods can be used when anthropometric designers understand the existing methods.

Third, the new RHM-generation method developed in the present study theoretically overcomes the limitations of the existing RHM-generation methods. The new method can generate a small group of RHMs that are statistically representative of the multidimensional body size characteristics of a designated percentage of the target population without using data reduction techniques, which are the limitation of the existing methods. Therefore, the new method theoretically solves the limitations of the existing methods and also contributes to developing products which better fit the target population.

Lastly, the anthropometric design process can be used for anthropometric product design of workstations such as passenger car interiors and airplane cockpits. The present study develops the anthropometric design process by integrating and modifying previous anthropometric design processes. Although the anthropometric design process proposed in the present study was used for the design of computer workstations, it can be applied to various kinds of workstation design to achieve better fit of the product to the target users.

1.4. Organization of the dissertation

The remainder of this dissertation is organized into seven chapters and three appendices. Chapter 2 reviews literature that is relevant to the present study, including RHM-generation methods and anthropometric design processes. Chapter 3 describes the multivariate evaluation protocol developed in the present study to evaluate the performance of RHM-generation methods. Chapter 4 provides the characteristics and performance information of the existing RHM-generation methods identified by applying the multivariate evaluation protocol. Chapter 5 proposes a new RHM-generation method that overcomes the limitations of the existing methods. Chapter 6 describes application of anthropometric product design process and provides the evaluation results on the new and existing RHM-generation methods in ergonomic design. Chapter 7 discusses the effectiveness and limitations of the present study and suggests an agenda for future studies. Chapter 8 presents concluding remarks. Appendix A includes the body-size information of the new and existing RHM-generation methods. Appendix B includes MATLAB codes for the generation of RHMs. Appendix C includes Visual Basic code for the design of the computer workstation.

Chapter 2
LITERATURE REVIEW

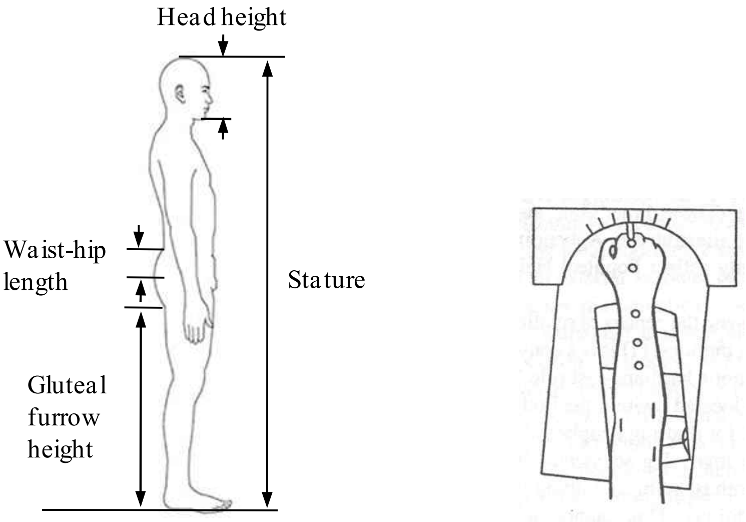
2.1. Anthropometry

2.1.1. Anthropometric measurement

Anthropometry (Geek: *anthropos*, man and *metrikos*, to measure) is the measurement of human bodies to understand the physical characteristics of humans and to design consumer products and workspaces that are better fitted to users (Wickens et al., 2004; HFES 300, 2003; Grandjean, 1988). Anthropometric measurements are usually taken for large number of anthropometric dimensions. For example, Gordon et al. (1988) took the measurements of 132 anthropometric dimensions of the US Army, and SizeKorea (2004) measured 359 anthropometric dimensions of Koreans civilians in SizeKorea anthropometry project.

Depending on measurement posture, anthropometric dimensions are divided into static or dynamic dimension (Figure 2.1) (Sanders and McCormick, 1992; Wickens et al., 2004). Static dimensions such as stature and gluteal furrow height are measured while subjects maintain standard measurement postures. These measurements are useful to understand the range of human body sizes. Dynamic dimensions such as the range of wrist motion are measured while the body part related to the measurement is moving. These measurements are useful to understand the movement characteristics of human bodies.

To standardize the measurement protocol, static dimensions are measured while the subjects are in standard standing or sitting postures (Gordon et al., 1998). The standard standing posture is that a participant stands erect with the heels together, holds the truck vertical, relaxes the arms, and keeps the Frankfurt plane parallel to the ground. The Frankfurt plane is defined as the plane including the orbitale and the upper edge of



(a) static dimension (b) dynamic dimension

Figure 2.1. Examples of anthropometric dimensions

tragions (Figure 2.2) (Wikipedia, 2008b; AIST, 2008); this Frankfurt plane is approximately parallel to the ground when a participant looks forward (Wikipedia, 2008b). The standard sitting posture is that a participant is seated with feet flat on the ground, and knee joints flexed at 90° with upper legs parallel to the ground, the truck vertical, and the Frankfurt plane parallel to the ground.

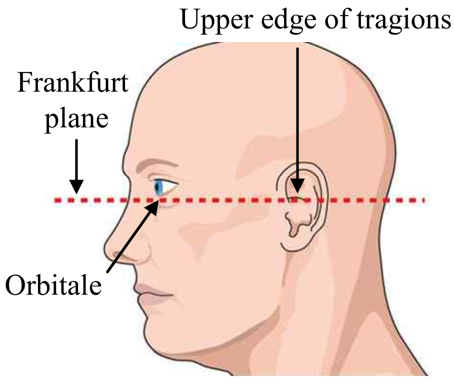
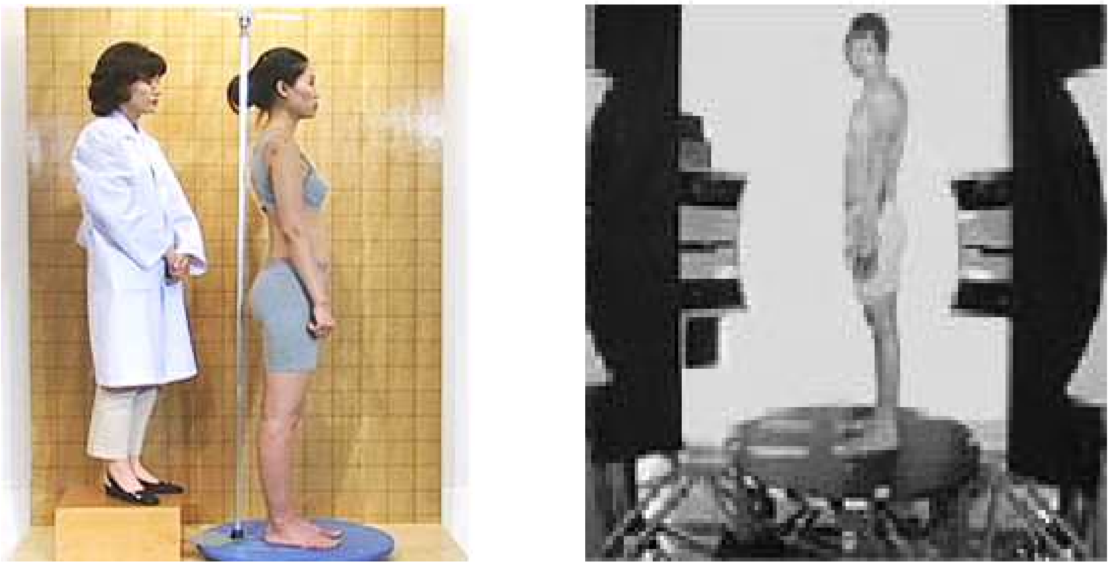


Figure 2.2. Illustration of the Frankfurt plane

The sizes of human bodies can be measured by either direct measurement or by 3D measurement (Figure 2.3). In direct measurement, a measurer takes the body sizes of a participant on the surface of skin with measurement tools (Gordon et al., 1998; SizeKorea, 2004). Because dimensions are measured one by one in direct measurement, much time and cost are required. In 3D measurement, a high quality 3D surface model of a participant is obtained in one scanning process, then measurements are taken using this model. The 3D human models are used for obtaining the body size information of the target population (Li and Whang, 2008) and can also be utilized for ergonomic design and evaluation in a digital environment (Hudson et al. 2006).



(a) direct measurement method (b) 3D measurement method

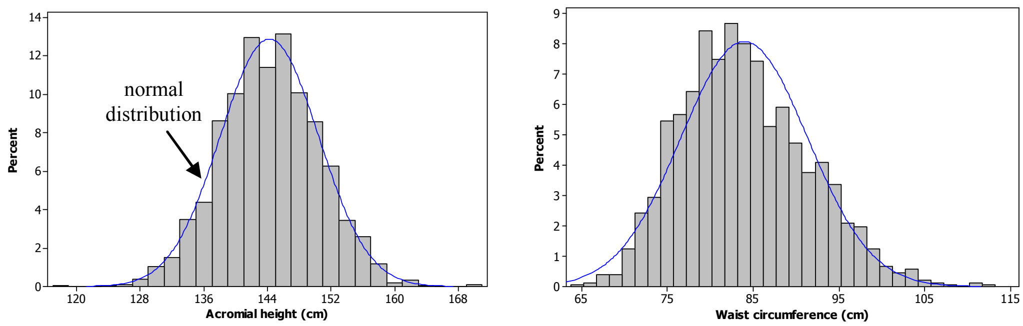
Figure 2.3. Anthropometric measurement techniques

Measurement values from the direct measurement method might be contaminated by four kinds of error (Ulijaszek and Kerr, 1999; Whang et al., 2002). First, measurer error originates from measurer's mistakes such as misreading values. Second, participant error occurs when a participant unintentionally changes position. For example, the measured value of stature is greater than the actual value when a participant takes deep breath and stands erect, rather than standing in a natural position. Third, measurement tool error is caused by the misuse of tools. Lastly, transient error occurs due to differences of measurement time or season. For example, human stature is normally greater in the morning than the evening (Reilly et al., 1984).

Because the 3D measurement method requires less time and effort to capture 3D human models with high quality, it is regarded as the next-generation technique for anthropometric measurement. Recently, the 3D measurement method has been commonly used in anthropometric measurement projects to enhance measurement quality and to obtain 3D human models (Robinette and Daanen, 2006). For example, the Civilian American and European Surface Anthropometry Resource (CAESAR) project used 3D scanners to capture measurements of approximately 5,000 people (Robinette et al., 1999; Ressler and Wang, 2002), and the SizeKorea project captured images of 5,000 Korean civilians (SizeKorea, 2004). Although the 3D technique requires additional effort (e.g., defining landmarks) to measure the body sizes from the scanned 3D human models (Burnsides et al., 2001; Robinette and Daanen, 2006), the method is preferable for anthropometric measurement because of the applicability of 3D human models and its short scanning time (e.g., 20 seconds).

2.1.2. Body size and secular trend

Distributions of body sizes are known to follow the normal distribution or to be similar to the normal distribution (HFES 300, 2004). Lengths of bones (e.g., acromial height and upper arm length) statistically follow the normal distribution (Roebuck et al., 1975). For example, acromial height of members of the US Army (n = 1,774) follows the normal distribution (p = 0.81) (Figure 2.4.a). In addition, the distributions of some anthropometric dimensions were quite similar to the normal distribution although they did not follow it exactly (Pheasant, 1997). For example, the distribution of waist circumference is left-skewed and differs significantly from the normal distribution (p < 0.001), but, a normal distribution is an adequate approximation (Figure 2.4.b). Because of the similarity of distributions to the normal, the distribution of anthropometric dimensions is usually assumed to be normal when percentile values of anthropometric dimensions are estimated from their means and standard deviations (Roebuck, 1995; Fernandez and Uppugonduri, 1992; Schoor and Konz, 1996)



(a) acromial height (b) waist circumference

Figure 2.4. Distributions of anthropometric dimensions (n = 1,774 of the US Army)

Secular trend, or change in the mean over time, is a phenomenon that occurs due to the improvement of life quality and nutrition (Roche, 1995). The body sizes of population are increasing over time. In some counties, statues have increased by 1 to 2 cm per decade (Table 2.1).

In a country, the rate of this secular trend increases rapidly as the economy improves; but, decreases as the economy reaches maturity (Roche, 1995). In advanced countries (e.g., European and American), the secular growth rate in stature per decade is less than 1 cm (Arcaleni, 2006; Roche, 1995). On the other hand, the growth rate in developing countries increases dramatically as the economy improves. For example, the average stature of Korean increased by 1.8 cm per decade from 1979 to 2004. However, this growth rate peaked in 1997 and then started to decrease (Figure 2.5). Similarly, the secular rate of stature in Japan increased until 1990 with the development of economy, and decreased after 1990 (Figure 2.6).

Table 2.1. Secular trend of stature for different populations

Populations	Age	Gender*	Secular trend per decade (cm)	References
Italian	N.S.*	N.S.	0.97	Arcaleni (2006)
American	N.S.	M	1.00	NASA (2006)
Portuguese	18	M	0.99	Padez and Johnston (1999)
Pole	19	M	2.10	Bielicki and Szklarska (1999)
Korean	20 ~ 49	M & F	1.80	SizeKorea (2004)
Japanese	20	M & F	1.20	AIST (2006)

* N.S.: not specified, M: male, F: female

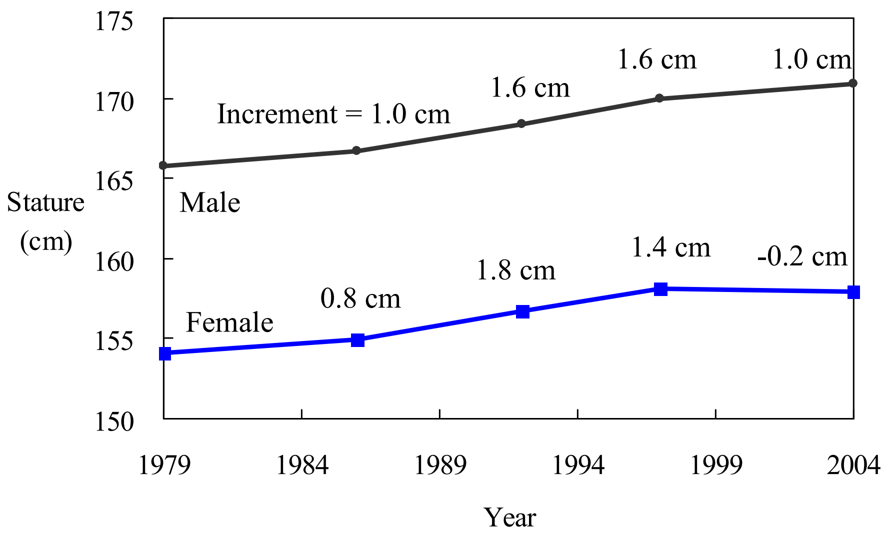


Figure 2.5. Secular trend of stature for Korean in their 20 ~ 40's based on Size Korea data

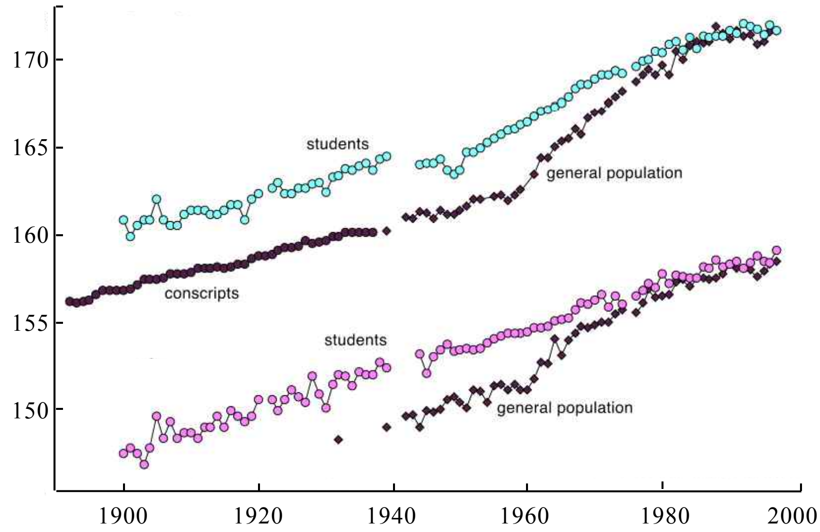


Figure 2.6. Secular trend of stature for Japanese (adapted from AIST (2006))

2.2. Anthropometric product design process

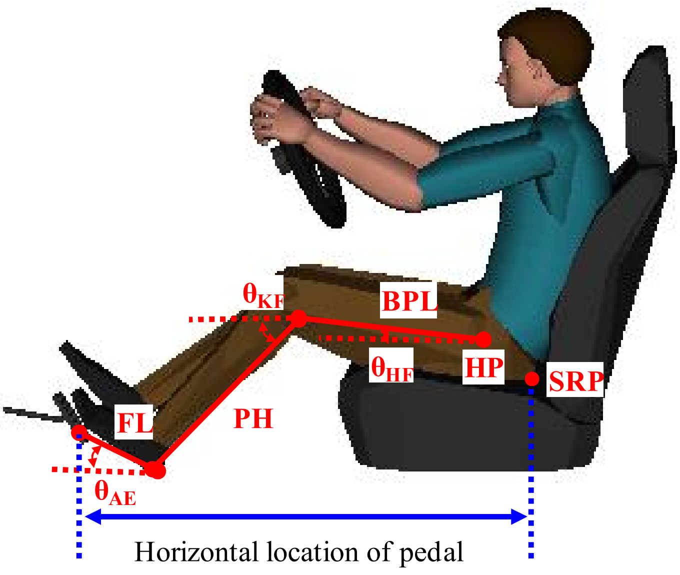
HFES 300 (2003) provides a five-step procedure for anthropometric product design (Table 2.2). The first step defines the problem statement including the design concept and the requirements for the target design. The second step determines the demographic information (e.g., nationality and age) and the anthropometric database for the target population. The third step generates a small number of RHMs which statistically represent the body size characteristics of the target population. The fourth step develops design equations and determines design values of a draft design by inputting the body sizes of RHMs into the design equations. The last step refines the draft design by conducting user testing and digital evaluation, or both.

The design equation in the fourth step of the design process reflects the geometrical relationship between design dimensions and anthropometric dimensions. For example, an equation to design the horizontal location of a vehicle pedal (Figure 2.7) can be developed by mathematically representing body dimensions (e.g., buttock-popliteal

Table 2.2. An anthropometric design process (HFES 300, 2003)

Step	Title	Produced outputs
1	Problem statement	• Design concept • Design constraint and requirement • Design dimensions
2	Target population	• Demographic information • Anthropometric database and adjustment • Anthropometric dimensions
3	Representative human model	• Accommodation percentage • Boundary or distributed human models
4	Anthropometric design	• Ergonomic design principles • Reference posture • Design equation • Design value
5	Evaluation and refinement	• Digital and/or physical prototype evaluation • Design refinement and documentation

Horizontal location of pedal = SRP-to-HP + BPL × cos (θ_{HF}) + PH × cos (θ_{KF}) + FL × cos (θ_{AE})



SRP: Seat reference point
HP: Hip point
BPL: Buttock-popliteal length
PH: Popliteal height
FL: Foot length
θ_{HF}: Postural angle for hip flexion
θ_{KF}: Postural angle for knee flexion
θ_{AE}: Postural angle for ankle extension

Figure 2.7. Illustration of a design equation in a passenger car design

length) and angular dimensions (e.g., hip flexion) that are related to pedal operation. This kind of design equations is commonly used in anthropometric product design. You et al. (1997) developed equations for steering wheel, seat, and pedals to design a bus operator's workspace. ANSI (2007) developed a standard design of computer workstation by using design equations developed by mathematizing the geometric relationship between workstation dimensions and anthropometric dimensions.

The design equations for anthropometric product design can be developed by analyzing design structure matrix (DSM) that represents the relationship between design dimensions and anthropometric dimensions. DSM analysis is a visualization tool that displays dependencies between elements in a matrix to understand the dependency relationship (Ulrich and Eppinger, 2000; DSMWEB, 2007). To develop design equations using DSM analysis, the dependencies between design dimensions (in rows) and anthropometric dimensions (in columns) are displayed in a matrix (Table 2.3). For example, the design value of seat height (DD1) depends on two body dimensions (BD1 and BD2) and two angular dimensions (AD1 and AD2); therefore the cells intersecting the row representing seat height and the columns of the anthropometric dimensions related to seat height are marked (Table 2.3). Next, the design equations for design dimensions are developed by mathematizing the anthropometric dimensions related to each design dimension. For example, the design equation of seat height is developed as 'popliteal height × sin {knee flexion - (hip flexion - 90°)} - buttock-popliteal length× sin (hip flexion) + allowance' by mathematizing the body dimensions and angular dimensions that are related to seat height design.

Table 2.3. An example of design structure matrix analysis for workstation design*

Classification			Body dimension		Angular dimension	
Design dimension		Code	BD1**	BD2	AD1	AD2
Seatpan	Height	DD1	❍	❍	❍	❍
	Depth	DD2	❍			❍
	Width	DD3				
Seatback	Height	DD4				
	Width	DD5				
Armrest	Height	DD6	❍		❍	❍
	Clearance	DD7	❍		❍	

* Cell is marked as '❍' when an anthropometric dimension in the column is related to a design dimension in the row.

** BD1: buttock-popliteal length, BD2: popliteal height, AD1: knee flexion, AD2: hip flexion

Ergonomic design principles for anthropometric product design are divided into three types: 1) design for extreme individuals, 2) design for adjustable range, and 3) design for the average (Sanders and McCormick, 1992). The principle of design for extreme individuals determines product sizes using the extreme body sizes of RHMs. For example, the design value of seatpan width is determined by the hip breadth of the 95th percentile RHM (large person) to fully support users' hips, and the design value of seatpan depth is designed by the popliteal height of the 5th percentile RHM (small person) to avoid placing the user's popliteal regions on the edge of the seatpan. The principle of design for adjustable range determines adjustment range of design dimension by applying the largest and smallest body sizes of RHMs. For example, the adjustment range of seatpan height is designed to accommodate the popliteal heights of the 5th and 95th percentile RHMs. The principle of design for the average determines the size of products by applying the average size of RHMs. For example, the design value of armrest height is designed using the seated elbow-rest height of the 50th percentile RHM.

These three ergonomic design principles should be defined for each design dimension by considering its design characteristics. If the value of a design dimension is satisfactory when it is larger or smaller than the body sizes of users, the design dimension can be designed by the principle of design for extreme individuals. However, if the value of a design dimension is preferred to be more similar to the body size of users, then the design dimension can be designed by either the principle of design for adjustable range or the design for the average whether the value of the design dimension is adjustable or not.

2.3. Representative human model (RHM) generation methods

RHMs are a small group of human models which statistically represent the body size characteristics of a designated percentage of the target population (Jung et al., 2008a; HFES 300, 2004). RHMs that represent the target population are used in anthropometric product design and evaluation for such products as computer workstations, cockpits, and vehicles (Zehner, 1996; Hudson et al., 1998; Zehner et al., 1999). For example, Hsiao et al (2005) created a 15-member group of RHMs to design and evaluate the operator space of a tractor (Figure 2.8). Meindl et al. (1993) generated an 8-member group of RHMs to design the cockpit of airplane. These small groups of RHMs provide anthropometric designers with a method of efficiently utilizing the body size information of the target population in product design and evaluation (HFES 300, 2004).

The RHMs generated by the percentile method, traditional univariate anthropometric approach, are not appropriate to represent the body size characteristics of the target population in multivariate design problems. The percentile method efficiently generates a small number of RHMs (e.g., 5^{th}, 50^{th}, and 95^{th} percentiles) which accommodate a designated percentage (90%) of the target population. However, the RHMs generated by the percentile method cannot represent multivariate characteristics of the dimensions (HFES 300, 2004; Meunier, 1998) because this method determines the body sizes as the percentile values of each anthropometric dimension separately. For example, stature and shoulder breadth of a 95^{th} percentile RHM are determined as 95^{th} percentile values of

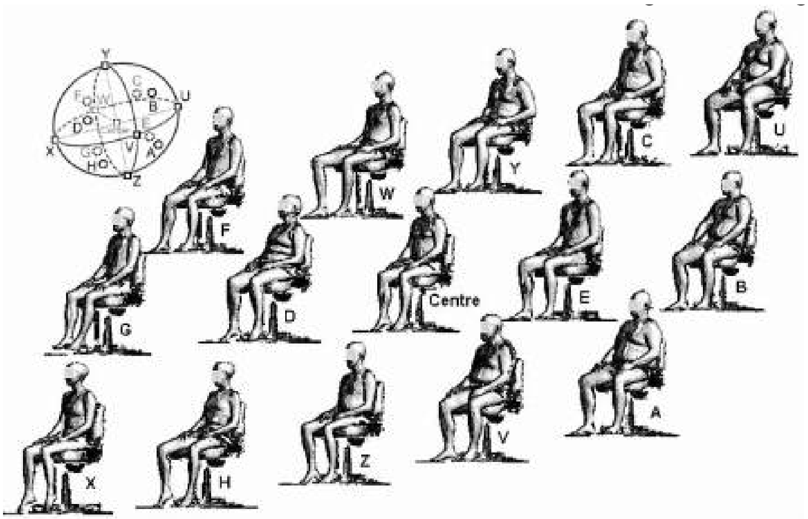


Figure 2.8. RHMs for the operator space design of a tractor (Hsiao et al., 2005)

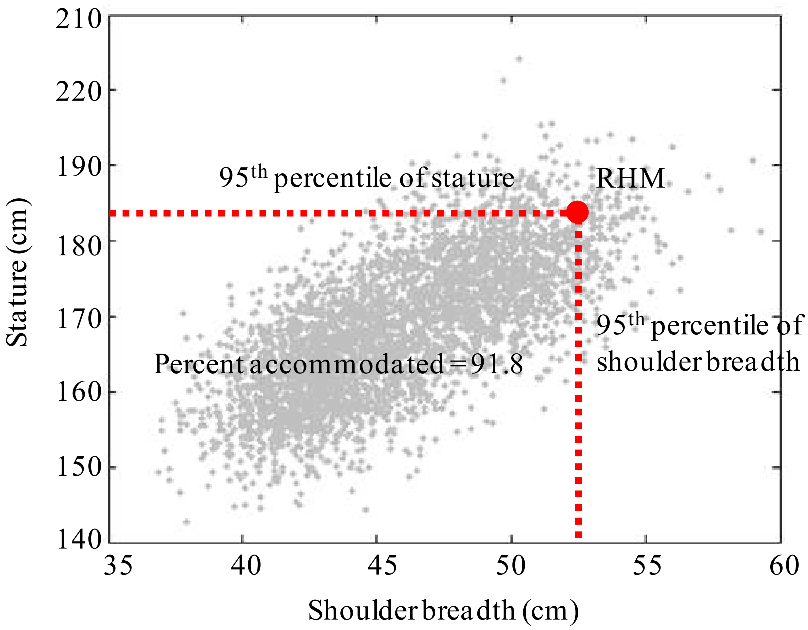


Figure 2.9. An example of multivariate accommodation of a percentile RHM

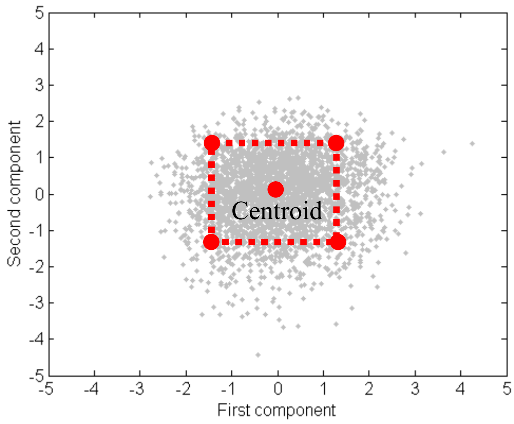
stature (184 cm) and shoulder breadth (52 cm) (Figure 2.9). Hence, univariate accommodation percentage (UAP) meets the designated percentage (95%); however, multivariate accommodation percentage (MAP), which is a proportion of smaller people than the RHMs for the two dimensions, is less than the designated percentage (Figure 2.9).

To overcome the multivariate accommodation problem of the percentile method, multivariate RHM-generation methods have been developed by utilizing data reduction techniques such as Factor Analysis and Principal Component Analysis. Bittner et al. (1987) developed a multivariate RHM-generation method at a square boundary formed in the space of the factors identified by Factor Analysis on anthropometric dimensions. Meindl et al. (1993) developed a RHM-generation method at a circular boundary formed in the space of the components extracted by Principal Component Analysis.

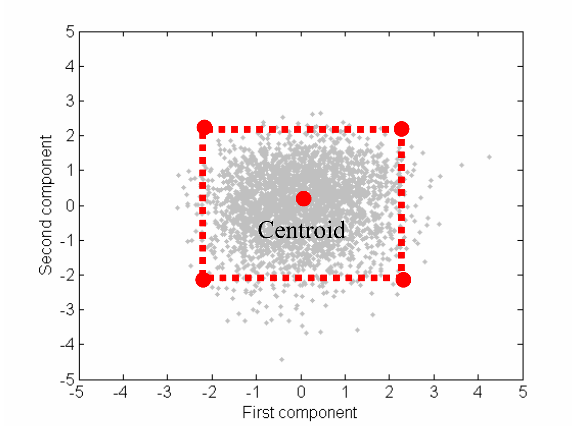
Depending on the shape of the boundary formed in the space of factors to accommodate a designated percentage of the target population, the existing multivariate RHM-generation methods are divided into three methods: 1) Square Method, 2) Rectangular Method, and 3) Circular Method. The Square Method (Bitter et al., 1987; Bittner, 2000) generates RHMs at the square boundary formed in the space of the factors (Figure 2.10.a). The Rectangular Method (Kim and Whang, 1997) creates RHMs at the rectangular boundary (Figure 2.10.b). The Circular Method (Meindl et al., 1993) generates RHMs at a circular boundary (Figure 2.10.c).

2.4. Digital human modeling systems

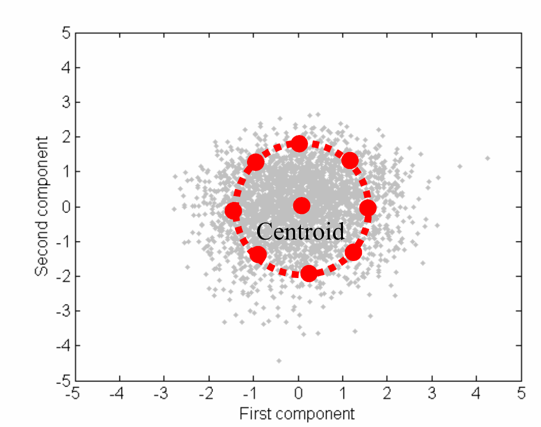
Digital human modeling (DHM) systems such as JACK® and RAMSIS® are widely used to design and evaluation of products in the early stage of product development. DHM systems make the iterative process of design, evaluation, diagnosis and revision more rapid and economical by introducing ergonomic evaluation in the early stage of the product development process (Chaffin, 2001). In addition, DHM systems are effective design tools to visualize the interaction between a human and workstation system (e.g., a passenger car or airplane cockpit) and to evaluate the ergonomic aspects (e.g., reach,



(a) Square Method



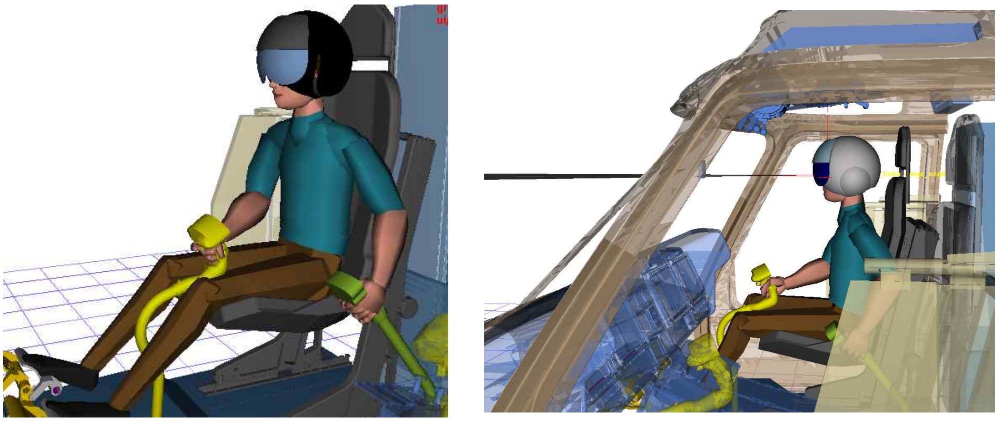
(b) Rectangular Method



(c) Circular Method

Figure 2.10. RHM-generation method using data reduction techniques (small dot: target population, large dot: RHM, dotted-line: area accommodated)

visibility and comfort) of human-machine interaction (HMI) (Figure 2.11). Lastly, product development cost and time can be reduced by utilizing DHM systems because the systems can evaluate a digital mockup (e.g., CAD model) of the product of interest in a computer environment without requiring development of a physical mockup (You, 2007).



(a) reach and posture evaluation (b) visibility evaluation

Figure 2.11. Example of helicopter cockpit evaluation by visualizing RHMs and a cockpit in JACK® (Park et al., 2008)

Since FirstMan® was developed around 1960 at Boeing Aircraft, many DHM systems have been developed in the USA and Germany (Figure 2.12). For example, FirstMan® and Boeman® were developed in the early years of the DHM era, and JACK®, DHMS® and BMD-HMS® were recently developed. JACK®, RAMSIS®, and SAFEWORK® are the most popular in ergonomic product design and evaluation although many DHM systems have been developed (You, 2007).

Ergonomic evaluation with DHM systems can be achieved by following a five-step process (Figure 2.13) (Meulen, 2001). In the first step, a digital prototype of the product of interest is developed using CAD software. In the second step, an RHM-generation method is used to generate a small number of RHMs that represent a designated percentage of the target population. In the third step, the digital prototype and the RHMs are visualized in a digital environment. In the fourth step, digital evaluation is conducted to evaluate ergonomic performances such as visibility, posture discomfort, and clearance. In the last step, the digital prototype is refined to improve usability.

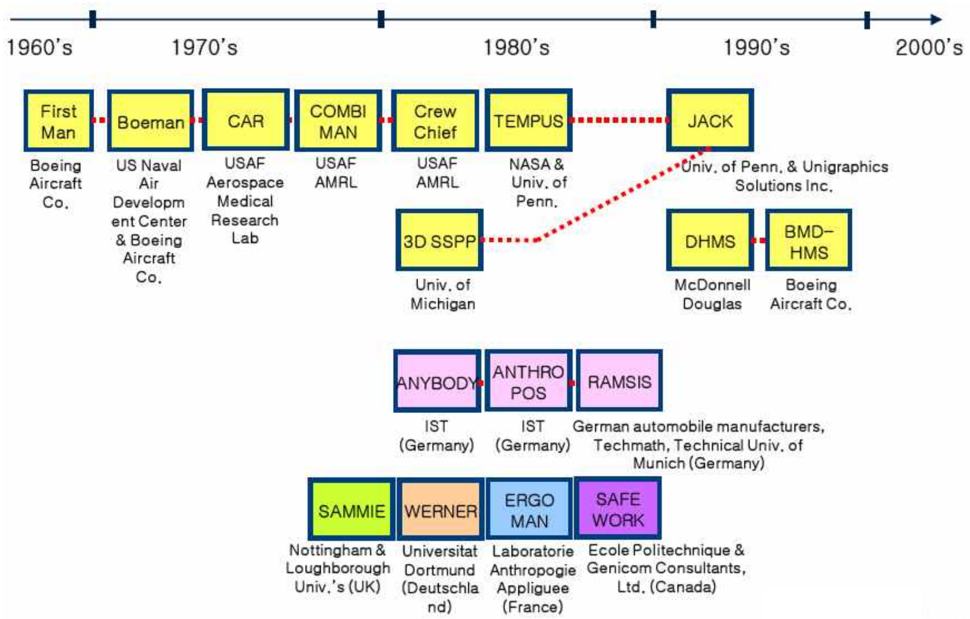


Figure 2.12. Development of digital human modeling systems (You, 2007)

Two RHM-generation methods (percentile and custom-built methods) are commonly implemented in DHM systems (Dassault Systems, 2005; UGS, 2006). The percentile method enables the user to generate percentile human models that represent specified (1st, 5th, 50th, 95th, and 99th) percentiles for different genders and age groups using anthropometric information stored in the simulation system. The custom-built method enables the user to tailor human models by specifying a set of anthropometric dimensions; missing values of anthropometric dimensions are estimated by regression equations incorporated in the simulation system

Existing DHM systems have several analysis capabilities for ergonomic product design and evaluation (Table 2.4) (EDS, 2008; RAMSIS, 2008; Chaffin, 2001; Das and Sengupta, 1995). For example, reach analysis evaluates whether digital humans can easily reach buttons or switches. Posture analysis investigates postural discomfort of digital humans when they are performing given tasks. Visibility analysis visualizes the view cone or scene from the eyes of digital humans to check visual interference and requirements.

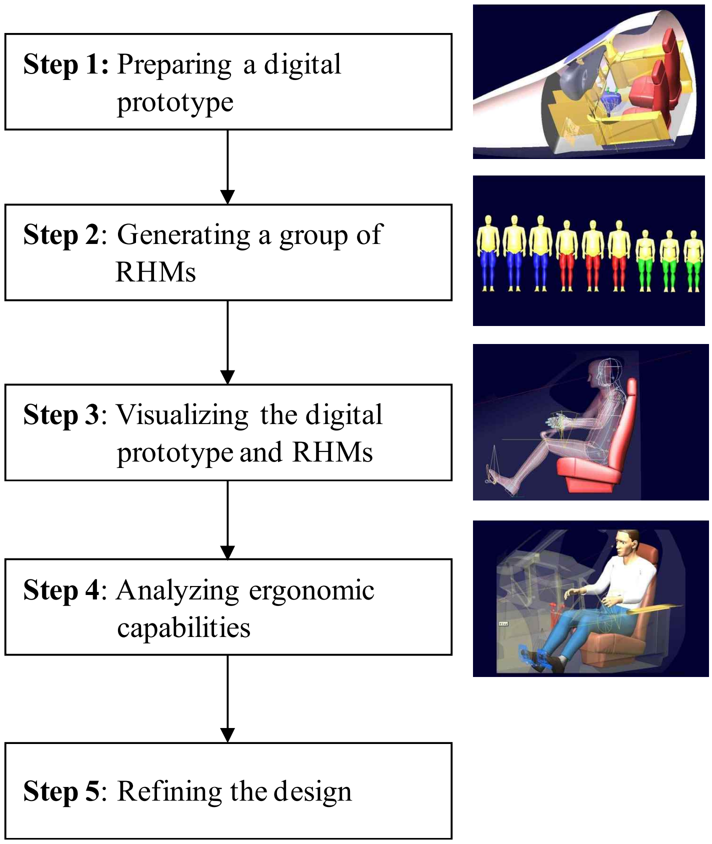
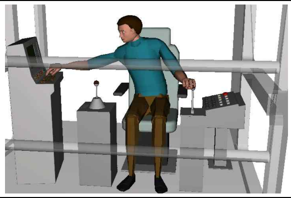
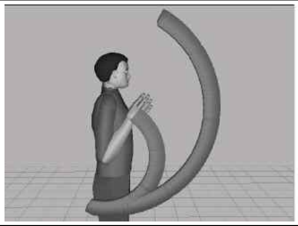
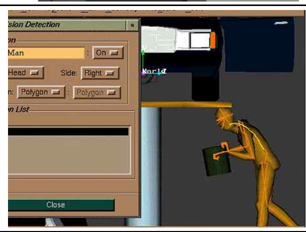
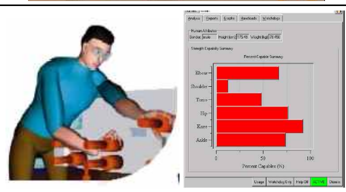


Figure 2.13. An ergonomic evaluation process using a digital human modeling system (adapted from Meulen (2001))

Table 2.4. Ergonomic evaluation capabilities of digital human modeling system (EDS, 2008; RAMSIS, 2008; Chaffin, 2001; Das and Sengupta, 1995)

Evaluation aspects	Description	Illustration
Reach	Evaluate whether digital humans can reach to objects such as buttons and switches	
Posture	Evaluate the postural discomfort score when digital humans perform tasks	
Motion efficiency	Animate motion profile of digital human when perform tasks or use the product of interest	
Visibility	Visualize the view cone or scene from the eyes of digital human	
Clearance	Check clearance space between digital humans and the product of interest	
Biomechanical load	Quantify joint torque occurred by external and postural loads	

Chapter 3
DEVELOPMENT OF A MULTIVARIATE EVALUATION PROTOCOL

3.1. Four-step evaluation protocol

The present study developed a multivariate evaluation protocol consisted of a four-step process for the evaluation of multivariate RHM-generation methods (Figure 3.1). In the first step, anthropometric data for the target population is randomly divided into a learning set and a testing set to avoid evaluation bias (Section 3.2). In the second step, anthropometric dimensions are selected (Section 3.3). In the third step, a small group of RHMs is generated using the learning set (Section 3.4). In the last step, performances of the multivariate RHM-generation methods are evaluated using the testing set, and factors affecting the performances are analyzed (Section 3.5).

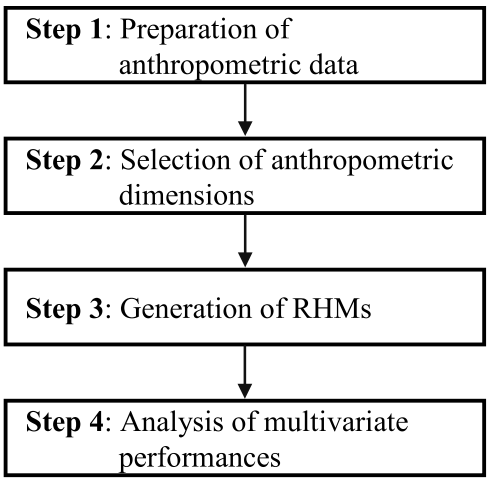


Figure 3.1. A four-step process of multivariate evaluation protocol

3.2. Step 1: Preparation of anthropometric data

US Army data (Gordon et al., 1988), known as reliable and accessible database, is used in the evaluation of multivariate RHM-generation methods. The US Army data is obtained by applying a rigorous measurement protocol and provides a large and comprehensive database on 3,987 participants (female = 2,213; male = 1,774). In addition, the US Army data can be easily accessible from websites (e.g., http://mreed.umtri.umich.edu/mreed/downloads.html) and is used in the development of a standard computer workstation design by American National Standards Institute (ANSI) and Human Factors and Ergonomics Society (HFES).

To avoid evaluation bias, the US Army data is partitioned into a learning set and a testing set. When developing a predictive model, it is necessary to verify that the fitted model can be generalized to future data (Hawkins et al. 2003). Hence, the present study divides the US Army data into a learning set for RHM generation and a testing set for RHM evaluation using Holdout validation method (Wikipedia, 2008a; Blum et al., 1999). In the Holdout method, observations are chosen randomly from the original data to form the testing set, and the remaining observations are retained as the learning set. Normally, one-third of the original data is used for testing data. In the present study, about one-third of the US Army data are randomly selected to form the testing set (n = 1,000) (Figure 3.2) and the rest are retained as the learning set (n = 2,982). The two data sets' means, SDs, and distributions are not significantly different at $\alpha = 0.05$ (Table 3.1).

3.3. Step 2: Selection of anthropometric dimensions

For the evaluation of RHM-generation methods, anthropometric dimensions can be selected by two different ways: 1) design-related dimension selection and 2) random dimension selection. In design-related dimension selection, anthropometric dimensions are selected by analyzing the relationship between product dimensions and anthropometric dimensions. For example, in seat design, anthropometric dimensions are

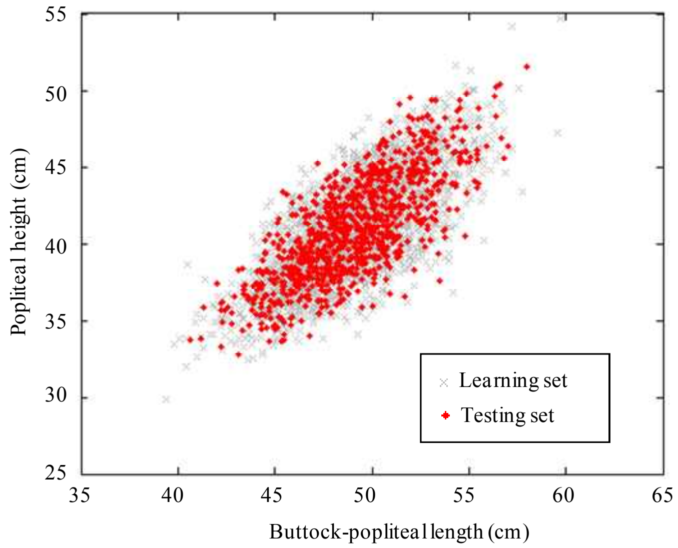


Figure 3.2. Bivariate plot of measurements in the learning and testing sets (x: learning, o: testing)

Table 3.1. Statistical difference tests between learning and testing sets

Dimensions	Mean		SD		Kolmogorov test	
	t	*p*	*F*	*p*	*D*	*p*
Abdominal extension depth	-0.34	0.73	1.00	0.93	0.02	0.88
Buttock-knee length	0.59	0.55	1.07	0.20	0.03	0.39
Elbow-rest height	-1.94	0.05	0.98	0.67	0.04	0.12
Foot length	0.48	0.63	1.04	0.43	0.02	0.86
Forearm-to-forearm breadth	-1.09	0.37	0.96	0.41	0.04	0.13
Hip breadth	-0.07	0.94	1.06	0.26	0.03	0.64
Knee height	0.35	0.72	1.04	0.51	0.02	0.99
Popliteal height	0.15	0.88	1.03	0.62	0.02	0.96
Thigh clearance	-0.85	0.39	1.06	0.30	0.03	0.53
Buttock-popliteal length	0.76	0.45	1.06	0.26	0.04	0.20

selected as popliteal height, hip breadth, and buttock-popliteal length which are related to the design of seat height, width, and depth, respectively. When this method is used, the evaluation results apply only to the dimensions used. In random dimension selection, various numbers and combinations of anthropometric dimensions are randomly selected. For example, the various sets of anthropometric dimensions can be randomly selected from the 132 dimensions in the US Army data. When this method is used, the evaluation results can be generalized

For a set of design-related anthropometric dimensions, the present study selects ten anthropometric dimensions related to the design of a computer workstation (Table 3.2) by referring to ANSI (2007). For example, popliteal height (BD1) and buttock-popliteal length (BD2) are related to the design of seat height and depth for a computer workstation

To allow generalization of the evaluation results, the random dimension selection method is also used. Various sets of anthropometric dimensions were randomly selected from the US Army data. Conditions for the number of anthropometric dimensions are determined as 5, 10, 15, and 20 by considering scale of anthropometric design and referring to previous studies (Meindl et al., 1993; Hudson et al., 2006; Hsiao et al., 2005; Bittner, 2000). For each number condition, five combinations of anthropometric dimensions are randomly selected from the US Army data.

3.4. Step 3: Generation of RHMs

A group of RHMs is generated to accommodate 90% of the target population in the learning set for the selected anthropometric dimensions. For example, using the Square Method (Bittner, 2000), the anthropometric dimensions are first reduced to a small number of factors by Factor Analysis. The appropriate number of factors is determined based on the eigen value and percentage of the variance explained. A square boundary in the space of the factors is defined by the combinations of Bittner constant (±1.2208) (Bittner, 2000), and the factor scores are determined as the centroid and the corners of the square boundary. Lastly, the standard normal scores of body sizes are estimated by multiplying the factor loading matrix by the factor score matrix.

Table 3.2. Relationship between computer workstation dimensions and anthropometric dimensions (ANSI, 2007)

Hierarchy of design dimensions			Code	Anthropometric dimensions
Seat	Seatpan	Height	BD1	Popliteal height
		Depth	BD2	Buttock-popliteal length
		Width	BD3	Hip breadth
	Armrest	Height	BD4	Elbow rest height
		Clearance	BD3	Hip breadth
	Backrest	Width	-	-
		Length	-	-
Desk	Table	Height	BD1	Popliteal height
			BD5	Thigh clearance
			BD6	Buttock-knee length
			BD7	Abdominal extension depth
		Width	BD8	Forearm-to-forearm breadth
	Legroom	Width	BD3	Hip breadth
		Depth at knee	BD6	Buttock-knee length
			BD7	Abdominal extension depth
		Depth at foot	BD1	Popliteal height
			BD9	Foot length
		Clearance at thigh	BD1	Popliteal height
			BD5	Thigh clearance
			BD6	Buttock-knee length
			BD7	Abdominal extension depth
		Clearance at knee	BD10	Knee height

3.5. Step 4: Analysis of performances

The performances of the RHM-generation methods are evaluated in terms of statistical representativeness and applicability of the RHMs generated (Table 3.3). First, accommodation percentage evaluates the proportion of the target population that is accommodated by the RHMs, i.e., the proportion of people whose measurement lie within the boundary that includes the RHMs in the space of anthropometric dimensions (Hudson et al., 2006; Jung et al., 2008a; HFES 300, 2004). According to the number of anthropometric dimensions considered in the calculation of the percentage, univariate accommodation percentage (UAP) and multivariate accommodation percentage (MAP) can be quantified. Second, the percentage of the RHMs that are outliers was measured; this simply evaluates whether the sizes of the RHMs are outside the size ranges of the target population. The sizes of the RHMs should be within the size ranges of the target population. Third, the number of RHMs generated by each approach evaluates the applicability of the RHMs in DHM systems such as JACK®. A smaller number of RHMs simplifies the application to design and evaluation because the existing DHM systems require much time and effort in creating humanoids, positioning them in a 3D space, and generating operating postures (Blome et al., 2006). Lastly, difficulty grade (low, moderate, and high) evaluates to judge complexity of the process of generating RHMs which accommodate a designated percentage of the target population.

Table 3.3. Evaluation criteria for the RHM-generation methods

Classification	Criteria		Explanation
Represent-ativeness	Accommodation percentage	Univariate (UAP)	Proportion of people accommodated by a group of RHMs in a single dimension
		Multivariate (MAP)	Proportion of people accommodated by a group of RHMs in multivariate dimensions
	Outlier		Whether sizes of RHMs are larger or smaller than the size ranges of the target population
Applicability	Number of RHMs		Applicability of RHMs to product design and evaluation in a digital environment
	Difficulty grade		Complexity (low, moderate, and high) of generating RHMs

Chapter 4
ANALYSIS OF EXISTING RHM-GENERATION METHODS

4.1. Characteristics of existing RHM-generation methods

To identify the characteristics of existing RHM-generation methods, a comprehensive literature survey was conducted. First, papers related to multivariate generation of RHMs were searched through ScienceDirect (www.sciencedirect.com), Taylor and Francis Online Journals (journalsonline.tandf.co.uk), Scopus (www.scopus.com), National Digital Science Library (www.ndsl.or.kr), Google (www.google.com), and Google Scholar (scholar.google.com) with combinations of relevant keywords such as anthropometry, anthropometric design, representative human model, and representative case. Next, key papers that introduced or applied multivariate RHM-generation methods were selected for in-depth analysis by reviewing the titles and abstracts.

The selected key papers indicated that the existing RHM-generation methods were applied either to the development of workstations or to sizing system of clothing (Table 4.1). For example, Bittner et al. (1986) and Meindl et al. (1993) developed multivariate RHM-generation methods for the development and evaluation of workstations such as cockpits and vehicles. On the other hand, Robinette and Annis (1986) and McCulloch et al. (1998) proposed multivariate RHM-generation methods to develop size systems for clothing.

To generate a group of RHMs that represents a designated percentage of the population, the existing RHM-generation methods utilized a generic three-step process (Figure 4.1). In the first step, the number of anthropometric dimensions under consideration was reduced into a small number (e.g., one to five) of key dimensions (or factors) to efficiently determine an accommodation envelope that includes a designated percentage of the population. In the second step, accommodation envelope(s) and

Table 4.1. Existing multivariate RHM-generation methods

Application area	Location of RHMs	Key dimensions	Accommodation envelope	Study (No. of studies)
One-size product design	Boundary	Factor Analysis (or Principal Component Analysis)	Square	BI-1, BI-2, HE (3)
			Rectangle	KI (1)
			Circle	ME, HS, HU-1, HU-2, HU-3, RE, ZE-1, ZE-2 (8)
Multiple-size product design	Scatter	Regression analysis (or correlation analysis)	Grid by grading system	RA, RO, MO, KW, ZH (5)
			Grid by optimization technique	MC (1)
		Factor Analysis	Cluster	LA (1)

BI-1: Bittner et al. (1987)
BI-2: Bittner (2000)
HE: Hendy (1990)
HU-1: Hudson et al. (1998)
HU-2: Hudson et al. (2003)
HU-3: Hudson et al. (2006)
HS: Hsiao et al. (2005)
KI: Kim and Whang (1997)
KW: Kwon et al. (2009)
LA: Laing et al. (1999)
MC: McCulloch et al. (1998)
ME: Meindl et al.(1993)
MO: Moon (2002)
RA: Robinette and Annis (1986)
RE: Reed and Flannagan (2000)
RO: Rosenblad-Wallin (1987)
ZE-1: Zehner (1996)
ZE-2: Zehner et al. (1999)
ZH: Zheng et al. (2007)

locations of RHMs were determined in the space of the selected key dimensions. In the last step, the body sizes of RHMs were estimated based on these locations. As an example of the generation process (Figure 4.1), two key dimensions were first selected which have high correlations with other anthropometric dimensions. Next, grids were formed to accommodate 90% of the population with a specified tolerance value (e.g., ± 2.5 cm). Lastly, the body sizes of RHMs for the selected key dimensions were determined as the centroid values of the grids, and the sizes of the remaining dimensions were estimated from regression equations using the selected key dimensions as independent variables.

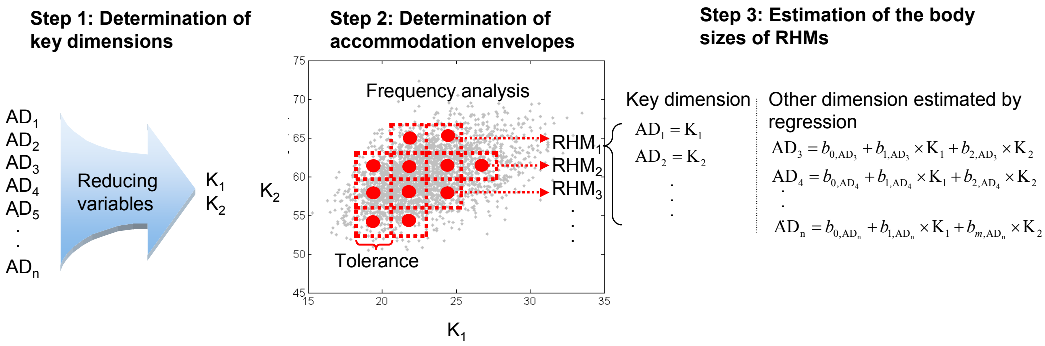


Figure 4.1. A three-step RHM-generation process (adapted from Robinette and Annis (1986)) (AD: anthropometric dimension, K: key dimension, RHM: representative human model)

To efficiently generate RHMs, existing RHM-generation methods reduce the number of anthropometric dimensions to a smaller number of key dimensions based on statistical relationships among the anthropometric dimensions. Key dimensions are a small number of dimensions which are highly correlated with other anthropometric dimensions (Hidson, 1991). These key dimensions are useful in the generation of RHMs because the accommodation envelopes and the sizes of RHMs can be efficiently determined in a manageable space of dimensions. For instance, Bittner (2000) extracted three factors by Factor Analysis of 18 anthropometric dimensions related to workstation design and evaluation, and Kwon et al. (2003) selected two key dimensions by correlation and regression analysis on 70 anthropometric dimensions to develop a glove size system.

The existing RHM-generation methods can be classified into boundary or distributed methods (Figure 4.2), depending on the shape of accommodation envelope and application area. Boundary methods created RHMs at a boundary encompassing a designated percentage of the target population. Boundary methods can be further classified into three methods, depending on the shape of the boundary: Square Method (Bittner et al., 1986), Rectangular Method (Kim and Whang, 1997), and Circular Method (Meindl et al., 1993). The RHMs generated were used for one-size product design such as cockpits and computer workstations. On the other hand, distributed methods generated RHMs centered on points in each grid which is formed to accommodate a designated percentage of the population. Depending on the method of forming the scattered grids, distributed methods can be further classified into three methods: Grid Method (Robinette and Annis, 1986), Cluster Method (Laing et al. 1999), and Optimization Method (McCulloch et al., 1998). The RHMs generated were used for multiple-size product design such as glove and upper garment.

4.2. Evaluation of existing RHM-generation methods

The existing RHM-generation methods were evaluated by applying the multivariate evaluation protocol proposed in Chapter 3. To compare the performances of the existing RHM-generation methods, each was used to generate several groups of RHMs for the set of ten anthropometric dimensions related to computer workstation design. Because the boundary and distributed methods were applied to different types of anthropometric design, the performances were compared within each method type.

4.2.1. Generation of RHMs

Boundary methods

The three-step RHM-generation process identified in Section 4.1 was utilized to generate three groups of RHMs for three boundary methods on the ten anthropometric

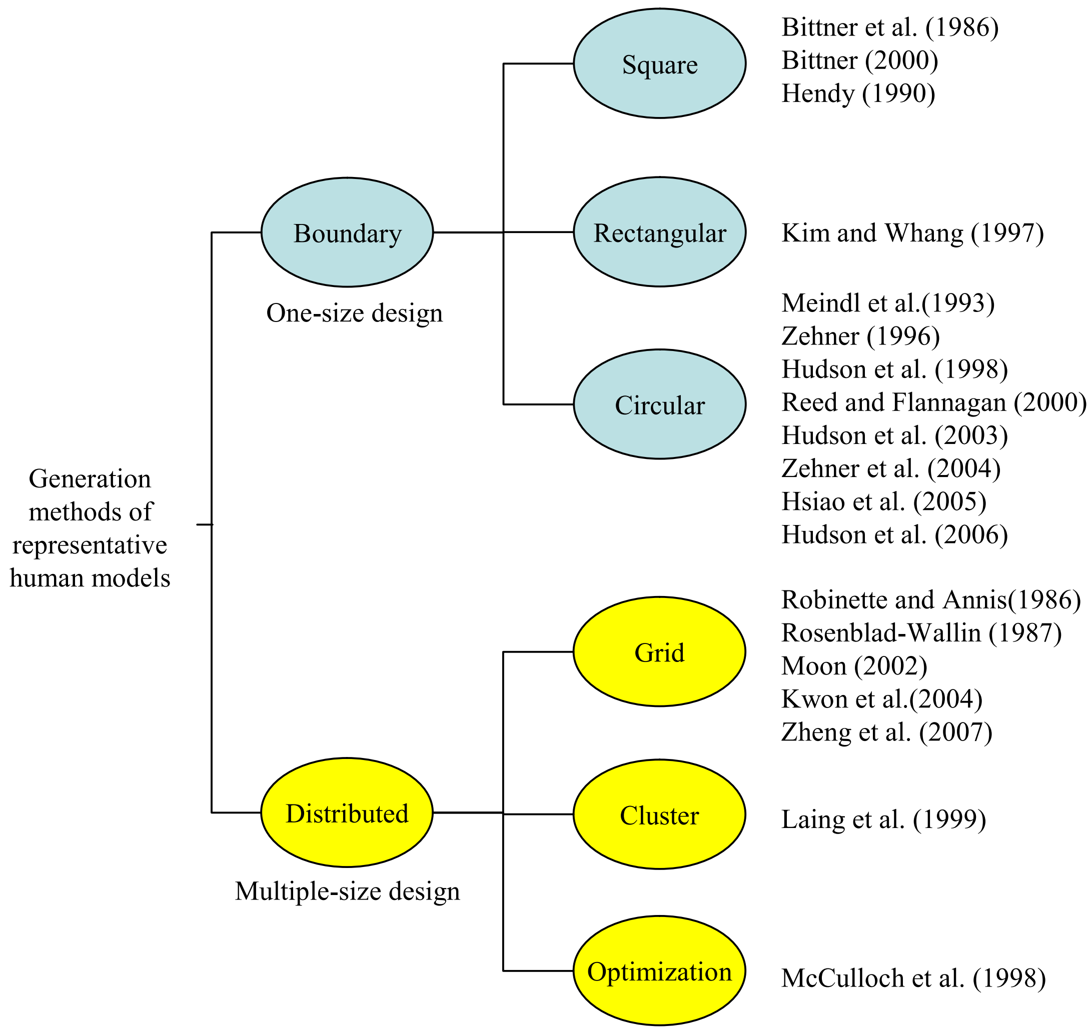


Figure 4.2. Classification taxonomy for existing RHM-generation methods

dimensions related to computer workstation design. In the first step, three factors were extracted (Table 4.2) by Factor Analysis and Principal Component Analysis with the factor selection criteria (eigen value > 1 and percent variance explained > 80%) provided in Lattin (2003). Rotation of the factor loadings extracted by Factor Analysis was done by Varimax rotation which was recommended by Bittner (2000).

Factor Analysis and Principal Component Analysis selected different sets of factors.

Factor Analysis chose 1) leg length and height, 2) leg and waist thickness, and 3) elbow height and distance by considering the characteristic of anthropometric dimensions with the highest loadings on each factor. Principal Component Analysis chose 1) overall size, 2) contrast between legs and other body parts, and 3) contrast between upper legs and waist and the other body parts based on the signs of the factor loadings by referring to previous studies (Meindl et al., 1993; Hudson et al., 2006).

Table 4.2. Factor loadings for the ten anthropometric dimensions related to computer workstation design

a) Factor loadings obtained by Factor Analysis *

Anthropometric dimension**	Leg length and height	Leg and waist thickness	Elbow height and distance	Communality
BD1	0.96	0.05	-0.11	0.94
BD10	0.95	-0.17	-0.10	0.95
BD9	0.88	-0.11	-0.25	0.85
BD6	0.85	-0.45	0.12	0.93
BD2	0.83	-0.38	0.23	0.89
BD3	-0.13	-0.88	0.05	0.79
BD7	0.20	-0.79	-0.29	0.75
BD5	0.35	-0.71	-0.30	0.72
BD4	-0.13	-0.08	-0.86	0.76
BD8	0.52	-0.43	-0.56	0.77
eigen value	4.48	2.47	1.38	8.34
Percent variation	0.45	0.25	0.14	0.83

* The cell with the highest factor loading is shaded.

** The codes are the same as Table. 3.2.

b) Factor loadings obtained by Principal Component Analysis

Anthropometric dimension*	Overall size	Contrast between legs and other body parts	Contrast between upper legs & waist and the other body parts
BD1	-0.36	-0.34	0.18
BD2	-0.37	-0.16	-0.31
BD3	-0.13	0.51	-0.43
BD4	-0.03	0.36	0.68
BD5	-0.30	0.36	-0.03
BD6	-0.40	-0.09	-0.24
BD7	-0.26	0.45	-0.09
BD8	-0.32	0.23	0.32
BD9	-0.37	-0.18	0.22
BD10	-0.40	-0.22	0.07
eigen value	5.34	1.90	1.10
Percent variation	0.53	0.19	0.11

* The codes are the same as Table 3.2.

In the second step, the factor scores of RHMs for the three methods were determined in the space of the factors. The factor scores of the Square Method were determined as the corner points (±1.22, ±1.22, ±1.22) and the centroid (0, 0, 0) of a square boundary (Figure 4.3.a) by applying the Bittner constant (1.22; Bittner, 2000). The factor scores of the Rectangular Method were defined as the corner points (±2.24, ±2.12, ±2.01) and the centroid (0, 0, 0) of a rectangular boundary (Figure 4.3.b) formed by Equation 4.1 (Kim and Whang, 1997), thereby finding a boundary that statistically accommodate a designated percentage of the target population with weights of each factor. If $P[F_i \in x_i]$ in Equation 4.1 is replaced with $w_i\alpha'$ (where: w_i is a weight for factor *i* and α' is the proportion of people not accommodated), the equation can be simplified to Equation 4.2. When the weights w_i are provided by a designer (e.g., $1/\sqrt{\lambda_i}$; where λ_i is the eigen value of factor *i*), the value of α' in Equation 4.2 can be obtained. Finally, standard normal scores for each $\Phi^{-1}(w_i\alpha')$ were determined using the cumulative density function of the standard normal distribution. Lastly, the factor scores of the Circular Method were determined as the points at every 45° on a circular boundary (r = 2.53; Figure 4.3.c) which was empirically formed to accommodate 90% of the target population by increasing the radius of the circle until the proportion of people within the circle met the designated percentage (Meindl et al., 1993).

In the third step, the body sizes of RHMs generated by each method were estimated based on the factor scores defined in the space of the factors (Bittner et al., 1986; Kim and Whang, 1997). To convert the factor scores into the body sizes, a standard normal score matrix was calculated using Equation 4.3 which multiplies the factor loading matrix (Table 4.2) by the factor score matrix. Next, the body sizes were estimated by applying a statistical relationship between the standard normal score and body size: $y = \mu + z \times s$ (where: y is body size of an RHM, μ is average size of the population, and z is standard normal score calculated, and s = standard deviation of the population).

$$\begin{aligned} &P(F_1 \in x_1 \cup F_2 \in x_2 \cup F_3 \in x_3) = P[F_1 \in x_1] + P[F_2 \in x_2] + P[F_3 \in x_3] \\ &- P[F_1 \in x_1] \times P[F_2 \in x_2] - P[F_1 \in x_1] \times P[F_3 \in x_3] - P[F_2 \in x_2] \times P[F_3 \in x_3] \\ &+ P[F_1 \in x_1] \times P[F_2 \in x_2] \times P[F_3 \in x_3] = \alpha \end{aligned}$$ Equation 4.1

where: $P[F_i \in x_i]$ = proportion of people not accommodated by factor *i*, and

α = proportion of people not accommodated by all the combination of factors.

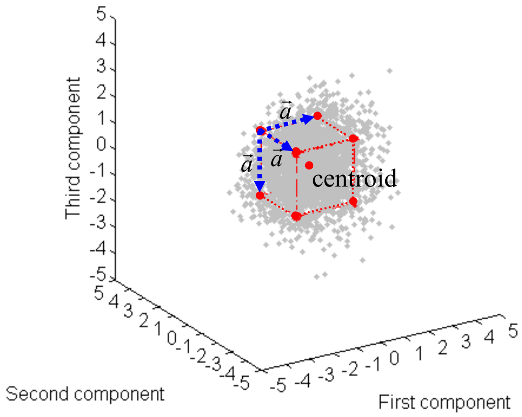
$$w_1\alpha' + w_2\alpha' + w_3\alpha' - w_1w_2\alpha'^2 - w_1w_3\alpha'^2 - w_2w_3\alpha'^2 + w_1w_2w_3\alpha'^3 = \alpha$$ Equation 4.2

where: $w_i\alpha'$ = proportion of people not accommodated by factor *i*,

α' = proportion of people not accommodated by a factor,

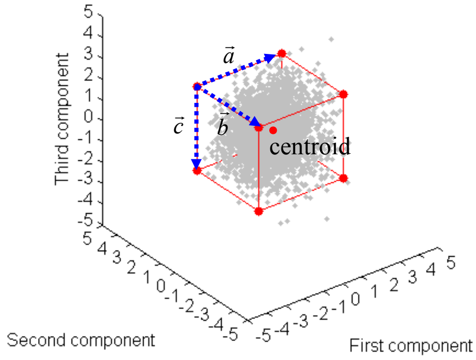
w_i = weight of factor *i*(e.g., $w_i = 1/\sqrt{\lambda_i}$ where λ_i is eigen value of factor *i*), and

α = proportion of people not accommodated by the combination of all factors.



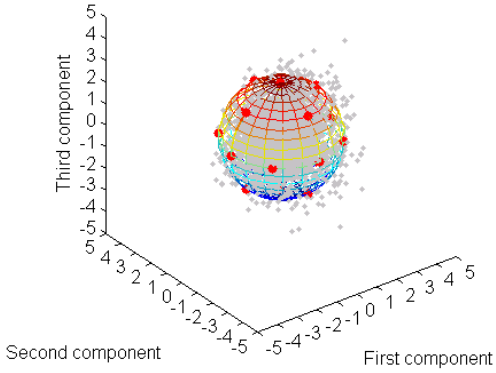
(a) Square Method

(Bittner, 2000)



(b) Rectangular Method

(Kim and Whang, 1997)



(c) Circular Method

(Meindl et al., 1993)

Figure 4.3. Accommodation boundary and RHM-generation locations in the space of factors (small dot: target population, line: accommodation boundary, and large dot: RHM)

$$\mathbf{Z} = \mathbf{FL} \times \mathbf{FS} \qquad \text{Equation 4.3}$$

where: **Z** = $10 \times n$ matrix of standard normal scores (n = number of RHMs generated),

FL = 10×3 matrix of factor loading, and

FS = $3 \times n$ matrix of the factor scores defined in the space of the factors

Distributed methods

The three-step RHM-generation process was also applied to create three groups of RHMs for three distributed methods in the ten anthropometric dimensions related to computer workstation design. In the first step, to identify an optimal number of key dimensions for computer workstation design, the maximum average of adjusted coefficients of determination (R^2) by the number of key dimensions was calculated (Figure 4.4). For the ten selected anthropometric dimensions, the maximum average adjusted R^2 was identified for one through nine of the key dimensions by multiple regression analysis on the combinations of the selected number of key dimensions and the other anthropometric dimensions. Table 4.3 illustrates the identification process of the maximum average of adjusted R^2 in case that the number of key dimensions is single; for each key dimensional candidate starting from AD1 to AD10, adjusted R^2 values of regression equations between the key dimensional candidate and the other anthropometric dimensions were obtained, and their average adjusted R^2 was calculated; finally the maximum of the average adjusted R^2 was identified (e.g., 0.41 for AD2).

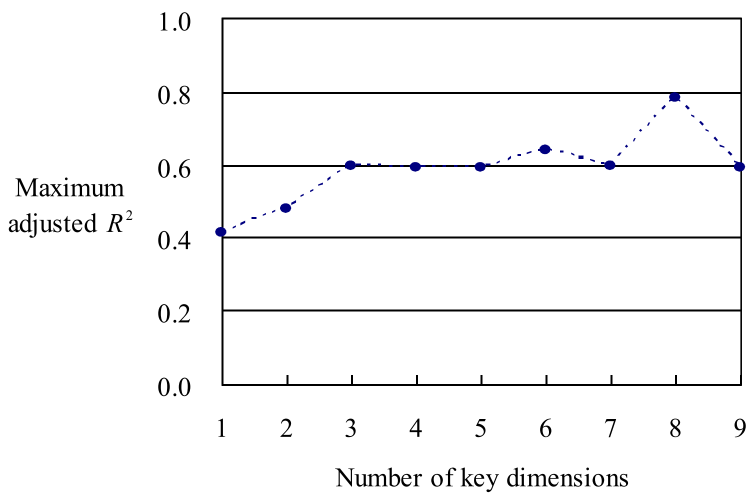


Figure 4.4. Maximum adjusted R2 for different numbers of key dimensions

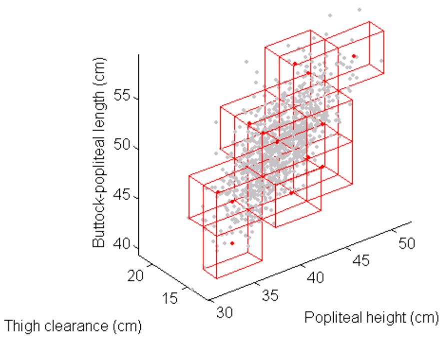
Table 4.3. Illustration of average adjusted R^2 analysis for a single key dimension*

Candidate for key dimension	Other dimension	Adjusted R^2	Average adjusted R^2
BD1	BD2	0.20	
	BD3	0.03	
	.	.	0.19
	.	.	
	.	.	
	BD10	0.13	
BD2	BD1	0.20	
	BD3	0.01	
	BD4	0.54	
	BD5	0.28	
	BD6	0.09	0.41
	BD7	0.74	
	BD8	0.58	
	BD9	0.30	
	BD10	0.93	
.	.	.	.
.	.	.	.
.	.	.	.
BD10	BD1	0.13	
	BD2	0.93	
	.	.	0.35
	.	.	
	.	.	
	BD9	0.18	

* The codes are the same as Table 3.2.

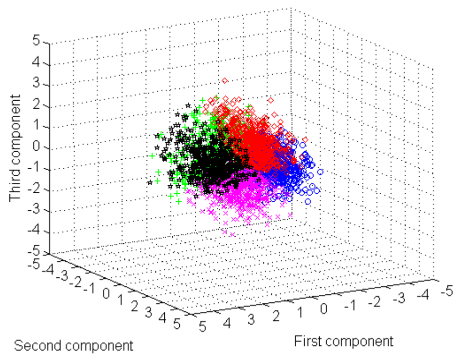
Based on the maximum average adjusted R^2 analysis results, three anthropometric dimensions (popliteal height, BD1; buttock-popliteal length, BD2; thigh clearance, BD5) were selected as the key dimensions for computer workstation design. The trend of maximum average adjusted R^2 in Figure 4.4 shows that the increase of maximum average adjusted R^2 becomes leveled-off at three. A follow-up, in-depth observation of the maximum adjusted R^2 values for various combinations of three anthropometric dimensions found the set of popliteal height (BD1), buttock-popliteal length (BD2), and thigh clearance (BD5) most preferred as key dimensions of computer workstation design.

In the second step, the locations of RHMs in the space of the selected key dimensions were determined for three distributed methods (Figure 4.5). The generation locations of the Grid Method were determined as the centroids of the grids formed to accommodate 90% of the target population by grading system (Kwon et al., 2005). The grading system formed many grids that together covered all of the target population and then, to accommodate a designated percentage of the population, selected a subset of these grids based on the proportions of people within each grid. The size of the grid was determined with a design tolerance value of ±2.5 cm by referring to previous studies (ANSI, 2007).



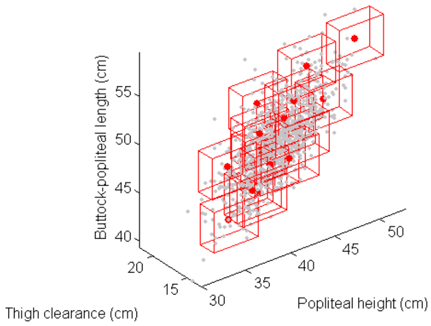
(a) Grid Method

(Robinette and Annis, 1986)



(b) Clustering Method

(Laing et al., 1999)



(c) Optimization Method

(McCulloch et al., 1998)

Figure 4.5. Illustrations of RHM-generation locations for distributed methods

The generation locations of the Cluster Method were determined as the centroids of the clusters generated by K-means cluster analysis in the space of the factors (Laing et al. 1999). To determine an optimal number of clusters, the trend of within-cluster average distances was analyzed by changing the number of clusters from 2 to 50. The cluster analysis showed that the within-cluster average distances decreased as the number of clusters increased until the number of clusters became about 15 (Figure 4.6). Because the within-cluster average distance for more than 15 clusters converged around 2 cm, the optimal number of clusters in the present study was selected as 15.

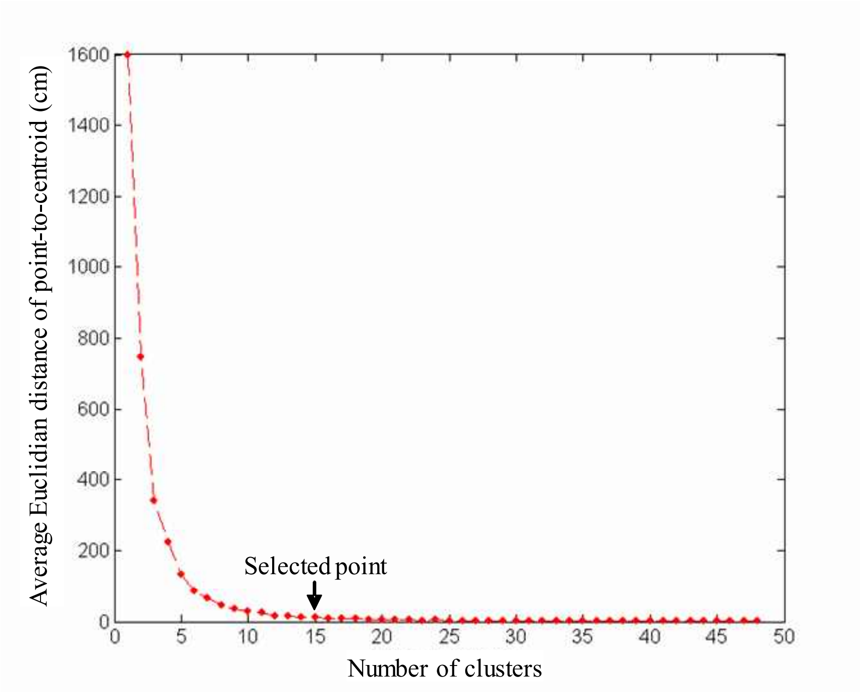


Figure 4.6. Trend of within-cluster average of point-to-centroid distances according to the number of clusters by K-means cluster analysis

The RHM generation locations of the Optimization Method were determined as the centroids of the grids formed in the space of the key dimensions by applying the Nelder-Mead optimization algorithm (McCulloch et al., 1998). To determine the optimal locations of the grids which together minimize the sum of loss scores for 90% of the population, an optimization algorithm (Equation 4.4) was applied. The loss score of a person is defined as the distance from the person to the centroid of the nearest grid in the space defined by the selected key dimensions. For example, the loss score became zero when a person was located at the centroid of any grid; however, the loss score linearly increased as the distance between a person and the centroid of the nearest grid increased.

$$\min \sum_{i=1}^{n} l(p_i)k_i + l(c_\alpha)(1-k_i) \qquad \text{Equation 4.4}$$

$$k_i = \begin{cases} 1 & \textit{if } l(p_i) < l(c_\alpha) \text{ where } l(p_i) = \min_s \{d(\mathbf{x}_i, \mathbf{y}_s)\} \\ 0 & \textit{o/w} \end{cases}$$

$$d(\mathbf{x}_i, \mathbf{y}_s) = \sum_{j=1}^{k} [d(x_{ij}, y_{sj})]^2$$

$$d(x_{ij}, y_{sj}) = \begin{cases} y_{sj} - x_{ij}, & \textit{if } x_{ij} \le y_{sj} \\ x_{ij} - y_{sj}, & \textit{if } x_{ij} > y_{sj} \end{cases}$$

where: n = number of the target population,

$l(p_i)$ = loss score of person i,

$l(c_\alpha)$ = loss cutoff to determine whether a person is accommodated or not,

$d(\mathbf{x}_i, \mathbf{y}_s)$ = distance between person i and its nearest grid,

k = number of key dimensions,

x_{ij} = body size of key dimension j of person i, and

y_{sj} = centroid of the nearest grid s in key dimension j.

In the third step, the body sizes of RHMs for the three distributed methods were estimated based on the generation locations defined in the space of the key dimensions. For the Grid and Optimization Methods, the body sizes of the key dimensions were determined as the generation locations defined in the space of the key dimensions. Next, the body sizes of the remaining dimensions were estimated by regression equations using the key dimensions as independent variables (Table 4.4). The regression equations were developed using multiple stepwise regression analysis with the probability required for inclusion in the model (p_{in}) = 0.05 and the probability for exclusion from the model (p_{out}) = 0.1. For the Cluster Method, the body sizes were estimated by multiplying the factor loading matrix (Table 4.2) by the generation locations defined in the space of the factors.

Table 4.4. Regression equations to estimate the sizes of anthropometric dimensions using three key dimensions*

Anthropometric dimension	Code	Regression equation	Adj. R^2
Hip breadth	BD3	BD3 = 18.87 - 0.59×BD1 + 0.60×BD2 + 0.85×BD5	0.42
Elbow rest height	BD4	BD4 = 25.88 + 0.19×BD1 - 0.43×BD2 + 0.59×BD5	0.11
Buttock-knee length	BD6	BD6 = 2.52 + 0.10×BD1 + 0.95×BD2 + 0.43×BD5	0.96
Abdominal extension depth	BD7	BD7 = -3.53 - 0.15×BD1 + 0.24×BD2 + 1.27×BD5	0.43
Forearm-to-forearm breadth	BD8	BD8 = -3.86 + 0.76×BD1 - 0.36×BD2 + 2.48×BD5	0.55
Foot length	BD9	BD9 = 3.40 + 0.41×BD1 + 0.32×BD5	0.81
Knee height	BD10	BD10 = 3.11 + 0.83×BD1 + 0.19×BD2 + 0.44×BD5	0.96

* Key dimensions: popliteal height (BD1), buttock-popliteal length (BD2), thigh clearance (BD5)

4.2.2. Performance evaluation

4.2.2.1. Boundary methods

The number of RHMs generated by the Circular Method was larger than those of the Square and the Rectangular Methods. The Circular Method generated a 19-member set of RHMs to accommodate 90% of the population for the ten anthropometric dimensions related to computer workstation design. However, the Square and the Rectangular Methods each created 9-member sets of RHMs.

Although the numbers of RHMs generated by the existing methods were small, the numbers can increase as the numbers of factors increases. The number of RHMs generated depends on the number of the factors extracted by Factor Analysis or Principal Component Analysis. For example, the number of RHMs generated by the Square Method is $2^n + 1$ (where n is number of the factors); hence, the number of RHMs increases exponentially with n.

The generation process of the Square Method was easier than the processes of the Rectangular and Circular Methods. The Square Method applied Factor Analysis and the Bittner constant to determine the generation locations of RHMs in the space of the factors. However, the other methods used Factor Analysis (or Principal Component Analysis) and an additional analysis to determine the size of the boundary that accommodates a designated percentage of the population. For example, in the Rectangular Method, the size of the boundary was determined by solving Equation 4.2.

Accommodation percentages of the existing methods decreased as the number of anthropometric dimensions considered in accommodation calculation increased (Figure 4.7). The UAPs of the existing methods were relatively high (Square Method = 87%, Circular Method = 97%, and Rectangular Method = 99%). However, the MAPs of the existing methods decreased as the number of the dimensions increased. For example, when using the Circular Method, average of MAPs was 95% for 120 combinations (${}_{10}C_3$) of three anthropometric dimensions, but only 85% for 45 combinations (${}_{10}C_8$) of eight anthropometric dimensions. This decreasing trend was the steepest when using the Square Method.

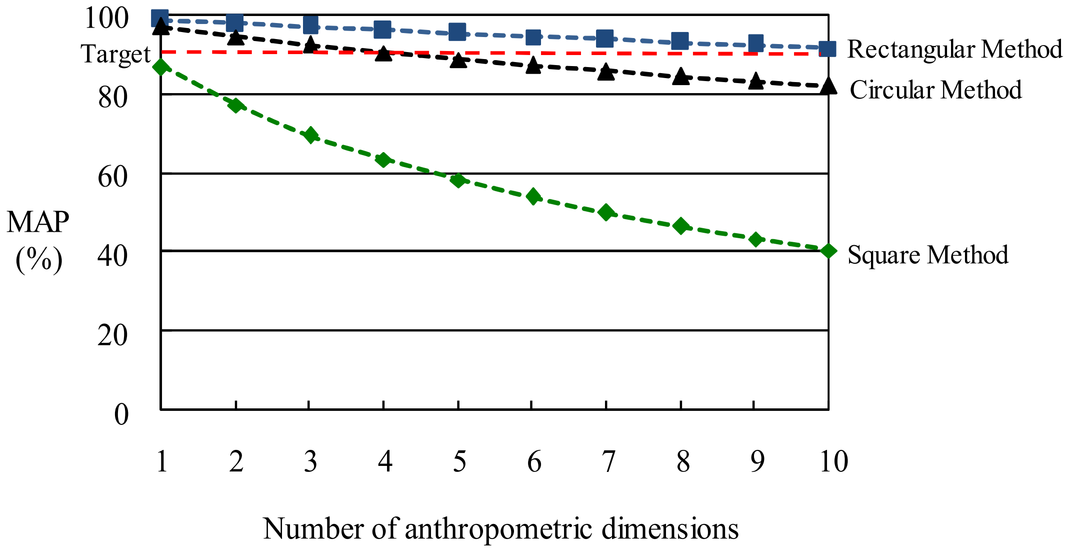


Figure 4.7. MAPs for the different number of anthropometric dimensions

Although the MAP of the Rectangular Method exceeded the target percentage, the MAPs of the Square and Circular Methods were less than the target. For the ten anthropometric dimensions related to computer workstation design, the MAP of the Rectangular Method was 92%, which was slightly greater than the target (90%). On the other hand, the MAP was 41% when using the Square Method and 82% when using the Circular Method. These results indicate that at least one workstation dimension (e.g., seat width) of a product designed when using the Square Method fails to fit 59% of the target population and that when using the Circular Method at least one dimension fails to fit 18% of the population.

Minimum sizes of the RHMs generated by the Rectangular Method were smaller than the minimum sizes of the target population in two anthropometric dimensions (Table 4.5). The minimum size for forearm-to-forearm breadth (BD8) in the Rectangular Method was 32.7 cm, which is appreciably smaller than the minimum size of the population (37.3 cm). In addition, the minimum of abdominal extension depth (BD7) in the Rectangular Method was 15.2 cm, which is slightly smaller than the minimum of the population (15.3 cm). These results indicate that a product designed by the Rectangular Method might be fitted preferentially to small users.

Table 4.5. Comparison of the size ranges for RHMs and the target population*

Classification		Anthropometric dimensions**									
		BD1	BD2	BD3	BD4	BD5	BD6	BD7	BD8	BD9	BD10
US Army	Max	54.7	59.7	49.3	31.1	22.0	72.3	35.0	72.5	31.0	67.5
	Min	29.9	39.4	29.9	12.4	12.1	49.1	15.3	37.3	20.3	40.6
Square Method	Max	45.4	53.8	41.2	26.2	18.5	65.6	27.5	60.8	28.1	58.3
	Min	36.5	44.1	34.2	19.1	14.2	54.5	18.5	40.3	23.0	48.6
Rectangular Method	Max	49.0	57.6	43.7	28.6	20.1	70.0	30.8	68.5	30.1	62.2
	Min	32.8	40.3	31.6	16.6	12.6	50.1	15.2	32.7	21.0	44.7
Circular Method	Max	48.9	54.8	43.7	28.7	18.9	67.3	28.7	61.3	29.5	61.7
	Min	33.0	43.1	31.6	16.6	13.8	52.8	17.3	39.8	21.6	45.1

* The cells exceeding the size range of the US Army are shaded.

** Codes are the same as Table 3.2.

4.2.2.2. Distributed methods

The existing distributed methods created similar numbers of RHMs to accommodate 90% of the population. The Grid and Optimization Methods each created 17-member sets of RHMs. The Cluster Method generated a 15-member set of RHMs. This similar number across the existing methods indicates that 15 to 17 grids (or clusters) were sufficient to represent the target population in the space defined by the selected three key dimensions with the tolerance value of ± 2.5 cm.

The generation process of the Grid Method was relatively simpler than the processes of the Cluster and Optimization Methods. The unique differences in the RHM-generation processes of the existing methods were their methods of forming grids or clusters. The Grid Method created grids using grading system which simply positioning the grids to cover a designated percentage of the population. However, the grids or clusters in the Cluster and Optimization Methods were formed by cluster analysis or an optimization algorithm, which were more difficult to implement than the grading system used in the Grid Method.

The MAPs of the distributed methods decreased as the number of anthropometric dimensions considered in the accommodation calculation increased (Figure 4.8). The UAPs of the distributed methods were higher than the target percentage (90%): Grid Method = 98%, Cluster Method = 94%, and Optimization Method = 98%. However, the MAPs dramatically decreased as the number of anthropometric dimensions increased. For example, using the Grid Method, the average of MAPs was 79% for 120 combinations ($_{10}C_3$) of three anthropometric dimensions, but only 20% for 45 combinations ($_{10}C_8$) of eight anthropometric dimensions. These decreasing trends as the number of dimensions increased were similar in all of the existing methods.

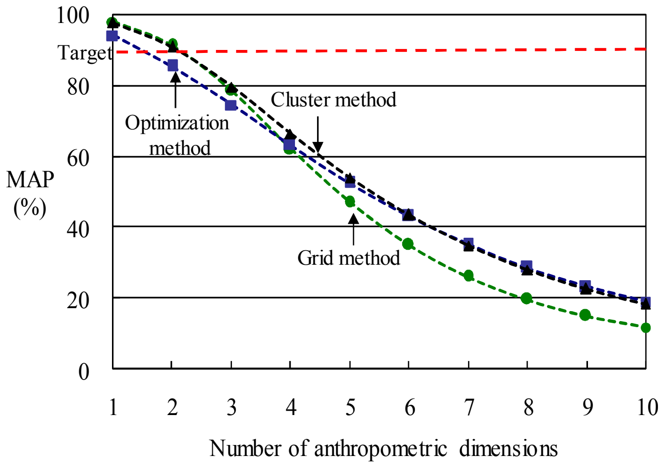
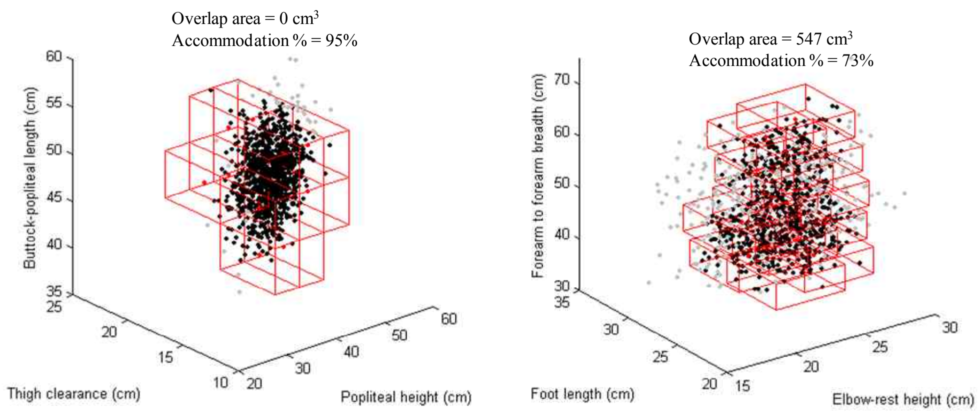


Figure 4.8. Average of accommodation percentages for different number of anthropometric dimensions

MAPs for all of the distributed methods were much lower than the target percentage. MAPs for the ten anthropometric dimensions were only 12% for the Grid Method, 18.5% for the Cluster Method, and 19% for the Optimization Method. These results implied that a product designed by the existing distributed methods would fail to fit a larger proportion of the users than the designer would expect.

A systematic analysis of the generated RHMs identified three variables that affected MAPs. These variables were: overlap area among grids (OA), average adjusted R^2 between key dimensions and other anthropometric dimensions (AR), and sum of the ranges of anthropometric dimensions (SR). First, OA among grids formed negatively related to MAPs. For example, the MAP for the key dimensions BD1, BD2, and BD5 having no OA among grids was 95% (Figure 4.9a), while that for elbow height (BD4), forearm-to-forearm breadth (BD8), and foot length (BD9) having an OA of 547 cm^3 decreased to 73% (Figure 4.9b). Second, AR between key dimensions and other body dimensions positively related to MAPs. For example, the MAP for buttock-knee length (BD6), foot length (BD9), and knee height (BD10) having a larger AR (0.89) was 98%,



(a) small overlap area (b) large overlap area

Figure 4.9. Overlap analysis of representative grids

while that for hip breadth (BD3), elbow height (BD4), and abdominal extension depth (BD7) having a smaller AR (0.32) decreased to 65%. Lastly, SR of anthropometric dimensions negatively related to MAPs. For example, the MAP for BD4 (range = 18.7 cm), BD5 (range = 9.4 cm), and BD9 (range = 10.7 cm) having a smaller SR (38.8 cm) was 86%, while that for BD6 (range = 23.2 cm), BD8 (range = 35.2 cm), and BD10 (range = 23.7 cm) having a larger SR (82.1 cm) decreased to 48%.

The statistical significance and relative influence of each of the three variables on MAP were examined by multiple regression analysis (Equation 4.5). All the variables were standardized, and following equation was obtained using all-possible regression analysis (Cp = 4, adjusted $R^2 = 0.85$):

$$\text{Accommodation \%} = (0.565 - 0.398 \times OA + 0.552 \times AR - 0.201 \times SR) \times 100 \quad \text{Equation 4.5}$$

where: OA = overlap area among grids,

AR = average adjusted R^2 between key dimensions and other anthropometric dimensions, and

SR = sum of the ranges of anthropometric dimensions

The regression coefficients indicated the directionalities of the variable effects agreeing with the aforementioned observations on the accommodation percentage: while OA and SR negatively related to MAP, AR had the opposite relationship. The variables AR, OA, and SR significantly affected MAP in descending order.

Chapter 5
DEVELOPMENT AND ANALYSIS OF A NEW RHM-GENERATION METHOD

5.1. Development of the Boundary Zone (BZ) Method

In this section, a new BZ Method is proposed which consists of a two-step RHM-generation process that can generate a group of RHMs which accommodates a designated percentage of the target population. In the first step, normalized squared distances of each anthropometric case from the centroid of the target population are calculated to identify a BZ (Section 5.1.1). In the second step, cluster analysis is conducted for the cases within the BZ to form a small group of RHMs (Section 5.1.2).

5.1.1. Identification of a BZ

To determine the boundary that accommodates a designated percentage of the population, the body sizes of the population were converted into normalized squared distances using Equation 5.1. Because the normalized squared distances of normally-distributed multivariate data follow a Chi-squared distribution with degrees of freedom (DOF) equal to the number of variables *n* (Johnson and Wichern, 1988), the boundary that encompasses a designated percentage can be easily identified. For example, using two anthropometric dimensions, the normalized squared distances of 90% of the target population are smaller than the Chi-squared value (χ_2^2(1-0.9) = 4.61) of 90% with 2 DOF.

The BZ that accommodates a designated percentage is formed by two boundaries (Figure 5.1), which are determined by a designated accommodation percentage plus or minus a tolerance percentage (e.g., 90% ± 1%). For example, when number of anthropometric dimensions = 2, the target percentage = 90%, and the tolerance percentage = 1%, the Chi-squared values of two boundaries are χ_2^2(1-0.89) = 4.41 and

χ_2^2(1-0.91) = 4.81.

$$D = (AD - \mu)^T \Sigma^{-1} (AD - \mu) \leq \chi_n^2 (1 - p) \qquad \text{Equation 5.1}$$

where: D = normalized squared distance

AD = n-by-1 body size matrix

μ = n-by-1 average body size matrix

Σ = n-by-n covariance matrix

$\chi_n^2(1-p)$ = Chi-squared value for n degree of freedom and p probability

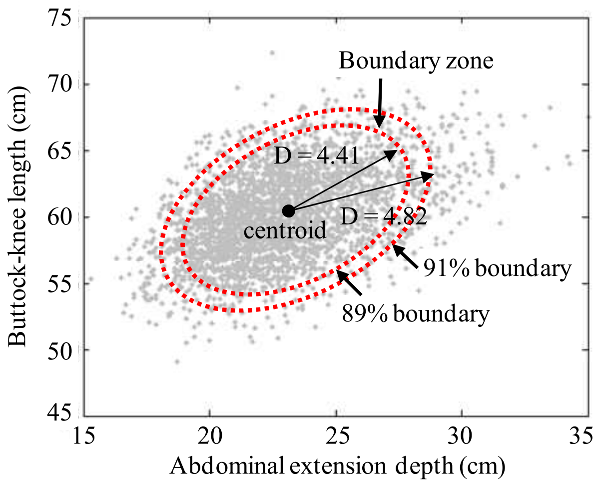
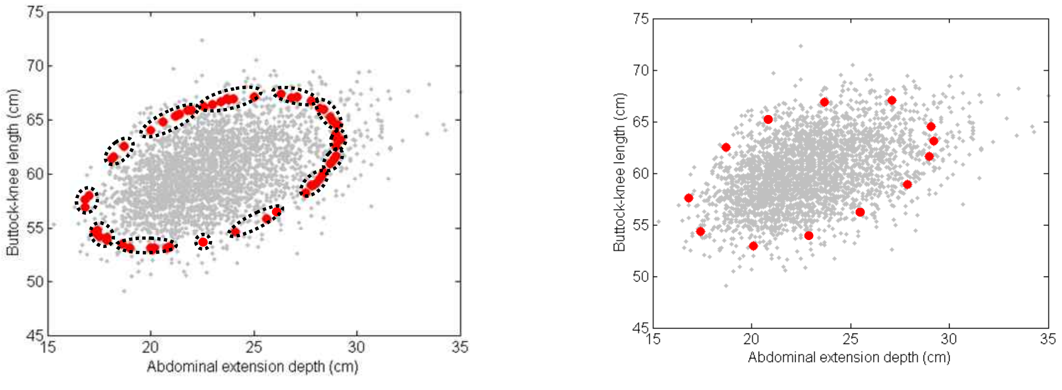


Figure 5.1. A BZ that accommodates 90% of the population with 1% tolerance

5.1.2. Cluster analysis in the BZ

To generate a small group of RHMs, K-means cluster analysis is applied to the cases within the BZ. Some of the cases within the BZ may have similar body sizes; these cases are grouped into clusters to construct an efficient set of RHMs (Figure 5.2). An appropriate number of clusters for K-means cluster analysis can be determined by in-depth analysis of MAPs for different numbers of clusters (Figure 5.3); in this figure, MAPs increased rapidly the number of clusters increased from 2 to 20, fluctuated when this number was between 21 and 33, and stabilized when this number was 34. Therefore, the appropriate number of clusters was determined to be 34, at which number the MAP meets the target percentage and is stable.

An RHM is generated for each cluster formed by K-means cluster analysis; this RHM is selected as the nearest case from the centroid of the corresponding cluster, as measured using Euclidian distance. Although the RHM representing a cluster can be either the nearest case (i.e., a real person) to the centroid or the centroid itself (i.e., an estimated person), the present study selects the nearest real person as the RHM to guarantee that the body sizes of the RHM are within the body size ranges of the target population. For instance, if a cluster includes three cases (Euclidian distance from the centroid: 3 cm, 5 cm, and 10 cm), the RHM representing the cluster is selected as the nearest case having a Euclidian distance of 3 cm.



(a) Cases within a BZ and clusters (b) Optimal number of RHMs

Figure 5.2. Cluster analysis on the cases within a BZ

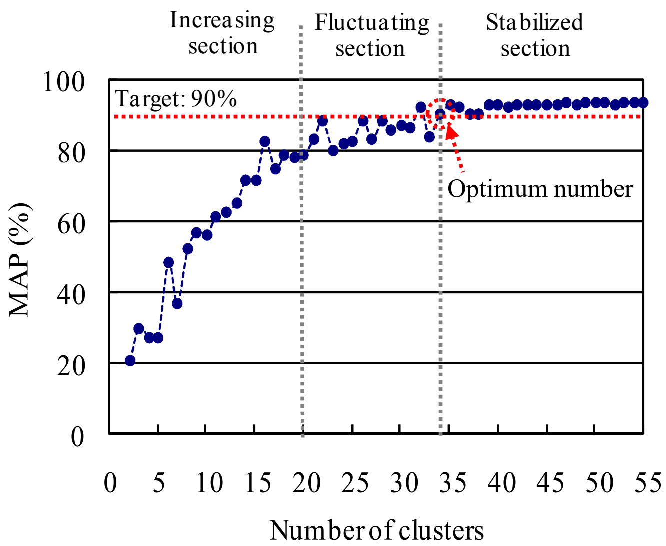


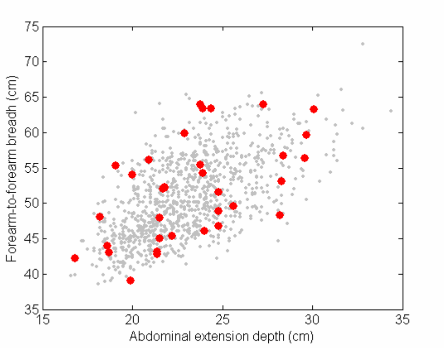
Figure 5.3. MAPs for different numbers of clusters

5.2. Evaluation of the BZ Method

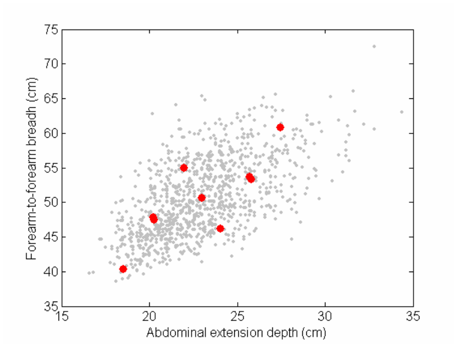
In the present study, two case studies were conducted. The first study compared the performance of the BZ Method with those of the existing method for the ten anthropometric dimensions related to computer workstation design. The second study comprehensively evaluated all of the RHM-generation methods under various numbers and combinations of anthropometric dimensions to generalize the evaluation results. In the case studies, the multivariate evaluation protocol of the present study was applied.

5.2.1. Case study 1: Ten anthropometric dimensions

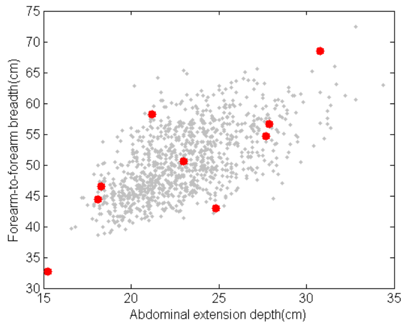
The number of RHMs generated by the BZ Method was larger than those of the existing RHM-generation methods (Figure 5.4). For the ten anthropometric dimensions related to computer workstation design, the BZ Method generated 34 RHMs to accommodate 90% of the target population. However, the existing RHM-generation methods created smaller numbers of RHMs (Square and Rectangular Methods = 9, Circular Method = 19). This result implies that the RHMs generated by the BZ Method had more diverse body sizes than did the RHMs generated by the existing methods..



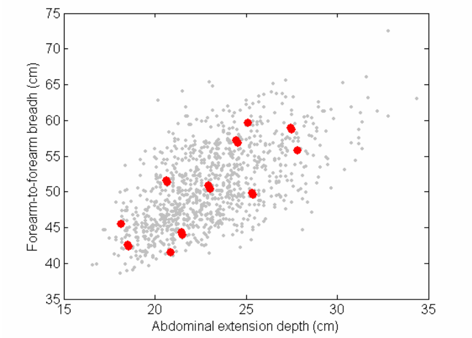
(a) BZ Method



(b) Square Method



(c) Rectangular Method



(d) Circular Method

Figure 5.4. Bivariate plots of the RHMs generated for computer workstation design (small dot: population, large dot: RHM)

The RHM-generation process of the proposed BZ Method was relatively simpler than the processes used in the existing methods. The BZ Method eliminated the process of selecting key dimensions that is typically used in the existing methods to reduce the number of anthropometric dimensions. Furthermore, the BZ Method easily identified a BZ that accommodates a designated percentage of the population by calculating the normalized squared distances from the centroid of the population distribution. However, the BZ Method required iterative cluster analysis to determine an optimal number of clusters.

The MAP of the BZ Method was the closest to the target percentage for the ten anthropometric dimensions. The MAP of the BZ Method was 91%, which is slightly greater than the designated percentage (90%). Whereas, the MAPs of the existing methods were less than (Square Method = 41% and Circular Method = 82%) or greater than (Rectangular Method = 92%) the designated percentage.

The MAPs of the existing RHM-generation methods were not changed although the number of RHMs on the boundary formed in the space of the factors was increased. To analyze the effects of the RHM numbers of the existing methods, more RHMs were generated at the boundary formed by each existing method. For example, in the Rectangular Method, 33 RHMs (original: 9 and additional: 24), i.e., similar number used in the BZ Method, were generated at equidistant points on the rectangular boundary formed in the space of the factors (Figure 5.5). Analysis results showed that the MAPs of the existing methods stayed at the same level because the size of the boundary was unchanged.

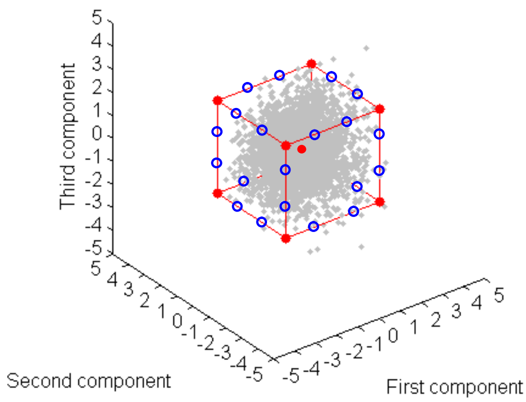


Figure 5.5. Original and additional RHMs generated by Rectangular Method
(red circle: original RHM, open circle: additional RHM)

The body sizes of the RHMs generated by the BZ Method were within the body size ranges of the target population (Table 5.1). For example, popliteal height (BD1) of the

BZ Method ranged from 33.6 cm to 49.2 cm, which falls within the range of the US Army data (29.9 cm to 54.7 cm).

Table 5.1. Body size ranges of RHMs and US Army*

Classification		Anthropometric dimensions**									
		BD1	BD2	BD3	BD4	BD5	BD6	BD7	BD8	BD9	BD10
US Army	Max	54.7	59.7	49.3	31.1	22.0	72.3	35.0	72.5	31.0	67.5
	Min	29.9	39.4	29.9	12.4	12.1	49.1	15.3	37.3	20.3	40.6
Square Method	Max	45.4	53.8	41.2	26.2	18.5	65.6	27.5	60.8	28.1	58.3
	Min	36.5	44.1	34.2	19.1	14.2	54.5	18.5	40.3	23.0	48.6
Rectangular Method	Max	49.0	57.6	43.7	28.6	20.1	70.0	30.8	68.5	30.1	62.2
	Min	32.8	40.3	31.6	16.6	12.6	50.1	15.2	32.7	21.0	44.7
Circular Method	Max	48.9	54.8	43.7	28.7	18.9	67.3	28.7	61.3	29.5	61.7
	Min	33.0	43.1	31.6	16.6	13.8	52.8	17.3	39.8	21.6	45.1
BZ Method	Max	49.2	56.7	44.1	30.2	20.6	68.8	30.1	64.0	30.0	61.6
	Min	33.6	43.4	30.8	14.3	12.1	52.1	16.8	39.0	21.3	45.0

* The cells exceeding the size range of the US Army are shaded.

** Codes are the same as Table 3.2.

Violation of the normality assumption in the BZ Method has an insignificant effect if the distributions of anthropometric dimensions are similar to the normal distribution. For anthropometric product design using percentiles, anthropometric dimensions have been commonly assumed to be normally distributed (Roebuck et al., 1975; Fernandez and Uppugonduri, 1992; Schoor and Konz, 1996). However, anthropometric dimensions significantly violate the normality assumption (Vasu and Mital, 2000). For the ten anthropometric dimensions considered in the present study, the distributions of the dimensions were symmetrical around their means (Figure 5.6), but the Anderson-Darling normality test revealed that none of the dimensions were normally distributed ($\alpha = 0.05$). This violation of the normality assumption affected the distribution property of the normalized squared distance (Figure 5.7). To investigate the effect of violation of the normality assumption, the present study analyzed differences between designated percentages and calculated percentages of people who have smaller normalized squared distances than the Chi-squared value of the designated percentage. Differences (Table 5.2) ranged from -1% to 3% for the 19 conditions of designated percentages (5% to 95% with 5% increment) and were relatively large around the mid-range of the percentage (e.g., 50%). However, the differences at the nominal percentages (5% and 95%) of anthropometric design were less than 1%.

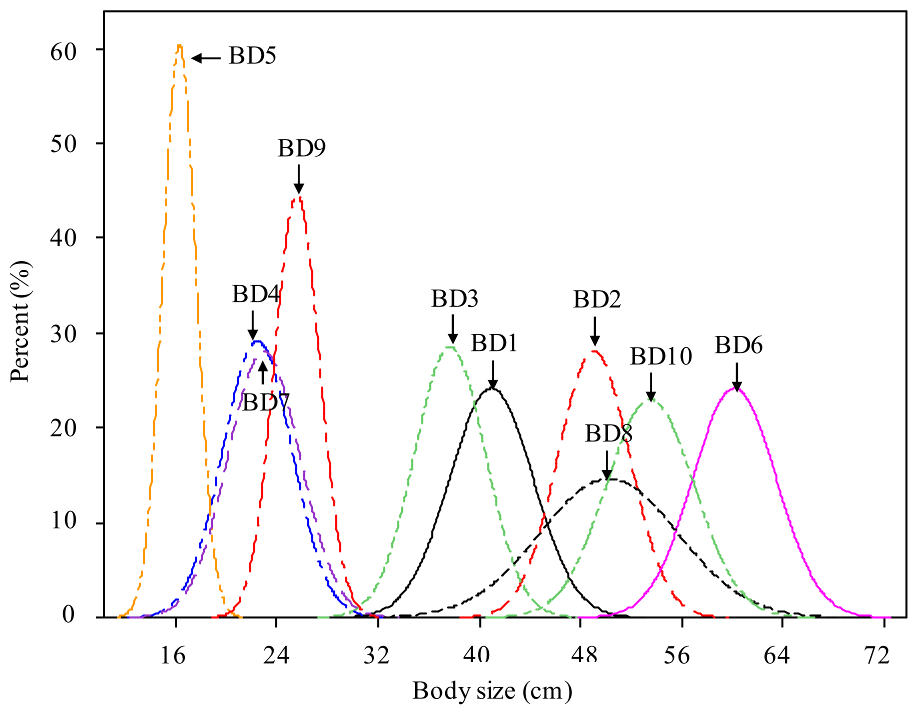


Figure 5.6. Distributions of ten anthropometric dimensions related to computer workstation design (codes are the same as Table 3.2)

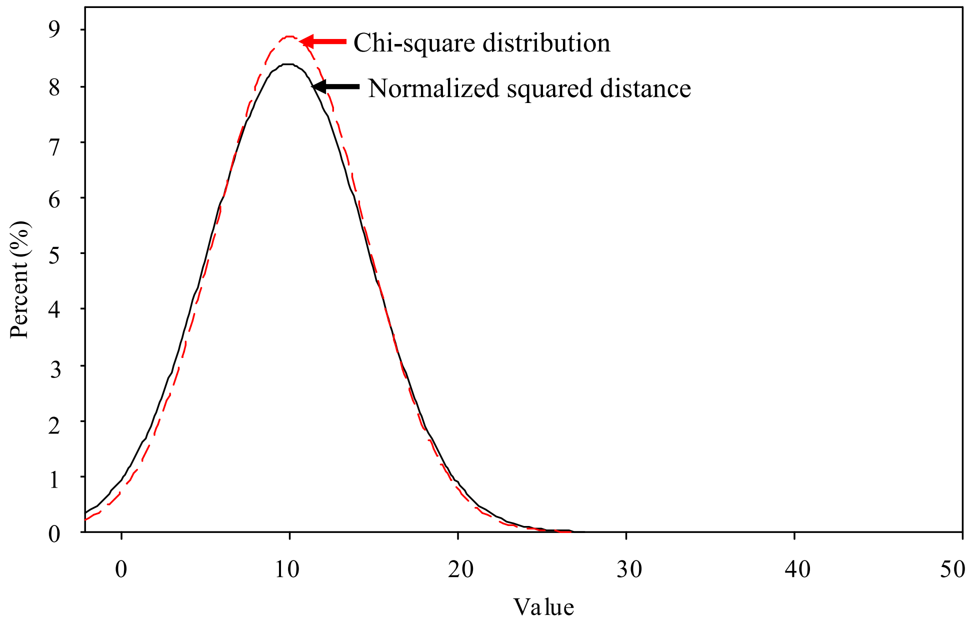


Figure 5.7. Distributions of Chi-squared and normalized squared distance for ten anthropometric dimensions

5.2.2. Case study 2: Various numbers and combinations of anthropometric dimensions

The average MAP of the BZ Method for the 20 evaluation conditions (number = 4 × combination = 5) was the closest to the target percentage compared to the existing methods (Figure 5.8). The average MAP of the BZ Method was 91% which is close to the target (90%). On the other hand, the average MAPs of the Square Method (49%) and the Circular Method (76%) were significantly smaller than the target percentage (Square Method: $t(20) = -23.0$, $p < 0.001$; Circular Method: $t(20) = -8.6$, $p < 0.001$). Conversely, the average MAP of the Rectangular Method (96%) was significantly greater than the target percentage ($t(20) = 9.8$, $p < 0.001$).

Table 5.2. Differences between designated percentages and calculated percentages by the normalized squared distance

No.	Designated percentage (DP)	Calculated percentage (CP)*	Difference (CP-DP)
1	5	4	-1
2	10	10	0
3	15	16	1
4	20	22	2
5	25	28	3
6	30	33	3
7	35	38	3
8	40	43	3
9	45	48	3
10	50	53	3
11	55	58	3
12	60	62	2
13	65	67	2
14	70	72	2
15	75	76	1
16	80	81	1
17	85	85	0
18	90	89	-1
19	95	94	-1

* Proportion of people having smaller normalized squared distance than the Chi-squared value of the designated percentage

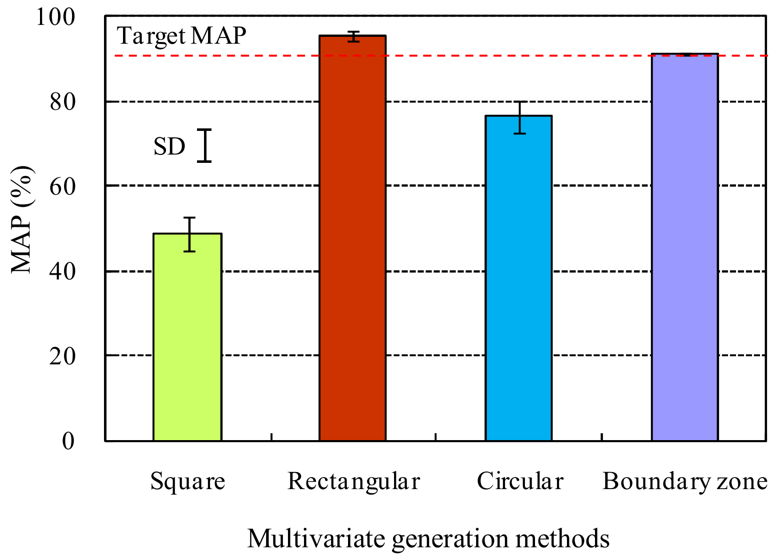
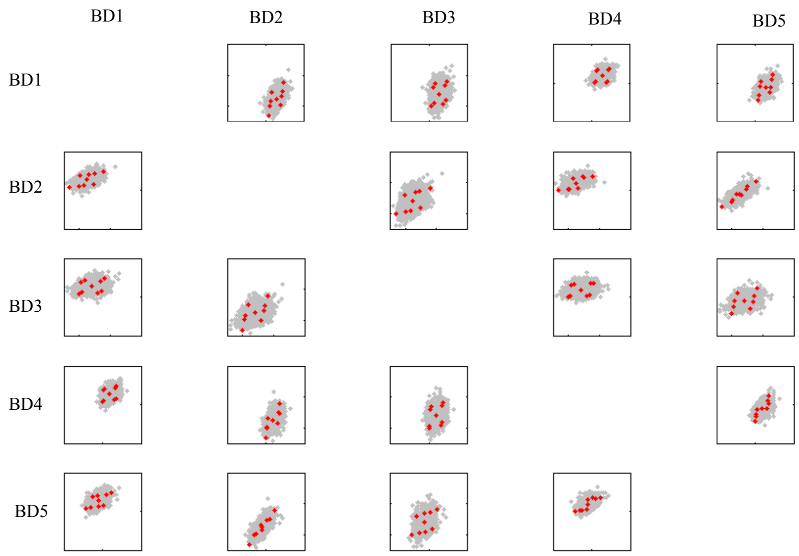


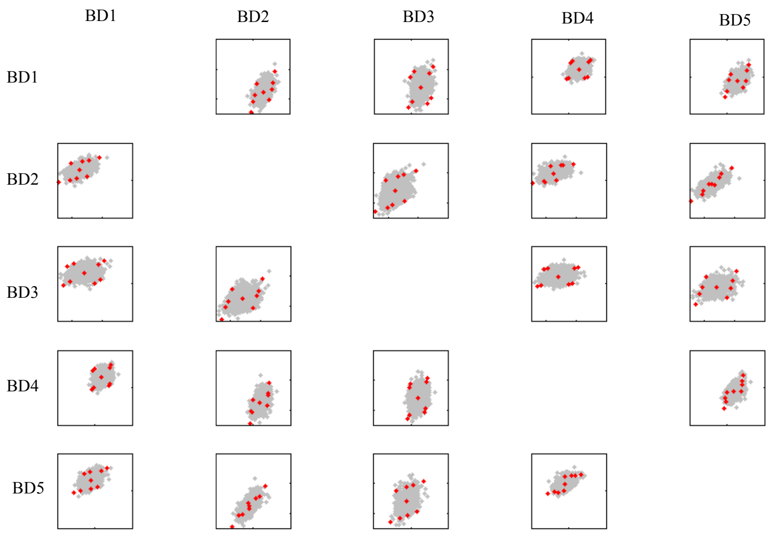
Figure 5.8. MAPs of RHM-generation methods for various numbers and combinations of anthropometric dimensions

The variability among MAPs of the BZ Method was significantly smaller than those of the existing RHM-generation methods. The SD of the BZ Method was 0.6% for the 20 evaluation conditions (Figure 5.8). Whereas, the SDs of the Square Method (8.2%), the Circular Method (7.3%), and the Rectangular Method (2.5%) were significantly greater than that of the BZ Method (Square Method: $F(20, 20) = 169$, $p < 0.001$; Circular Method: $F(20, 20) = 15$, $p < 0.001$; Rectangular Method: $F(20, 20) = 133$, $p < 0.001$).

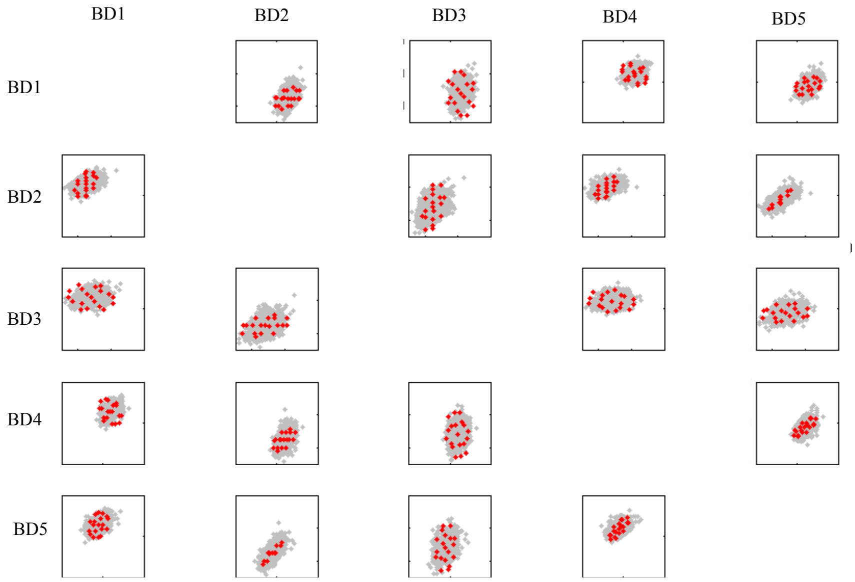
Groups of RHMs generated by the existing RHM-generation methods did not properly represent the body size diversity of the target population for combinations of anthropometric dimensions having similar factor loading patterns (Figure 5.9). For example, in the Square and Rectangular Methods, the sizes of BD2 and BD5 were linearly related because the two dimensions had similar factor loading patterns (Table 5.3)—BD2 and BD5 had the highest factor loadings on the first factor (BD2 = -0.72, BD5 = -0.61) and similar factor loadings on the second (BD2 = 0.26, BD5 = 0.39) and third factors (BD2 = -0.42, BD5 = -0.43). These results indicate that the RHMs generated by the existing RHM-generation methods do not appropriately represent the body size distribution of the target population.



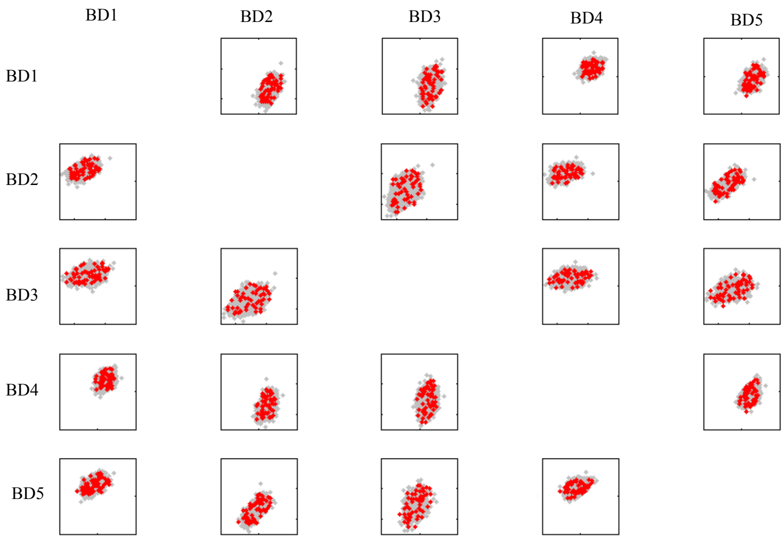
(a) Square Method



(b) Rectangular Method



(c) Circular Method



(d) BZ Method

Figure 5.9. Bivariate plots of the RHMs generated for five anthropometric dimensions

Table 5.3. Factor loadings on five anthropometric dimensions

a) Factor loadings obtained by Factor Analysis

Anthropometric dimension	Factor 1	Factor 2	Factor 3
BD1	-0.18	0.11	-0.94
BD2	-0.61	0.39	-0.43
BD3	-0.18	0.96	-0.12
BD4	-0.90	0.08	-0.06
BD5	-0.72	0.26	-0.42

b) Factor loadings obtained by Principal Component Analysis

Anthropometric dimension	Factor 1	Factor 2	Factor 3
BD1	-0.40	0.42	-0.73
BD2	-0.50	0.01	0.01
BD3	-0.38	-0.87	-0.17
BD4	-0.43	0.21	0.65
BD5	-0.51	0.15	0.14

Analysis of the proportions of outliers showed that the Rectangular Method often generated RHMs that were smaller or larger than the ranges of the body sizes of the target population. For 95% of the total evaluation conditions, the body size of at least one RHM generated by this method was outside the size range of the target population. In addition, the proportion of the RHMs that were outside the size range of the target population was strongly correlated (r = 0.71, p < 0.001) with the number of the factors extracted by Factor Analysis.

The average number of RHMs generated by the BZ Method was significantly larger than those of the existing RHM-generation methods (Figure 5.10) (Square Method: $t(22)$ = -5, p < 0.001; Rectangular Method: $t(22)$ = -5, p < 0.001; Circular Method: $t(22)$ = -2.6, p = 0.02) . In addition, the variation of the number of RHMs generated by the BZ Method was significantly greater than the existing RHM-generation methods (Square Method: $F(20,20) = 15.6$, $p < 0.001$; Rectangular Method: $F(20,20) = 15.6$, $p < 0.001$; Circular Method: $F(20,20) = 4.1$, $p = 0.003$).

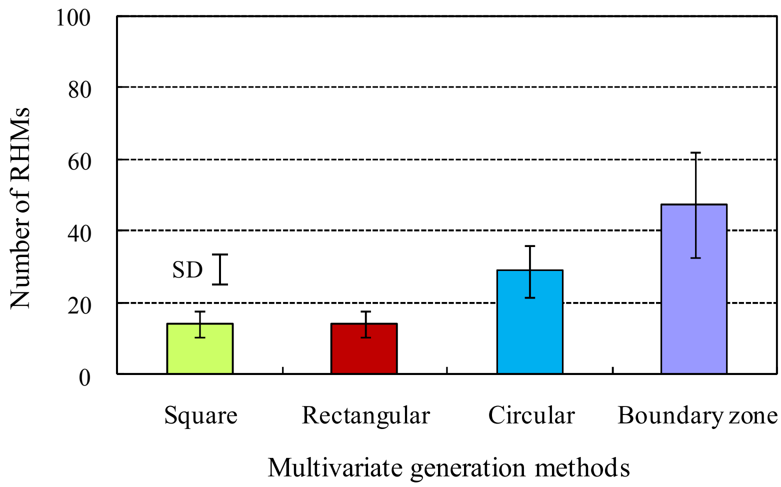


Figure 5.10. Average number of RHMs for the RHM-generation methods

In all methods, the numbers of RHMs generated increased linearly with the number of anthropometric dimensions considered (Figure 5.11). Regression analysis between the number of the RHMs and anthropometric dimensions revealed that regression slopes (b_1) of the Square and Rectangular Methods were not significantly different from 1.0 (R^2 = 0.53, $F(1,19)$=23, $p < 0.001$). On the other hand, the slope was 2.0 for the Circular Method (R^2 = 0.57, $F(1,19)$=27, $p < 0.001$) and 4.9 for the BZ Method (R^2 = 0.87, $F(1,19)$=135, $p < 0.001$).

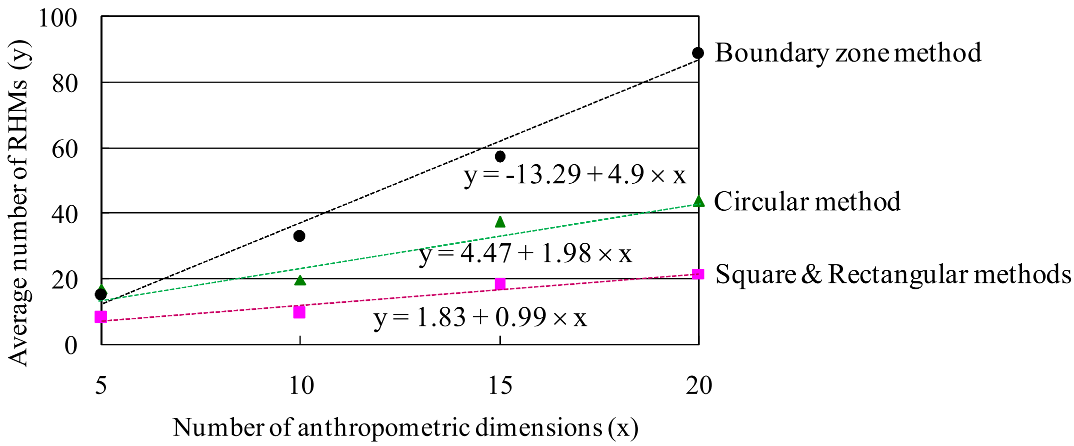


Figure 5.11. Relationship between number of RHMs and number of dimensions

To investigate variables affecting MAP, multiple regression analysis was conducted on three variables (number of factors (NF), percent variance explained (PV), and number of anthropometric dimensions (ND)) that are related to the characteristics of the RHM-generation methods. In multiple stepwise regression analysis, the three variables were used as independent variables and MAP was the dependent variable, with P_{in} = 0.05 and P_{out} = 0.1. The analysis showed that two variables of Factor Analysis and Principal Component Analysis significantly affected the MAPs of the existing RHM-generation methods (Table 5.4). PV was positively related (b_1 = 2.06) to the MAP of the Square Method, and NF was positively related (b_1 = 5.27) to the MAP of the Circular Method. None of the three variables significantly affected the MAP of the BZ Method. In regression analysis of the BZ Method, only ND was considered because the other two variables were not relevant in this method.

Table 5.4. Multiple stepwise regression analysis results for variables affecting MAPs of the RHM- generation methods.

Generation methods	Regression equation*	Adjusted R^2
Square Method	-123.0 + 2.06 × PV	0.33
Rectangular Method	88.7 - 0.280 × ND + 2.81 × NF	0.55
Circular Method	56.9 + 5.27 × NF	0.47
BZ Method**	N.S.***	-

* NF: number of factors, PV: percent variance explained, and ND: number of anthropometric dimensions

** NF and PV were not considered in regression analysis.

*** N.S.: not significant at $\alpha = 0.05$

Chapter 6
EVALUATION OF THE RHM-GENERATION METHODS IN ERGONOMIC DESIGN OF A COMPUTER WORKSTATION

6.1. An anthropometric design process of computer workstation

The computer workstation in the present study was designed by applying a four-step process (Figure 6.1) which was adapted from previous studies (ANSI, 2007; Roebuck, 1995; Wickens et al., 20048, You et al., 1997; Jung et al., 2007; Sanders and McCormick, 1992; Molenbroek et al., 2003). In the first step, the problem statement was defined (Section 6.1.1). In the second step, a small group of RHMs that accommodates a designated percentage of the population was generated (Section 6.1.2). In the third step, design equations for computer workstation were developed based on geometrical relationships between workstation dimensions and anthropometric dimensions (Section 6.1.3). In the last step, design values were calculated using either *deterministic* method (Section 6.1.4.1) or *simulation* method (Section 6.1.4.2) depending on the posture-relatedness of the workstation dimension.

6.1.1. Step 1: Definition of problem statement

The problem statement for computer workstation design was defined in terms of five aspects: 1) demographic information of the target population, 2) computer workstation dimensions, 3) design principles for each workstation dimension, 4) anthropometric dimensions, and 5) workstation design guidelines. First, the US Army was selected as the target population by considering database availability. The target accommodation range was determined to be 90%, which is a nominal percentage in anthropometric product design.

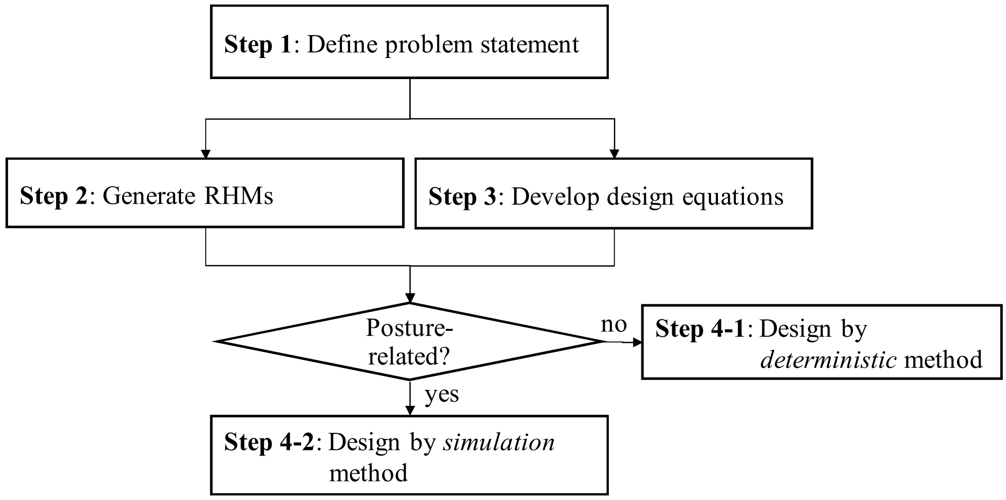


Figure 6.1. Anthropometric design process of computer workstation

Second, workstation design dimensions (*n* = 14) were determined (Table 6.1). The selected workstation dimensions are related to the body sizes of the users. For example, the width (DD1) of the seatpan is related to the hip breadth (BD7) of the users; the depth (DD2) of the seatpan is related to the buttock-popliteal length (BD8) of the users.

Third, ergonomic design principles for the selected design dimensions were assigned (Table 6.1) by referring to the computer workstation design guidelines of ANSI (2007). For example, the design principle for seatpan width (DD1) was determined as design for extreme individuals (EXT) to provide sufficient sitting clearance to the users. The design principle for seat height (DD3) was determined as design for adjustable range (ADJ) to allow the users to adjust the seat height depending on their leg lengths.

Fourth, anthropometric dimensions (*n* = 11) related to computer workstation design were selected (Table 6.1) by analyzing the relationships between workstation dimensions and anthropometric dimensions. For instance, abdominal extension depth (BD1) relates to design of legroom depth (DD12), and acromial height (BD2) relates to design of seatback length (DD5) and armrest height (DD8).

Table 6.1. Computer workstation design characteristics

Design dimension		Code	Relevant anthropometric dimensions	Design principle**
Seatpan	Width	DD1	Hip breadth (BD7)	EXT
	Depth	DD2	Buttock-popliteal length (BD8)	EXT
	Height	DD3	BD8 and popliteal height (BD10)	ADJ
Seatback	Width	DD4	Bideltoid breadth (BD3)	EXT
	Length	DD5	Acromial height (BD2)	EXT
Armrest	Width	DD6	Forearm breadth (BD4)	AVE
	Length	DD7	Span (BD6)*	EXT
	Height	DD8	BD2 and BD6*	ADJ
	Clearance	DD9	Forearm-to-forearm breadth (BD5)	EXT
Legroom	Width	DD10	BD7	EXT
	Height	DD11	Thigh clearance (BD9) and BD10	EXT
	Depth	DD12	Abdominal extension depth (BD1), BD8, BD10, and foot length (BD11)	EXT
Table	Width	DD13	BD3	EXT
	Height	DD14	BD2, BD6, BD8, BD10	ADJ

* Span (BD6) is used in the estimation of humeral link and forearm link length.

** EXT: design for extreme individuals, ADJ: design for adjustable range, AVE: design for the average

Lastly, computer workstation design guidelines were identified (Table 6.2) (ANSI, 2007). For example, pinch points should be removed by means of design or guarding, and the seat edge should be rounded to avoid excessive pressure on the legs. The guidelines identified in the present study can be utilized in manufacture and installation of computer workstations.

Table 6.2. Design guidelines for computer workstation (ANSI, 2007)

Classification		Guidelines
General	Pinch point	Avoided by means of design or guarding
	Adjustment control	● No interfere with user's activities or pose hazard during use ● Usable by users while in the relevant reference posture
	Stability	Structurally rigid and stable under typical usage condition
	Finish of furniture	● Work surface: radii of at least 3 mm ● Other furniture: radii of at least 2 mm
Table	Leg clearance	Shall accommodate seated working posture
	Depth and width	● Allow a viewing distance of at least 50 cm ● Allow positioning of the monitor so that the gaze angle to the center of the screen ranges between 15 and 20 degrees
Seat	Edge	Rounded
	Backrest	Sufficiently tall and wide
	Armrest	● Maintain a good thermal balance ● Not create excessive pressure points ● Not irritate or abrade the skin ● Be able to detached from the chair if necessary to fit the workplace
Monitor		● A minimum viewing distance of 50 cm ● Be designed so as to allow placement of the monitor's viewing area below the user's horizontal eye height
Input device		Adjust in height (or a combination of height and tilt)

6.1.2. Step 2: Generation of RHMs

To compare the performances of the RHM-generation methods in an ergonomic design, five groups of RHMs were created using five RHM-generation methods (Percentile, Square, Circular, Rectangular, and BZ Methods). The RHMs were generated to accommodate 90% of the learning set (n = 2,980) selected from the US Army data (Gordon et al., 1998). The numbers of the RHMs generated by the five methods were three (Percentile Method), nine (Square and Rectangular Methods), 19 (Circular Method), and 34 (BZ Method).

6.1.3. Step 3: Development of design equations

Design equations for computer workstation design were formulated by applying a three-step process: 1) relationship analysis between the workstation design dimensions and anthropometric dimensions, 2) development of design equations, and 3) validation of the design equations. In the first step, relationships between the design dimensions and anthropometric dimensions were identified by DSM analysis (Table 6.3). To conduct the DSM analysis, the design dimensions and anthropometric dimensions were placed in the row and column of a matrix. Next, a symbol (❍) was used to mark the cells at intersections of rows of design dimensions and columns of anthropometric dimensions that are related to the design of the corresponding dimension. For example, the cell intersecting the row that represents seatpan width (DD1) and the column that represents hip breadth (DB7) was marked because DB7 is related to design of DD1.

In the second step, design equations were formulated based on the identified relationships between the design dimensions and anthropometric dimensions (Table 6.4). For example, the design equation of seatpan height (DD3) was developed as “BD10 × sin (AD5) + 2.5 cm” where BD10 is popliteal height, AD5 is knee flexion angle, and 2.5 cm is an allowance for shoes. The allowances used in the present study were adapted from ANSI (2007).

Table 6.3. Relationship between design dimensions and anthropometric dimensions

Design dimension		Code	Body dimension											Angular dimension*				
			Trunk			Arm			Hip	Leg				Trunk	Shoulder		Elbow	Knee
			Abdominal extension depth	Acromial height	Bideltoid breadth	Forearm breadth	Forearm-to-forearm breadth	Span**	Hip breadth	Buttock-popliteal length	Thigh clearance	Popliteal height	Foot length	FE(+)	FE(+)/ EX(-)	AB(+)/ AD(-)	FE(+)	FE(+)
			BD1	BD2	BD3	BD4	BD5	BD6	BD7	BD8	BD9	BD10	BD11	AD1	AD2	AD3	AD4	AD5
Seat-pan	Width	DD1							❍									
	Depth	DD2								❍								
	Height	DD3								❍		❍						❍
Seat-back	Width	DD4			❍													
	Length	DD5		❍														
Arm-rest	Width	DD6				❍												
	Length	DD7						❍										
	Height	DD8		❍				❍						❍	❍	❍	❍	
	Clearance	DD9					❍											
Leg-room	Width	DD10							❍									
	Height	DD11								❍	❍							❍
	Depth	DD12	❍							❍		❍	❍					❍
Table	Width	DD13			❍													
	Height	DD14		❍				❍		❍		❍		❍	❍	❍	❍	

* FE: flexion motion, EX: extension motion, AB: abduction motion, and AD: adduction motion

** Span (BD6) is used in the estimation of humeral link and forearm link length

Table 6.4. Design equations of computer workstation design (unit: cm)

Design dimension		Code	Design equation*	Allowance (ANSI, 2007)
Seatpan	Width	DD1	BD7 + 2.5	2.5
	Depth	DD2	BD8 - 1	1
	Height	DD3	BD10 × sin (AD5) + 2.5	2.5
Seatback	Width	DD4	BD3	-
	Length	DD5	BD2	-
Armrest	Width	DD6	BD4	-
	Length	DD7	BD6	-
	Height	DD8	BD2 × cos (AD1) – BD6 × cos (AD2) × cos (AD3)	-
	Clearance	DD9	BD5	-
Legroom	Width	DD10	BD7 + 2.5	-
	Height	DD11	BD10 × sin (AD5) + BD9 + 5	5
	Depth	DD12	BD8 + BD10 × cos (AD5) + BD11 + 2.5 - BD1	2.5
Table	Width	DD13	BD3 + 2.5	2.5
	Height	DD14	DD8 + BD2 × cos (AD1) – BD6 × cos (AD2) × cos (AD3) – BD6 × cos (AD4)	-

* Abbreviations are the same as Table 6.3.

In the last step, the design equations were validated by comparing values calculated by the design equations and measured using CAD software (Rhino®). To evaluate the design equations, the values calculated by the design equations were compared with the values measured by visualizing an average linkage person with the anatomical standard sitting posture in CAD software (Figure 6.2). Evaluation results showed that the differences between the values from the design equations and CAD software were no greater than 0.1 cm for all of the workstation dimensions. This difference may be due to rounding error.

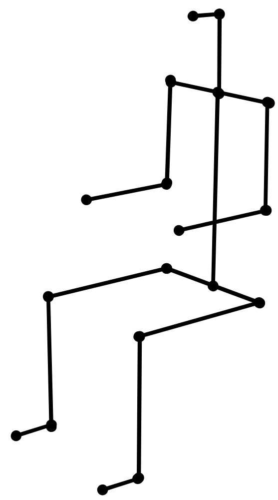


Figure 6.2. An average linkage person visualized in Rhino®

6.1.4. Step 4: Determination of design values

Depending on the posture-relatedness of a given workstation dimension, deterministic method or simulation method were applied to determine the design value of computer workstation. If the size of a design dimension is not affected by usage posture, this dimension is designed using a deterministic method, which determines the design value by inputting the body sizes of the RHMs into the design equation. Conversely, if the size of a design dimension is affected by usage posture, this dimension is designed using simulation method, which simulates the RHMs' postures and finds an optimal design value.

6.1.4.1. Deterministic method

Based on the ergonomic design principle of a design dimension, the direct design method selected the design value of the dimension from the design value candidates that were calculated by inputting the body sizes of RHMs into the corresponding design equation. For example (Figure 6.3), the design value of seatpan width (DD1) was selected as 43.7 cm based on its ergonomic design principle (design for upper extreme person) from the calculated design value candidates (e.g., 37.8, 37.3, and 43.7 cm).

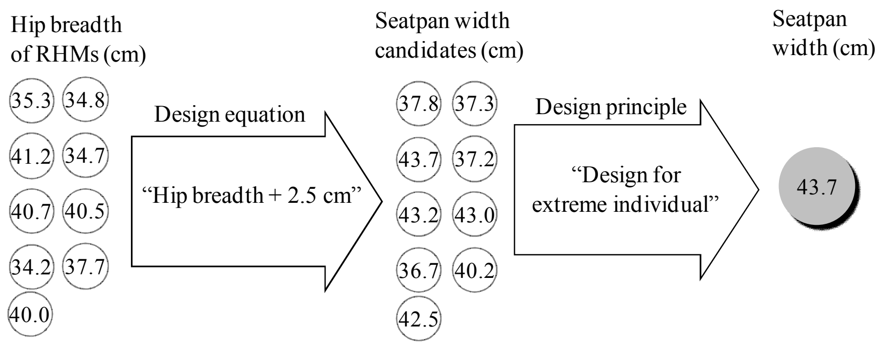


Figure 6.3. Determination process of the design value of seatpan width using direct design method

6.1.4.2. Simulation method

The postural simulation method determined the design value of a workstation dimension by applying a three-step process (Figure 6.4) that simulates the posture of the RHMs for various design value candidates. In the first step, three kinds of information (linkage human model, loss function, and postural simulation range) were defined for postural simulation. First, to simulate the posture of the RHMs, linkage human models (

Figure 6.5) were developed by converting the body sizes of the RHMs into linkage sizes using body-to-link (BL) conversion ratios (Table 6.5) provided in SAE (1991) and Human Scale (1980). For example, the size of the humeral link (LD2) is calculated by

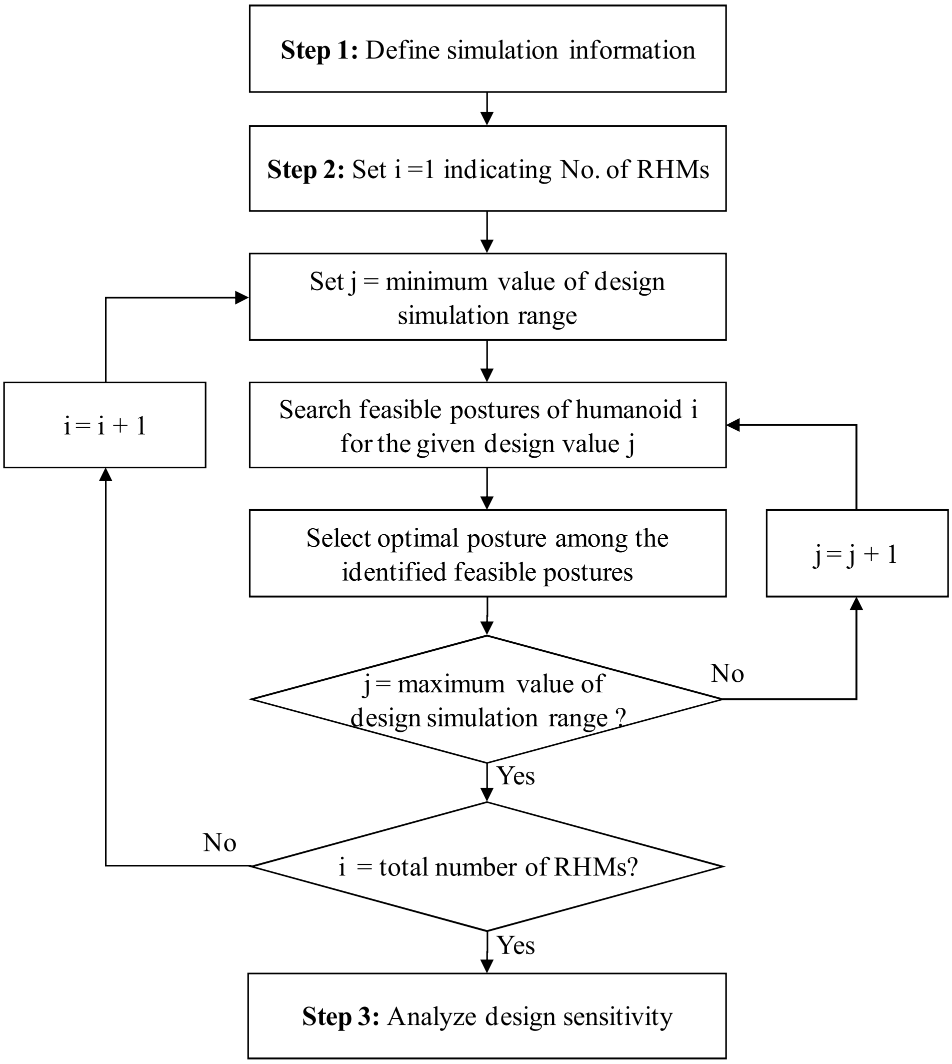


Figure 6.4. A postural simulation process to determine an optimal design value

Table 6.5. BL ratios used to convert body sizes into corresponding link sizes (SAE, 1991; Human Scale, 1980)

Linkage dimension		Body dimension		BL ratio
Variable	Code	Variable	Code	
Shoulder pivot width	LD1	Bideltoid breadth	BD3	0.77
Humeral link	LD2	Span	BD6	0.16
Forearm link	LD3	Span	BD6	0.16
Trunk link	LD4	Acromial height	BD2	0.91
Hip pivot width	LD5	Hip breath, sitting	BD7	0.49
Femoral link	LD6	Buttock-popliteal length	BD8	0.89
Shank link	LD7	Popliteal height	BD10	0.90
Ankle-to-toe	LD8	Foot length	BD11	0.75
Ankle pivot to floor	LD9	Popliteal height	BD10	0.20
HP-Seat vertical	LD10	Thigh clearance	BD9	0.50
HP-Seat horizontal	LD11	Buttock-popliteal length	BD8	0.28

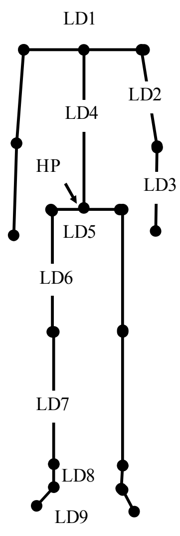


Figure 6.5. Linkage human model for computer workstation design

(Abbreviations are the same as Table 6.5) multiplying span (BD6) by a BL ratio of 0.16. Second, loss functions for each joint motion were defined by referring to design reference postures and comfortable ranges of motions (Table 6.6) for computer workstation provided in previous studies (Chaffin and Andersson, 1984; Karlqvist et al., 1996; Cushman, 1984; Grandjean et al.,1983; Miller and Suther, 1983; Weber et al., 1984; Hedge el al.,1995; Rempel and Horie, 1994; and Weiss et al., 1995). The loss function converted joint angles of the RHMs into loss scores which indicate postural load of a given posture. The loss score of the present increased linearly as joint angle departed from the reference posture (Figure 6.6). Lastly, postural simulation ranges for each joint motion were restricted to be within the comfortable ranges of motions. For example, the range of elbow flexion motion was restricted to be within 70° ~ 135°.

Table 6.6. Reference posture and comfortable range of motions for computer workstation use*

Classification		Reference posture	Comfortable range of motion (°)
Trunk	Flexion(+)	90	[90, 120]
Shoulder	Flexion(+)/ extension(-)	0	[0, 25]
	Abduction(+)/ adduction(-)	0	[0, 25]
Elbow	Flexion(+)	90	[70, 135]
Knee	Flexion(+)	90	[70, 110]**

* Source: BSR/HFES 100 (2002), Chaffin and Andersson (1984), Karlqvist et al. (1996), Cushman (1984), Grandjean et al.(1983), Miller and Suther (1981), Weber et al. (1984), Hedge el al.(1995), Keir et al. (1995), Rempel and Horie (1994), Weiss et al. (1995)

** Assumed in this study

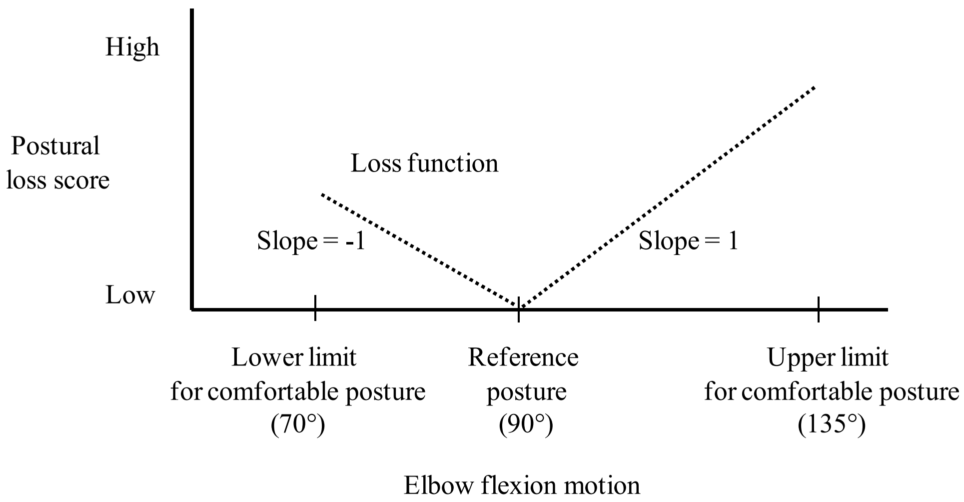


Figure 6.6. Loss function for elbow flexion motion

In the second step, postural simulation analysis was conducted based on the information defined in the first step. The simulation analysis found feasible postures of the linkage human models for various design value candidates and converted the feasible postures into loss scores by applying the loss functions. For example, in seat height simulation, the feasible postures of the linkage human models for various seat heights (30 cm ~ 60 cm) were found and the loss scores for each seat height were calculated. For efficient simulation and posture visualization of the linkage human models, simulation software was developed (Figure 6.7).

In the last step, an optimal design value was determined by design sensitivity analysis of the loss scores identified in the second step. The design sensitivity analysis visualizes a distribution of the loss scores for various design values (Figure 6.8). Based on the result of this analysis, the optimal design value was determined by a two-step process: 1) determination of the best design values for each RHM and 2) determination of the optimal design value for the group of RHMs. First, the best design values for each RHM were determined by minimizing the loss scores based on the design sensitivity analysis result. For example (Figure 6.8), the best design values of seatpan and table height dimensions for an RHM were 42 cm and 59.5 cm, respectively. Next, the optimal design value for a group of RHMs was determined from the best design values obtained for each RHM by considering the design principle of the design dimension. For example, in seat height, for which the design principle is design for adjustable range, the adjustable range is determined as 38.3 cm ~ 48.9 cm to accommodate the best design values (e.g., 38.3 cm, 42 cm, and 48.9 cm) of each RHM.

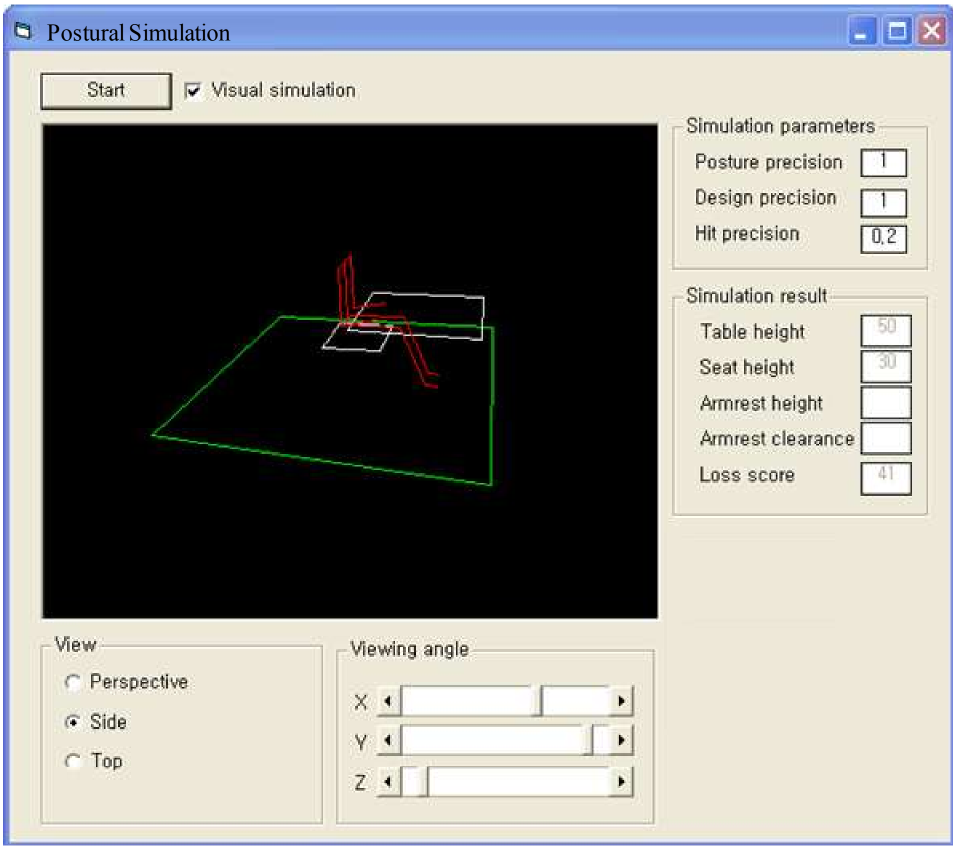


Figure 6.7. Simulation software for computer workstation design

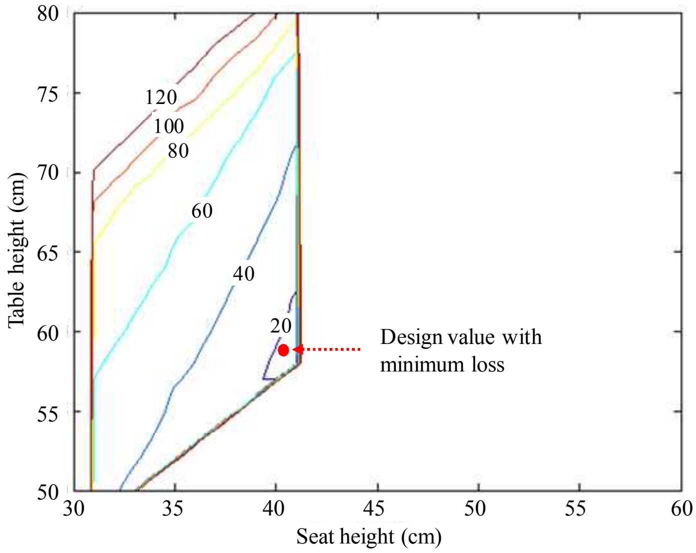


Figure 6.8. Design sensitivity analysis for seat and table heights

6.2. Evaluation of the RHM-generation methods

To evaluate the designs, maximum differences (MD) of the design values determined by the five RHM-generation methods varied from 0.5 cm (6%) to 10.2 cm (62%) depending on design dimensions. For example (Table 6.7), MD of seat width (DD1) was small, i.e., 3.2 cm (6.9%); but MD of the adjustable range of seatpan height (DD3) was large, i.e., 8.6 cm (44.8%).

Most of the design values derived in the present study were similar to the design values of standards and products on the market; however, discrepancies in some dimensions occurred due to differences in design concepts. The design values of the present study were compared to the design values of five standard designs (ANSI, EU, CEN, DIS, and SS) and two products (OH2320B, Livart, Korea; OH3250BU, Neoce, Korea) on the market (Table 6.8). Most of the design values were similar to each other; but some of the design values differed. For example, the design values of seatback length (DD5) of the present study ranged from 62.2 to 66.5 cm depending on the RHM-generation method used; but, the design value (45 cm) of ANSI was significantly smaller. In addition, the difference between the seatback lengths of the two products (45 cm and 60 cm) was large. This discrepancy may be due to use of different design concepts for seatbacks.

Table 6.7. Computer workstation design values of the RHM-generation methods (unit: cm)

Dimensions			Code	Generation methods (cm)					Maximum difference	
				Percentile	Square	Circular	Rectangular	BZ	Value	%
Seat-pan	Width		DD1	44.9	43.5	46.3	45.8	46.7	3.2	6.9
	Depth		DD2	43.5	43.5	42.0	40.2	41.9	3.3	7.6
	Height	Min	DD3	38.3	37.9	36.4	33.8	37.1	4.5	11.7
		Max		48.9	48.8	50.4	53.0	52.5	4.2	7.9
		Range		10.6	10.9	14.0	19.2	15.4	8.6	44.8
Seat-back	Width		DD4	41.8	41.5	42.8	44.3	45.1	3.6	8.0
	Length		DD5	63.4	62.2	63.6	65.8	66.5	4.3	6.5
Arm-rest	Width		DD6	4.7	4.7	4.9	5.2	5.0	0.5	9.6
	Length		DD7	30.8	30.6	31.7	32.8	33.0	2.4	7.3
	Height	Min	DD8	22.0	22.3	21.4	20.7	18.4	3.9	17.5
		Max		26.8	26.6	27.5	28.3	29.7	3.1	10.4
		Range		4.9	4.3	6.2	7.6	11.3	7.0	61.9
	Clearance		DD9	43.4	42.0	44.8	44.3	45.2	3.2	7.1
Leg-room	Width		DD10	49.9	48.5	51.3	50.8	51.7	3.2	6.2
	Depth		DD11	56.6	60.2	63.0	65.1	66.8	10.2	15.3
	Height		DD12	67.5	66.4	68.3	71.4	69.8	5.0	7.0
Table	Width		DD13	67.5	66.8	68.9	73.6	68.5	6.8	9.2
	Height	Min	DD14	52.6	53.0	51.1	47.9	52.8	5.1	9.6
		Max		67.5	66.4	68.3	71.4	69.8	5.0	7.0
		Range		14.9	13.4	17.2	23.5	17.1	10.1	43.0

Table 6.8. Benchmarking of computer workstation designs

Dimensions			Code	Computer workstation design standard*					Product***	
				ANSI	BS	CEN	DIN	SS	A	B
Seat-pan	Width		DD1	46<**	41	40<	40 ~ 45	42<	46	48.5
	Depth		DD2	43>	36 ~ 47	38 ~ 47	38 ~ 42	38 ~ 43	41	45
	Height	Min	DD3	38	43	39	42	43	43	42
		Max		56	51	54	54	50	50	48
		Range		18	8	15	12	7	7	6
Seat-back	Width		DD4	36<	30 ~ 36	36 ~ 40	36 ~ 40	36 ~ 40	41.5	46.5
	Length		DD5	45<	-	-	-	-	45	60
Arm-rest	Width		DD6	-	4	4<	-	4<	5	4.8
	Length		DD7	-	22	20<	20 ~ 28	20<	37	34
	Height	Min	DD8	17	16	21	21	19	19	21
		Max		27	23	25	25	25		
		Range		10	7	4	4	-	-	-
	Clearance		DD9	46<	47 ~ 56	46 ~ 50	48 ~ 50	46	50	50
Leg-room	Width		DD10	52	-	-	-	-	60	120
	Depth		DD11	60	-	-	-	-	46	70.5
	Height		DD12	50 ~ 72	-	62<	62<	61<	60	70
Table	Width		DD13	70<	-	-	-	-	60	120
	Height	Min	DD14	50	-	60	60	62	62	73
		Max		72	-	68	68	67		
		Range		22	-	8	8	-	-	-

* ANSI: American National Standards Institute, BS: British Standard, CEN: European Standard, DIN: German Standard, SS: Swedish Standard

** 46< means 46 cm or higher

*** Product information: A (OH2320B, Livart, Korea), B (OH3250BU, Neoce, Korea)

The UAPs of the BZ Method ranged from 96% to 99.9%, which exceeded the target percentage (90%) (Table 6.9). On the other hand, some UAPs of the existing RHM-generation methods were below the target percentage. For example, using the Percentile Method, the UAP of seatpan width (DD1) was 95.9% which was greater than the target percentage; but that of legroom depth (DD11) was 64.9% which was smaller than the target.

Table 6.9. Univariate accommodation percentages of the RHM-generation methods*

Design dimensions		Code	Generation methods				
			Percentile	Square	Circular	Rectangular	BZ
Seat-pan	Width	DD1	95.9	89.1	97.9	97.3	98.7
	Depth	DD2	94.8	94.8	98.6	99.9	98.7
	Height	DD3	90.4	90.7	97.0	99.9	98.3
Seat-back	Width	DD4	95.2	93.9	98.6	99.9	99.9
	Length	DD5	95.6	90.5	95.9	98.8	99.6
Arm-rest	Width	DD6	95.4	95.4	98.2	99.7	99.4
	Length	DD7	94.6	93.3	98.3	99.9	99.9
	Height	DD8	60.2	55.3	72.6	83.8	97.6
	Clearance	DD9	95.9	89.1	97.9	97.3	98.7
Leg-room	Width	DD10	95.9	89.1	97.9	97.3	98.7
	Depth	DD11	64.9	94.9	97.9	99.7	99.9
	Height	DD12	95.1	91.7	97.5	99.8	96.9
Table	Width	DD13	94.3	93.3	97.0	99.7	96.0
	Height	DD14	90.8	90.3	91.3	93.6	95.8

* The cell is shaded when the accommodation percentage for the design dimension is below the target percentage.

A systematic analysis on the generated RHMs identified two variables as those affecting the UAPs of the existing RHM-generation methods. These variables were: number of anthropometric dimensions (NA), and affiliation characteristics of anthropometric dimensions to the factors (AC). NA negatively related to UAP. For example, using the Percentile Method, seat width (DD1) which was designed by a single anthropometric dimension (hip breadth) had high UAP (96%); however, legroom depth (DD11) which was designed by three anthropometric dimensions (upper leg length, lower leg length, and foot length) had low UAP (65%). AC, which is a binary variable indicating whether or not the anthropometric dimensions applied to design of a workstation dimension have similar factor loading patterns, was also negatively related to UAP. For example, using the Square Method (Table 6.10), legroom height (AC = 0; DD12) designed by popliteal height (BD10) and thigh clearance (BD9) having different factor loading patterns had high UAP (91.7%); however, armrest height (AC = 1; DD8) designed by acromial height (BD2) and upper arm length (estimated by span (BD6) using a BL ratio) having similar factor loading patterns had low UAP (55.3%).

Statistical significance of the two variables was analyzed (Table 6.11) by multiple stepwise regression analysis ($P_{in} = 0.05$, $P_{out} = 0.1$). NA was significant in the Percentile Method ($F(1,11) = 5$, $p = 0.047$) and negatively ($b_1 = -15.3\%$) related to UAP. On the other hand, AC was significant in the Square ($F(1,12) = 224$, $p < 0.001$), Circular ($F(1,12) = 151$, $p < 0.001$), and Rectangular ($F(1,12) = 59$, $p < 0.001$) Methods and negatively related (b_1 = -37.1%, -25.1%, and -15.4%, respectively) to UAP. NA and AC were not significant in the BZ Method.

The MAP of the BZ Method satisfied the target percentage, but those of the existing boundary methods did not. The MAP of the BZ Method for all of the workstation dimensions was 89%, which is close to the target percentage (90%). However, the MAPs were 25% for the Percentile Method, 33% for the Square Method, 63% for the Circular Method, and 80% for the Rectangular Method. These results indicate that a greater than expected proportion of the users must adjust their postures to fit workstations designed by the existing RHM-generation methods.

Table 6.10. Factor loading for eleven anthropometric dimensions *

Anthropometric dimension	Code	Factor1	Factor2	Factor3
Forearm breadth	BD4	-0.90	-0.10	-0.30
Span	BD6	-0.89	0.35	0.17
Foot length	BD11	-0.88	0.27	0.04
Forearm-to-forearm breadth	BD5	-0.82	-0.25	-0.35
Popliteal height	BD10	-0.82	0.47	0.19
Bideltoid breadth	BD3	-0.82	0.18	-0.16
Buttock-popliteal length	BD8	-0.73	0.10	0.61
Acromial height	BD2	-0.72	0.03	-0.20
Thigh clearance	BD9	-0.67	-0.54	-0.05
Abdominal extension depth	BD1	-0.57	-0.66	-0.02
Hip breadth	BD7	-0.18	-0.79	0.43

* Cell is shaded if the absolute value of the cell is greater than 0.5.

Table 6.11. Factors affecting UAPs of the RHM-generation methods

RHM-generation methods	Regression equation	Adj R^2
Percentile Method	110 - 15.3 × NA*	70.8
Square Method	92.4 - 37.1 × AC**	94.3
Circular Method	97.7 - 25.1 × AC	98.8
Rectangular Method	99.2 - 15.4 × AC	93.3
BZ Method	NS***	-

* NA = number of anthropometric dimensions (N>0)

** AC = 0 (different factor loading pattern) or 1 (similar factor loading pattern)

*** Not significant at $\alpha = 0.05$

Chapter 7
DISCUSSION

7.1. Multivariate evaluation protocol development

The multivariate evaluation protocol developed in the present study has four characteristics and utilities. First, the evaluation protocol can comprehensively evaluate the performances of RHM-generation methods for various sets of anthropometric dimensions. Previous studies used a particular set of anthropometric dimensions in evaluation of RHM-generation methods. For example, Meunier (1998) considered the six anthropometric dimensions related to cockpit design, and McCulloch et al. (1998) used the five anthropometric dimensions related to garment size system development. On the other hand, the evaluation protocol can consider various anthropometric dimensions in evaluation.

Second, the evaluation protocol includes a step that separates the original anthropometric data into two subsets (learning and testing sets) to avoid evaluation bias. Previous studies (Meunier, 1998; Zheng et al., 2007) used the same anthropometric samples in RHM generation and evaluation. However, the RHM generation and evaluation should be conducted on separate samples to avoid evaluation bias (Hawkins et al., 2003). Hence, the evaluation protocol randomly divides the original anthropometric data (n = 3,982) into learning (n = 2,982) and testing (n = 1,000) sets by applying Holdout validation method (Wikipedia, 2008a; Blum et al., 1999).

Third, the evaluation protocol can be utilized in examining variables that affect the performances of RHM-generation methods. Meunier (1998) discussed the effect of data reduction techniques on the performances of the existing RHM-generation methods. However, a scientific investigation on variables that affect the performances has not been made, yet. The evaluation protocol proposed in the present study can be used in the investigation of statistical relationships between the variables and performances because this protocol can quantify the performances.

Lastly, the evaluation results obtained using the evaluation protocol can be utilized to compare and understand the performances of the existing RHM-generation methods. Anthropometric designers have encountered difficulties in selecting an RHM-generation method because a comparison study among the existing methods was lacking (Jung et al., 2008a). Therefore, the evaluation results for the existing methods can be used as reference information when a designer selects an RHM-generation method that is appropriate to a specific design problem.

One limitation of the evaluation protocol is that significant differences may occur between two MAPs calculated in anthropometric dimension and design dimension using the evaluation protocol. The MAP of the BZ Method obtained in anthropometric dimension was 91%, which is similar to 89% obtained in design dimension. However, the MAPs of the existing RHM-generation methods calculated in anthropometric dimension were greater than those calculated in design dimension. For example, the MAP of the Circular Method calculated in anthropometric dimension was 82%, which is greater than 63% calculated in design dimension. These differences are apparent when the generated RHMs cannot represent the size diversity in combinations of anthropometric dimensions because the values of design dimensions are determined by mathematical combinations of anthropometric dimensions.

7.2. Classification taxonomy for RHM-generation methods

The classification taxonomy proposed in the present study has two significance and utilities. First, the classification taxonomy can specifically classify the RHM-generation methods depending on their characteristics. HFES 300 (2004) classified the existing RHM-generation methods into three types according to the locations of RHMs: 1) central case, 2) boundary case, and 3) distributed case. As characteristic analysis for the existing methods identified in Section 4.1, the existing methods have different characteristics in terms of the location of RHMs, the shape of accommodation envelope, and the formation techniques of the envelope. The classification taxonomy, which specifically classifies the existing methods, better highlights the distinctive properties of each method than that of HFES 300 (2004).

Second, the classification taxonomy and results can be used when a designer selects a RHM-generation method that is appropriate to a specific design problem. HFES 300 (2004) provided a decision tree (Figure 7.1) that selects a relevant RHM-generation method by responding to simple questions. However, the decision tree is limited to choose the type of generation method (e.g., boundary cases or distributed cases). On the other hand, the taxonomy and results in the present study provide detailed information on the characteristics and statistical techniques applied. Hence, the taxonomy and results can be used as reference information when an anthropometric designer selects a relevant RHM-generation method.

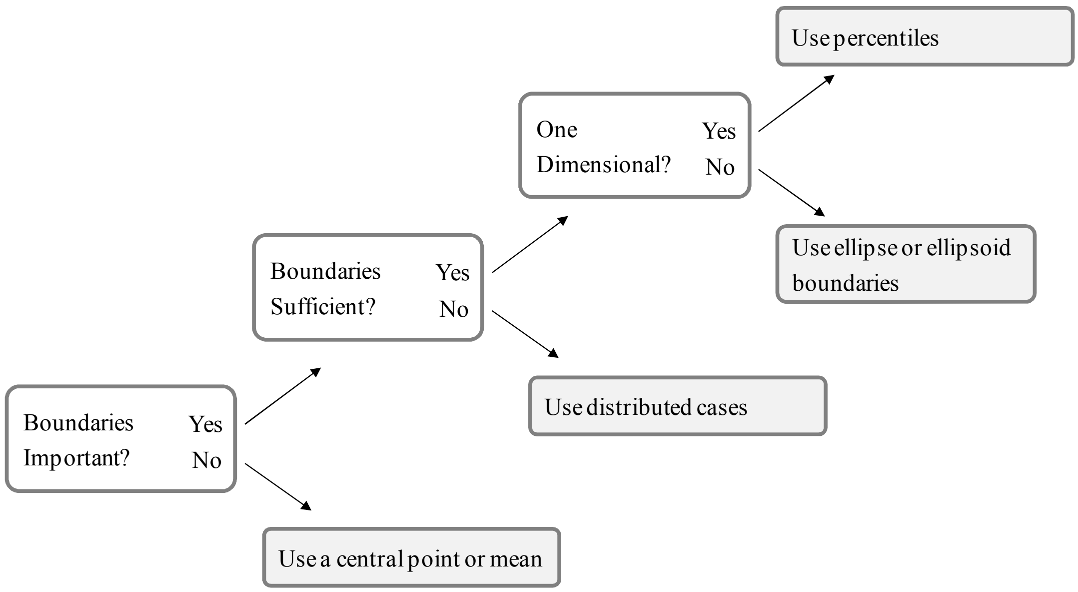


Figure 7.1. Decision tree to select a relevant RHM-generation method that is appropriate to a design problem (HFES 300, 2004)

7.3. BZ Method development

The BZ Method proposed in the present study has seven characteristics and benefits. First, the BZ Method uses the normalized squared distance in identifying the BZ that accommodates a designated percentage of the population. The existing RHM-generation methods (Bittner et al., 1987; Kim and Whang, 1997; Meindl et al., 1993) used data reduction techniques to form a boundary in the space defined by the factors (or key dimensions). On the other hand, the BZ Method uses the normalized squared distances of each anthropometric case, which follow the Chi-squared distribution with degrees of freedom equal to the number of variables n (Johnson and Wichern, 1988).

Second, the BZ Method applies cluster analysis for the cases within the BZ to minimize the generation number of RHMs. Because some cases within the BZ have similar body sizes, the homogenous cases should be grouped. The BZ Method uses K-means cluster algorithm to grouping the homogenous cases into clusters. An appropriate number of clusters, which is an input parameter of K-means cluster algorithm, is determined based on in-depth analysis of MAPs as the number of clusters increased.

Third, the RHMs generated by the BZ Method appropriately represent the size diversities of the people who lie within the BZ. The evaluation results in Chapter 5 and Chapter 6 indicate that the RHMs generated by the existing RHM-generation methods are lacking in representation of the size diversities for the pairs of anthropometric dimensions having similar factor loading patterns. However, the RHMs of the BZ Method adequately represent the size diversities of the population for any pair of anthropometric dimensions.

Fourth, the sizes of RHMs generated by the BZ Method are within the size ranges of the population. The existing RHM-generation methods estimate the sizes of RHMs using the factor scores defined in the space of the factors (Kim and Whang, 1997). This estimation process may contribute to generate smaller or larger RHMs than the size ranges of the population. However, the BZ Method selects the nearest real people to each cluster centroid as the RHMs to guarantee that their sizes are within the size ranges of the population.

Fifth, the BZ Method achieves the designated accommodation percentage. The evaluation results in Chapter 5 show that the existing RHM-generation methods are under- or over-accommodated than the designated percentage. For example, the Square Method accommodated 49%, which is less than the target percentage (90%), but the Rectangular Method accommodated 96%, which is greater than the target. However, the BZ Method accommodated 91%, which is the closest to the target.

Sixth, the BZ method is required to apply for various anthropometric data to investigate its applicability to other anthropometric data. The present study only applied the BZ method to the US Army data (Gordon et al., 1988); however, the body sizes can significantly vary depending on demographic characteristics (e.g., race and age) of the population (Wickens et al., 2004). Therefore, to confirm the applicability, the BZ method should be applied to various anthropometric data such as Size Korea and CAESAR.

Lastly, the MAPs of the BZ Method are robust regardless of the evaluation conditions of anthropometric dimensions. The MAPs of the existing RHM-generation methods largely varied. For example, the MAPs of the Square Method ranged from 30% to 70% (SD = 8.2%) depending on evaluation conditions. However, the MAPs of the BZ Method ranged from 90% to 92% (SD = 0.6%), which is narrower than those of the existing methods.

The BZ Method has five limitations. First, the BZ Method requires a large anthropometric database on the target population. The existing RHM-generation methods generate RHMs using summary statistics of the target population (e.g., mean, SD, and covariance matrix). For example, the Square Method uses a covariance matrix to conduct Factor Analysis and applies mean and SD of the target population to convert the standard normal scores to the body sizes (Bittner, 2000). However, the BZ Method needs a raw data of the target population to indentify the cases within the BZ that accommodates a designated percentage.

Second, the BZ Method requires a tolerance percentage (e.g., ±1 %) to form a BZ. If the tolerance percentage is small, the cases within the BZ are too small to represent the target population. Conversely, if the tolerance percentage is large, unnecessary cases, which are far apart from the boundary of a designated percentage, are included in the candidates of RHMs. An appropriate tolerance percentage should be decided by considering various technical aspects such as size of anthropometric database. For example, the larger the anthropometric database, the smaller the required tolerance; the opposite becomes true for the small database.

Third, the BZ Method generates larger number of RHMs than those of the existing RHM-generation methods. The number of RHMs affects its applicability to ergonomic design and evaluation in a digital environment because the existing DHM systems require much time and effort in creating digital humanoids and generating operating postures (Blome et al., 2006). The evaluation results in Chapter 5 show that the BZ Method creates large number of RHMs (mean = 48, SD = 29), and this number significantly increases as the number of anthropometric dimensions increases.

Fourth, the BZ Method cannot analyze morphological characteristics of the RHMs generated. On the other hand, the existing RHM-generation methods can classify RHMs according to their morphological characteristics because the methods use factor analysis. For example, the RHMs generated in Hudson et al. (2006) can be classified according to the locations of the RHMs in the space defined by the factors (Figure 7.2).

Lastly, violation of the normality assumption in the BZ Method has a minor effect on MAP if the difference between a designated percentage and an achieved percentage by the normalized squared distance is less than 2%. The BZ Method assumes that the distributions of anthropometric dimensions are the normal distribution to identify a boundary that accommodates a designated percentage of the population. However, the normality tests in the present study reveal that most of the anthropometric dimensions do not statistically fit the normal distribution. In the present study, the differences between the designated percentage and the achieved percentages were less than 2% for 21 evaluation conditions of anthropometric dimensions. Hence, the BZ Method appropriately forms a boundary if the difference is less than 2%. However, a comprehensive future research is needed to develop a quantitative guideline that can be used to judge whether the BZ Method can apply or not.

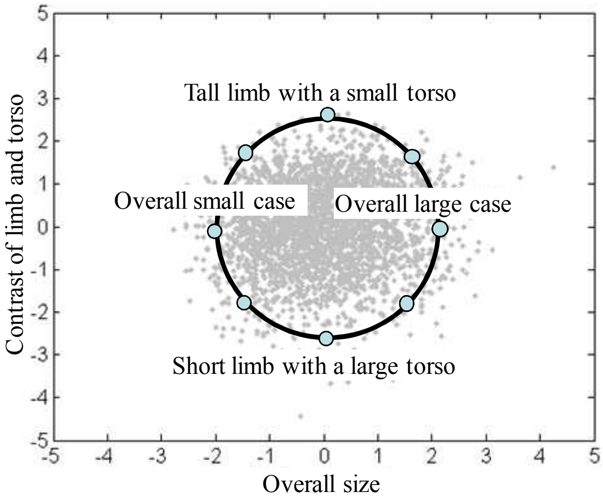


Figure 7.2. Morphological characteristics of RHMs (Hudson et al., 2006)

7.4. Characteristics of existing RHM-generation methods

7.4.1. Boundary methods

The present study found ten characteristics or limitations of the existing boundary RHM-generation methods. First, the MAP of the Square Method is positively related to percent variance explained (PV), which is determined by Factor Analysis. The regression equation (-123.0 + 2.06 × PV) of the Square Method indicates that the MAP increases 2.06% as PV increases. It implies that selection of the factors that explain larger variability of the original data is important in the Square Method.

Second, the MAPs of the Rectangular and Circular Methods are positively related to the number of factors (NF). For example, the regression equation (56.9 + 5.27 × NF) of the Circular Method indicates that the MAP increases 5.27% as NF increases. This phenomenon may be caused by two reasons. The first reason is that NF relates to the size of the boundary, which affects the MAP (Hudson et al., 2006). For example, using the Circular Method, the average of circle radiuses was 1.75 (SD = 0.02) for two factors, but 2.01 (SD = 0.43) for three factors. The other reason is that NF relates to PV because the more the number of factors extracted, the more the variance explained.

Third, the number of RHMs generated by the existing RHM-generation methods depends on how many points are selected at the boundary in the space defined by the factors. The Square and Rectangular Methods generate smaller number of RHMs than that of the Circular Method. However, the number of RHMs can be changed by creating more RHMs at the boundary. For example, the Square Method can generate RHMs at the corners of the square and the midpoints of its edges. Conversely, the Circular Method can reduce the number of RHMs by generating RHMs at the points of every 90° of the circle instead of the points of every 45° (Hudson et al., 2006).

Fourth, the MAPs of the existing RHM-generation methods are not changed although the number of RHMs generated increases. The effect of numbers on MAP, which is identified in the Section 5.2.1, indicates that the MAPs of the existing methods are unchanged even if the more number of RHMs is generated at the mid-points of a boundary in the space defined by the factors. This phenomenon occurs because the existing methods already include the extreme points of a boundary, and the size of a boundary remains the same.

Fifth, the size of RHMs in the existing RHM-generation methods can be determined by either of two ways: 1) case estimation, and 2) the nearest neighbor selection. The existing methods estimated the sizes of RHMs by multiplying a factor loading matrix by a factor score matrix (Bittner et al., 1987; Bittner, 2000; Kim and Whang, 1997; Meindl et al., 1993). However, the sizes of RHMs can be selected to be the real people who are the nearest to each estimated case.

Sixth, the sizes of RHM generated by the Rectangular Method are outside the ranges of the target population, but it may be prevented by adjusting the size of a boundary formed in the space of factors. The size of a boundary in the Rectangular Method can be easily changed by adjusting the weights of each factor, which are determined by a designer. Kim and Whang (1997) demonstrated their method with the weight factor of $1/\sqrt{\lambda_i}$ (where λ_i is eigen value of factor *i*). According to the weighting system used, the edge length of an axis (factor) of a rectangular boundary becomes larger as the axis has higher eigen value. For example, the edge lengths of the prism in the Section 4.2.1.1 were 4.48 (λ_1 = 4.48), 4.24 (λ_2 = 2.47), and 4.02 (λ_3 = 1.38), respectively. Therefore, the weights, which determine the sizes of the boundary, should be changed when outliers exist.

Seventh, discrepant results exist in the Rectangular Method. The univariate percentile ranges of RHMs generated in the present study were over 90%, but the percentile ranges of four anthropometric dimensions reported in Kim and Whang (1997) were less than 90%. For example, the percentile range of elbow-rest height was 97.1% (1.7% ~ 98.8%) in the present study, but only 86.5 % (9.2% ~ 95.7%) in Kim and Whang (1997). This discrepant result may be occurred because the Factor Analysis results are different. The communalities (mean = 0.63, SD = 0.15), which are percent variances of each anthropometric dimension explained by the selected factors, in Kim and Whang (1997) were significantly lower than those of the present study (mean = 0.84, SD = 0.09). The minimum of the communalities of the present study was 0.72; however, one-fifth of the communalities in Kim and Whang (1997) were less than 0.5. In addition, the absolute values of the factor loadings in Kim and Whang (1997) were all less than 0.86; however, the absolute values of the present study are less than 0.96. The large absolute factor loadings make the sizes of RHMs larger or smaller because the sizes are determined by multiplying a factor loading matrix by a factor score matrix.

Ninth, the factor loading pattern is important in determining the size diversity of RHMs. The existing RHM-generation methods determine the sizes of RHMs by multiplying a factor loading matrix by a factor score matrix. Therefore, the size characteristics of RHMs are affected by the pattern of the factor loadings. If two anthropometric dimensions have similar factor loading patterns, the sizes of RHMs calculated must be closely related.

Lastly, the existing RHM-generation methods should be carefully used when pairs of anthropometric dimensions are applied in ergonomic design and evaluation. The present study found that the RHMs generated by the existing methods cannot appropriately represent the size diversity of the target population for combinations of anthropometric dimensions which have similar factor loading patterns. It implies that the sizes of the target population cannot be appropriately applied to ergonomic design and evaluation if pairs of anthropometric dimensions are simultaneously considered.

7.4.2. Distributed methods

The present study found six characteristics or limitations of the existing distributed RHM-generation methods. First, the existing distributed methods can over- or under-accommodate a designated percentage of the target population depending on the number of anthropometric dimensions considered in MAP calculation. The MAP analysis results in the Section 4.2.2.2 illustrated an over-accommodation for one or two anthropometric dimensions is one or two (e.g., Grid Method = 98% for single anthropometric dimension) and an under-accommodation for three or more number of anthropometric dimensions (e.g., Grid Method = 78% for three anthropometric dimensions). Relatively large decreasing rates in MAPs were observed over the mid range (n = 2 to 6) of the number of anthropometric dimensions.

Second, the standardized multiple regression model was established which explains the effects of the three factors (overlap area among grids; average adjusted R^2 between key dimensions and other anthropometric dimensions; and sum of anthropometric dimension ranges) on MAP. The MAP regression model can be used to prioritize anthropometric dimensions to increase the accommodation performance of product design. For example, for efficient improvement in MAP, design measures such as change of materials for a different fitting tolerance can be devised with high priority for anthropometric dimensions having a smaller adjusted R^2, larger overlap area, and larger range.

Third, the Cluster Method cannot reflect the target accommodation percentage in RHM generation. The Cluster Method groups all of the target population into several clusters without consideration of the target percentage. It is noticed that the Cluster Method always generates the same number of RHMs regardless of the target percentage. However, the Grid and Optimization Methods consider the target percentage in the formation of grids that accommodate a designated percentage of the population.

Fourth, the MAP analysis results of the present study indicate that accommodation evaluation for the noncritical anthropometric dimensions is necessary. The present study evaluated the MAPs of the existing distributed methods, which defines RHMs at representative grids (clusters) formed in the space of key dimensions with a fitting tolerance. The MAPs of the existing distributed methods have been evaluated only for the key anthropometric dimensions selected (Chung et al., 2007; McCulloch et al., 1998), but not for noncritical anthropometric dimensions. Although the key dimensions mainly determine the fitness of a product, noncritical dimensions still affect it to some extent; thus, an analysis on the accommodation performance of the existing distributed methods is necessary for noncritical anthropometric dimensions.

Fifth, the value of fitting tolerance used in MAP analysis is often determined by considering product fitness and production economy (Kwon et al., 2009; McCulloch et al., 1998; Moon, 2002). The present study applied ±2.5 cm as fitting tolerance to all anthropometric dimensions for the evaluation of the existing distributed methods. A small fitting tolerance can increase the level of product fit to the users, but requires a large number of size categories which negatively affects production economy; the opposite becomes true for a large fitting tolerance.

Lastly, a new RHM-generation method needs to be developed for multiple-size product design. The evaluation results of the present study indicate that the existing distributed methods have a limitation in multivariate accommodation of the population. This limitation occurs because the grids (or clusters) are formed in the space defined by the key dimensions. To overcome this limitation, a new distributed method considers the overlap area among the grids in the space of non-key dimensions and selects better key dimensions explaining the variability of non-key dimensions to enhance the prediction accuracy (e.g., adj. R^2) of the regression equations using the key dimensions.

7.5. Anthropometric design process development

The anthropometric design process used in the present study has seven characteristics or limitations. First, the four-step design process of the study can be applied to design various workstations such as cockpit and vehicle. The present study developed the design process by adapting previous design processes (ANSI, 2007; Roebuck, 1995; Wickens et al., 2004, You et al., 1997; Sanders and McCormick, 1992; Molenbroek et al., 2003). The design process only applied to design a computer workstation in this study, but it can be utilized in designing various workstations by customizing the design simulation properties (e.g., design equations) to fit a specific design problem.

Second, depending on the posture-relatedness of a workstation dimension, the design value is determined by either of two ways: 1) direct design method, and 2) postural simulation method. For the non-posture related dimension, the design value is determined by inputting the sizes of RHMs into the corresponding design equation. For example, the value of seat width is calculated by inputting the hip breadth sizes into the design equation (hip breadth + 2.5 cm; ANSI, 2007). On the other hand, for the posture related dimension, the design value is determined by analyzing the loss scores for various design values.

Third, the design equations, which mathematically represents the geometrical relationships between the workstation and anthropometric dimensions, find the user postures that fit to a given workstation parameter. To predict the user postures that operate a computer workstation, the design equations are applied. The design equation find all feasible postures for a given workstation parameter by iterative simulation of the joint angles of a RHM.

Forth, for the realistic postural simulation, the design equations should be improved in terms of human adaptabilities. The design equations were developed based on rigid human model that is an idealization of a solid body in which deformation is neglected (Wikipedia, 2009). However, the human body is not rigid because human have adaptabilities such as skin deformation. To apply the human adaptabilities to product design, the design equations should be modified.

Fifth, the postural simulation finds all feasible postures (joint angles) which are within the comfortable ranges of joint motions. Previous studies provide the ranges of comfortable and preferable joint motions related to computer workstation use (Chaffin and Andersson, 1984; Karlqvist et al., 1996; Cushman, 1984; Grandjean et al., 1983; Miller and Suther, 1983; Weber et al., 1984). Since the feasible postures in the present study are estimated by postural simulation within the ranges of comfortable motions, the postures estimated must be within the reasonable posture ranges.

Sixth, for efficient posture prediction with the design equations and loss functions, an optimization algorithm needs to be developed. The postural simulation of the present study takes much time to iteratively find all feasible postures. Hence, this simulation time is the bottleneck of ergonomic analysis. To reduce the simulation time, an optimization algorithm, which finds a minimum loss posture, is needed.

Lastly, the design sensitivity analysis is used to determine a workstation design value which minimizes the loss scores of RHMs. This sensitivity analysis investigates how sensitively the loss score changes according to unit change in workstation parameter (Rahman, 2009; Chinneck, 2007; Breierova and Choudhari, 2001). Hence, the loss scores identified for various workstation parameters are useful to determine a best workstation value.

Chapter 8
CONCLUSION

The present study has four contributions. First, the classification taxonomy of the RHM-generation methods is developed based on a comprehensive literature review. The taxonomy can classify the RHM-generation methods according to their characteristics such as locations of RHMs and shape of an accommodation envelope. In addition, the taxonomy and classification results are useful to understand and contrast the characteristics of each method.

Second, the multivariate evaluation protocol is introduced to evaluate the performances of the RHM-generation methods. The evaluation protocol randomly divides the original data of the target population into a learning set and a testing set to avoid evaluation bias. Various sets of anthropometric dimensions are considered to comprehensively evaluate the performances. The evaluation protocol can analyze the performances of the RHM-generation methods in terms of statistical representativeness and applicability of the RHMs to ergonomic design and evaluation.

Third, the BZ Method is proposed which generates RHMs at a BZ that accommodates a designated percentage of the population. The normalized squared distances of the target population are calculated to identify the BZ that accommodates a designated percentage. Next, cluster analysis is conducted for the cases within the BZ to form a small group of RHMs. The BZ Method theoretically overcomes the limitations of the existing RHM-generation methods because it uses the normalized squared distances instead of data reduction techniques.

Lastly, the anthropometric design process is developed by referring to the previous design processes. The design process uses design equations which represent the geometrical relationships between workstation dimensions and anthropometric dimensions. The design values of a workstation are determined using the design equations by either of two ways depending on the posture-relatedness. For the non-posture related dimension, the design value is calculated by inputting the sizes of RHMs into the design equation. Otherwise, for the posture related dimension, the design value is determined by a design sensitivity analysis which analyzes the loss scores of RHMs according to change in design values.

The present study has three major findings regarding to the existing RHM-generation methods. First, the two characteristics of Factor Analysis and Principal Component Analysis, percent variance explained (PV) and number of factors (NF), significantly related to the MAPs of the existing RHM-generation methods. PV is positively related to the MAP of the Square Method, and NF is positively related to the MAPs of the Circular and Rectangular Methods.

Second, the factor loading pattern affects the size diversity of RHMs generated by the existing RHM-generation methods. The sizes of RHMs are calculated using a factor loading matrix. Therefore, the sizes of anthropometric dimensions that have similar factor loading patterns are estimated to have a linear relationship among them.

Third, the three variables of the existing distributed RHM-generation methods significantly affect the MAPs (overlap area among grids, OA; average adjusted R^2 between key dimensions and other anthropometric dimensions, AR; and sum of the ranges of anthropometric dimensions, SR). While OA and SR negatively relate to MAPs, AR has the opposite relationship. The factors AR, SR, and OA significantly affected MAPs in descending order.

As a future study, an anthropometric simulation system in a digital environment may be developed based on a development framework (Figure 8.1) that consists of three modules. Design information module contains design-related information such as design dimensions and design equations. This module should be customized according to the design problem of interest. Anthropometric database module includes DBs for various population and kinematic information of human motions. Design evaluation and optimization module simulates the postures of RHMs based on the information stored in the other two modules and visualizes digital humanoids in a 3D graphic environment as illustrated in Figure 8.2.

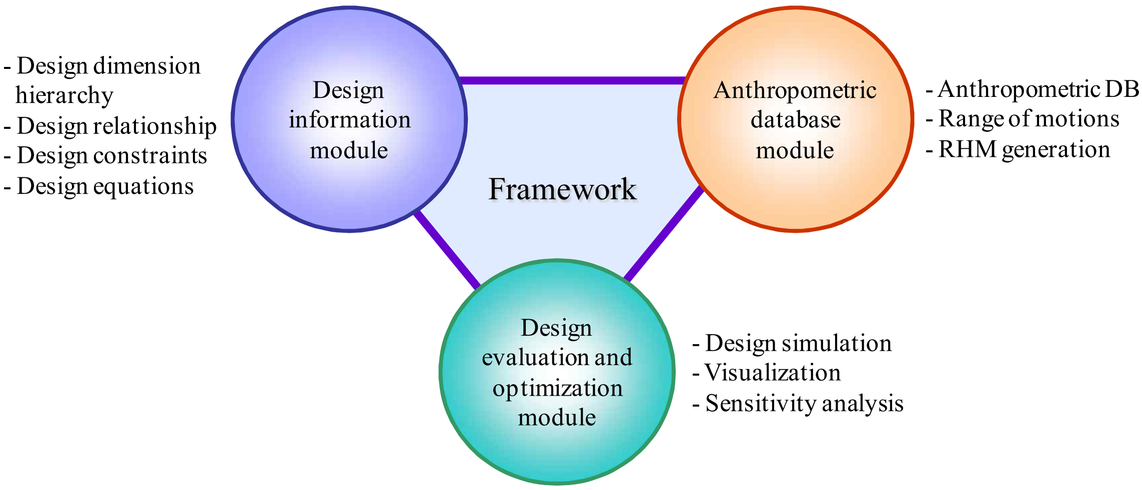


Figure 8.1. A development framework of anthropometric simulation system

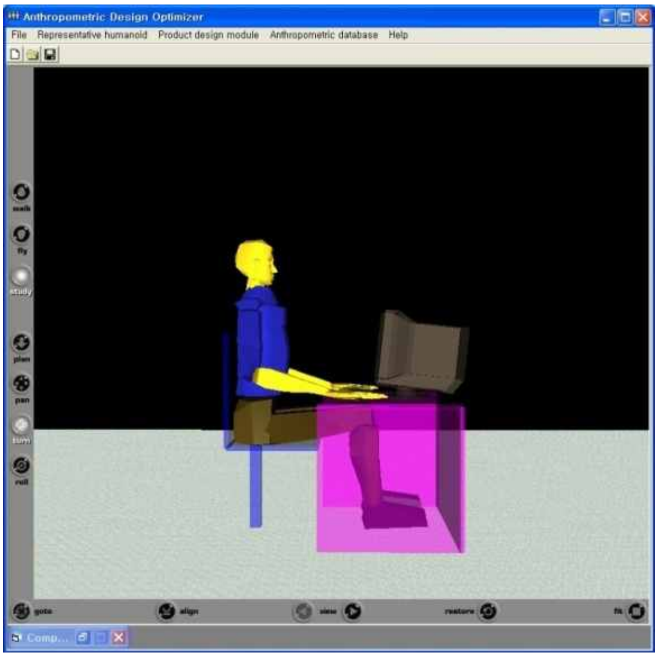


Figure 8.2. Visualization interface for an anthropometric simulation system

요 약 문

인체측정학적 제품 설계를 위해 요인 분석(factor analysis) 및 주성분 분석(principal component analysis)을 적용한 대표인체모델(representative human models, RHMs) 생성 기법이 개발되고 있다. 기존 대표인체모델 생성 기법들은 효율적으로 대표인체모델을 생성하기 위해 자료축약기법(data reduction technique)을 적용해 설계와 관련된 다변량 인체변수를 소수의 요인(factor)으로 축약한다. 자료축약기법은 설계대상인구의 인체크기 다양성을 대부분(예: 80%) 설명하도록 다변량 인체변수를 소수의 요인으로 축소시키는 장점이 있으나, 인체크기 다양성의 일부(예: 20%)를 대표인체모델 생성 시 누락시키는 한계점이 있다.

본 연구는 지정된 비율의 설계대상인구를 통계적으로 적합하게 대표하는 다변량 대표인체모델 생성 기법을 개발하고 평가하였다. 이를 위한 세부 연구목표는 다음과 같은 네 가지로 구성되었다.

(1) 다변량 성능 평가 방법 개발

(2) 기존 대표인체모델 생성 기법의 특성 및 성능 분석

(3) 신규 다변량 대표인체모델 생성 기법 개발

(4) 인체측정학적 설계 적용을 통한 대표인체모델 생성 기법의 성능 평가

첫째, 대표인체모델 생성 기법의 정량적 성능 평가를 위해 다변량 성능 평가 방법이 개발되었다. 개발된 성능 평가 방법은 네 단계의 정형화된 절차를 통해 대표인체모델 생성 기법의 성능을 종합적으로 평가한다. 첫 번째 단계는 설계대상인구에 대한 인체측정자료를 인체모델 생성 집단과 평가 집단으로 구분하고, 두 번째 단계는 평가 대상 인체변수를 설계 맥락을 고려한 변수 선택 방법(design-related dimension selection)과 무작위 변수 선택 방법(random dimension selection)을 적용해 선정한다. 세 번째 단계는 지정된 비율(예: 90%)의 설계대상인구를 수용하는 대표인체모델을 생성하고, 마지막 단계는 생성된 대표인체모델의 성능을 통계적 대표성과 적용성 측면에서 종합적으로 분석한다.

둘째, 기존 대표인체모델 생성 기법의 특성을 파악하기 위해 기존 기법의 특성과 성능이 체계적으로 분석되었다. 먼저, 문헌조사를 통해 기존 대표인체모델

생성 기법의 개발 현황이 조사되었으며, 조사된 기존 기법에 대한 분석을 통해 기법의 특성(예: 적용 분야, 수용 경계의 형상)이 파악되었다. 그리고, 본 연구는 파악된 기존 기법의 특성에 근간해 대표인체모델 생성 기법 분류 체계를 개발하였다. 기존 대표인체모델 생성 기법의 성능은 본 연구에서 개발된 다변량 성능 평가 방법을 적용해 정량적으로 비교 평가되었으며, 성능에 영향을 주는 요인들이 다중회귀분석을 통해 파악되었다.

셋째, 다변량 대표인체모델 생성 기법인 경계 영역(boundary zone, BZ) 기법이 개발되었다. 경계 영역 기법은 지정된 비율의 인구를 통계적으로 수용하는 경계 영역을 설정하는 단계와 경계 영역에 포함된 인구에 대한 군집분석을 통해 대표인체모델 생성 개수를 최적화하는 두 단계로 구성되었다. 다변량 성능 평가 방법을 적용해 개발된 경계 영역 기법의 성능 분석한 결과, 경계 영역 기법의 다변량 수용 비율(91%)은 기존 기법들(square method: 49%, circular method: 76%, rectangular method: 96%)보다 적합하게 지정된 비율(90%)의 설계대상인구를 수용하는 대표인체모델을 생성할 수 있는 것으로 나타났다.

마지막으로, 경계 영역 기법의 성능은 컴퓨터 워크스테이션 설계 적용을 통해 기존 대표인체모델 생성 기법과 비교 평가되었다. 컴퓨터 워크스테이션 설계는 대표인체모델 생성 기법별로 기존 인체측정학적 설계 절차를 적용하여 개발되었다. 개발된 컴퓨터 워크스테이션의 설계대상인구 수용 성능을 분석한 결과, 경계 영역 기법의 수용 성능(89%)은 지정된 비율(90%)에 근접하는 것으로 나타났으나, 기존 기법들의 수용 성능은 지정된 비율보다 유의하게 작은 것으로 분석되었다 (percentile method: 25%, square method: 33%, circular method: 63%, rectangular method: 80%). 기존 대표인체모델 생성 기법의 수용 성능 저하 원인을 분석한 결과, 기존 기법은 설계대상인구의 인체크기 다양성 중 일부(예: 20%)가 대표인체모델 생성 시 누락되어 성능이 저하되는 것으로 나타났다.

본 연구의 의의는 체계적인 분석을 통해 기존 대표인체모델 생성 기법의 특성과 한계점을 파악하고, 파악된 기존 기법의 한계점을 보완하는 새로운 다변량 대표인체모델 생성 기법을 개발한 것이다.

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APPENDICES

Appendix A. Percentile sizes of the RHMs generated

A.1. Boundary methods

A.1.1. Square Method

a) *n* (# of dimensions) = 5

Condition no.	RHM no.	BD1	BD2	BD3	BD4	BD5
1	1	0.058	0.048	0.069	0.049	0.098
	2	0.697	0.118	0.270	0.775	0.139
	3	0.029	0.079	0.027	0.126	0.877
	4	0.423	0.821	0.846	0.103	0.085
	5	0.577	0.177	0.146	0.896	0.914
	6	0.303	0.880	0.718	0.225	0.860
	7	0.971	0.919	0.971	0.874	0.122
	8	0.942	0.951	0.927	0.950	0.901
	9	0.500	0.498	0.493	0.500	0.499
	Range	0.942	0.903	0.944	0.901	0.829
2	1	0.092	0.131	0.795	0.098	0.082
	2	0.872	0.637	0.870	0.129	0.480
	3	0.054	0.008	0.057	0.062	0.013
	4	0.198	0.831	0.901	0.913	0.819
	5	0.804	0.169	0.100	0.085	0.186
	6	0.130	0.363	0.131	0.868	0.527
	7	0.947	0.992	0.944	0.936	0.988
	8	0.909	0.869	0.206	0.900	0.920
	9	0.502	0.500	0.501	0.497	0.504
	Range	0.893	0.985	0.887	0.874	0.975
3	1	0.058	0.046	0.056	0.023	0.039
	2	0.179	0.225	0.826	0.649	0.269
	3	0.824	0.773	0.168	0.351	0.729
	4	0.944	0.954	0.941	0.977	0.960
	5	0.502	0.499	0.495	0.500	0.499
	Range	0.929	0.970	0.886	0.939	0.850
4	1	0.129	0.029	0.774	0.130	0.089
	2	0.035	0.015	0.056	0.030	0.074
	3	0.209	0.514	0.811	0.216	0.884
	4	0.930	0.594	0.925	0.937	0.134
	5	0.068	0.403	0.072	0.062	0.862
	6	0.964	0.985	0.942	0.969	0.924
	7	0.785	0.483	0.184	0.781	0.114
	8	0.867	0.971	0.221	0.867	0.908
	9	0.496	0.498	0.497	0.498	0.497
	Range	0.929	0.970	0.886	0.939	0.850
5	1	0.058	0.812	0.122	0.626	0.121
	2	0.642	0.858	0.905	0.922	0.197
	3	0.010	0.059	0.047	0.025	0.048
	4	0.653	0.914	0.206	0.795	0.908
	5	0.341	0.085	0.787	0.194	0.089
	6	0.352	0.140	0.091	0.072	0.798
	7	0.990	0.940	0.951	0.973	0.950
	8	0.940	0.186	0.874	0.360	0.875
	9	0.497	0.498	0.496	0.493	0.496
	Range	0.980	0.880	0.905	0.948	0.902

b) $n = 10$

Condition no.	RHM no.	BD1	BD2	BD3	BD4	BD5	BD6	BD7	BD8	BD9	BD10
1	1	0.042	0.023	0.041	0.063	0.019	0.002	0.012	0.045	0.053	0.034
	2	0.110	0.025	0.727	0.173	0.099	0.007	0.064	0.096	0.098	0.063
	3	0.835	0.804	0.093	0.233	0.142	0.773	0.484	0.114	0.126	0.220
	4	0.066	0.182	0.152	0.551	0.594	0.107	0.233	0.793	0.791	0.673
	5	0.929	0.811	0.845	0.443	0.393	0.891	0.756	0.206	0.206	0.319
	6	0.883	0.974	0.270	0.823	0.895	0.993	0.932	0.904	0.900	0.934
	7	0.156	0.189	0.905	0.762	0.850	0.224	0.501	0.886	0.872	0.773
	8	0.954	0.975	0.958	0.935	0.980	0.998	0.987	0.955	0.946	0.965
	9	0.493	0.495	0.498	0.497	0.493	0.498	0.493	0.500	0.498	0.496
	Range	0.912	0.952	0.917	0.871	0.962	0.997	0.975	0.909	0.893	0.931
3	1	0.168	0.139	0.228	0.417	0.038	0.377	0.854	0.550	0.141	0.132
	2	0.310	0.231	0.293	0.726	0.477	0.943	0.912	0.675	0.215	0.906
	3	0.015	0.038	0.097	0.006	0.013	0.001	0.061	0.020	0.041	0.051
	4	0.954	0.921	0.864	0.955	0.675	0.999	0.892	0.954	0.925	0.203
	5	0.043	0.077	0.136	0.042	0.309	0.001	0.106	0.043	0.073	0.789
	6	0.680	0.765	0.706	0.264	0.504	0.051	0.086	0.314	0.780	0.089
	7	0.984	0.961	0.903	0.994	0.985	0.999	0.938	0.978	0.958	0.946
	8	0.825	0.858	0.771	0.571	0.958	0.602	0.144	0.438	0.855	0.862
	9	0.494	0.497	0.499	0.494	0.491	0.489	0.498	0.494	0.497	0.495
	Range	0.970	0.923	0.806	0.988	0.972	0.999	0.877	0.958	0.917	0.894
5	1	0.930	0.948	0.628	0.934	0.920	0.820	0.932	0.923	0.894	0.235
	2	0.877	0.905	0.445	0.906	0.178	0.663	0.912	0.817	0.771	0.148
	3	0.961	0.977	0.994	0.980	0.965	0.937	0.958	0.969	0.963	0.963
	4	0.859	0.699	0.073	0.745	0.884	0.760	0.138	0.908	0.880	0.221
	5	0.142	0.274	0.382	0.148	0.762	0.203	0.840	0.106	0.111	0.076
	6	0.071	0.044	0.019	0.029	0.692	0.149	0.056	0.089	0.098	0.070
	7	0.218	0.412	0.971	0.309	0.869	0.413	0.891	0.208	0.247	0.860
	8	0.083	0.181	0.223	0.109	0.053	0.092	0.803	0.038	0.042	0.040
	9	0.914	0.816	0.770	0.886	0.945	0.906	0.197	0.961	0.957	0.959
	10	0.777	0.583	0.028	0.682	0.128	0.584	0.109	0.789	0.749	0.138
	11	0.927	0.954	0.980	0.969	0.303	0.849	0.944	0.910	0.900	0.929
	12	0.120	0.093	0.545	0.089	0.818	0.334	0.088	0.181	0.225	0.850
	13	0.038	0.022	0.006	0.019	0.034	0.062	0.042	0.031	0.036	0.036
	14	0.854	0.722	0.608	0.846	0.233	0.795	0.161	0.892	0.887	0.922
	15	0.068	0.051	0.362	0.063	0.077	0.178	0.068	0.076	0.104	0.762
	16	0.497	0.497	0.495	0.495	0.497	0.498	0.500	0.498	0.498	0.498
	Range	0.924	0.955	0.989	0.961	0.932	0.874	0.916	0.938	0.927	0.927

Condition no.	RHM no.	BD1	BD2	BD3	BD4	BD5	BD6	BD7	BD8	BD9	BD10
2	1	0.060	0.049	0.026	0.041	0.024	0.050	0.040	0.035	0.051	0.049
	2	0.808	0.749	0.702	0.238	0.783	0.227	0.261	0.195	0.251	0.229
	3	0.189	0.249	0.295	0.765	0.213	0.775	0.740	0.806	0.749	0.771
	4	0.939	0.950	0.973	0.960	0.975	0.951	0.961	0.965	0.949	0.951
	5	0.498	0.498	0.498	0.502	0.497	0.501	0.501	0.501	0.500	0.500
	6										
	7										
	8										
	9										
	Range	0.880	0.901	0.947	0.919	0.951	0.901	0.921	0.930	0.899	0.902
4	1	0.896	0.972	0.923	0.965	0.976	0.973	0.972	0.955	0.884	0.977
	2	0.252	0.571	0.818	0.274	0.922	0.917	0.378	0.739	0.866	0.252
	3	0.994	0.979	0.935	0.924	0.262	0.868	0.718	0.952	0.066	0.973
	4	0.278	0.370	0.153	0.823	0.882	0.276	0.947	0.265	0.945	0.758
	5	0.714	0.619	0.841	0.164	0.115	0.717	0.050	0.728	0.056	0.231
	6	0.741	0.418	0.175	0.709	0.076	0.080	0.614	0.254	0.134	0.736
	7	0.006	0.019	0.061	0.069	0.733	0.128	0.275	0.046	0.934	0.025
	8	0.100	0.026	0.073	0.032	0.023	0.026	0.027	0.043	0.116	0.021
	9	0.495	0.494	0.495	0.490	0.497	0.496	0.496	0.496	0.501	0.493
	Range	0.988	0.960	0.874	0.933	0.953	0.948	0.945	0.913	0.889	0.956
6 (computer workstation)	1	0.164	0.757	0.154	0.756	0.324	0.198	0.817	0.880	0.245	0.812
	2	0.365	0.630	0.863	0.885	0.804	0.152	0.853	0.913	0.498	0.598
	3	0.830	0.953	0.222	0.821	0.732	0.899	0.894	0.832	0.838	0.956
	4	0.058	0.089	0.108	0.075	0.034	0.143	0.079	0.122	0.054	0.136
	5	0.944	0.905	0.911	0.923	0.972	0.863	0.919	0.874	0.952	0.856
	6	0.653	0.366	0.162	0.112	0.227	0.847	0.144	0.089	0.528	0.388
	7	0.173	0.043	0.809	0.175	0.298	0.107	0.103	0.163	0.160	0.041
	8	0.839	0.230	0.871	0.239	0.708	0.800	0.172	0.116	0.752	0.169
	9	0.503	0.498	0.515	0.485	0.522	0.506	0.491	0.496	0.498	0.486
	Range	0.886	0.910	0.804	0.848	0.938	0.792	0.839	0.824	0.898	0.915

c) $n = 11$ (application to ergonomic design of a computer workstation in Chapter 6)

RHM no.	BD1	BD2	BD3	BD4	BD5	BD6	BD7	BD8	BD9	BD10	BD11
1	0.922	0.647	0.527	0.771	0.295	0.856	0.865	0.286	0.892	0.211	0.390
2	0.564	0.123	0.066	0.095	0.055	0.158	0.888	0.245	0.434	0.047	0.059
3	0.385	0.589	0.550	0.624	0.297	0.662	0.124	0.071	0.407	0.302	0.387
4	0.940	0.907	0.924	0.958	0.943	0.951	0.855	0.943	0.950	0.913	0.940
5	0.060	0.095	0.074	0.041	0.055	0.050	0.149	0.056	0.050	0.082	0.058
6	0.437	0.879	0.932	0.903	0.943	0.843	0.115	0.750	0.566	0.950	0.939
7	0.616	0.416	0.446	0.372	0.697	0.339	0.879	0.927	0.594	0.687	0.605
8	0.078	0.357	0.469	0.225	0.699	0.145	0.139	0.708	0.108	0.780	0.601
9	0.500	0.502	0.498	0.498	0.497	0.500	0.503	0.497	0.500	0.494	0.495
Range	0.880	0.813	0.866	0.916	0.888	0.901	0.773	0.887	0.899	0.903	0.882

d) $n = 15$

Condition no.	RHM no	BD1	BD2	BD3	BD4	BD5	BD6	BD7	BD8	BD9	BD10	BD11	BD12	BD13	BD14	BD15
	1	0.659	0.944	0.251	0.900	0.904	0.925	0.963	0.972	0.972	0.612	0.916	0.437	0.963	0.603	0.887
	2	0.779	0.499	0.181	0.746	0.905	0.770	0.869	0.366	0.879	0.151	0.787	0.151	0.690	0.149	0.068
	3	0.076	0.765	0.211	0.961	0.766	0.290	0.610	0.877	0.810	0.323	0.149	0.179	0.523	0.317	0.720
	4	0.233	0.500	0.080	0.059	0.112	0.887	0.326	0.710	0.301	0.448	0.827	0.344	0.658	0.446	0.846
	5	0.986	0.993	0.964	0.957	0.962	0.963	0.995	0.993	0.988	0.987	0.980	0.980	0.995	0.986	0.989
	6	0.856	0.806	0.857	0.131	0.227	0.940	0.641	0.861	0.430	0.964	0.946	0.965	0.886	0.964	0.982
	7	0.641	0.944	0.952	0.986	0.884	0.419	0.862	0.955	0.889	0.929	0.354	0.901	0.804	0.928	0.952
	8	0.995	0.806	0.940	0.865	0.962	0.862	0.973	0.574	0.935	0.815	0.928	0.880	0.902	0.814	0.344
1	9	0.005	0.193	0.062	0.140	0.037	0.216	0.025	0.423	0.059	0.191	0.070	0.123	0.093	0.192	0.653
	10	0.355	0.056	0.050	0.015	0.113	0.694	0.132	0.045	0.103	0.074	0.641	0.101	0.189	0.075	0.047
	11	0.142	0.193	0.148	0.874	0.768	0.105	0.349	0.138	0.552	0.038	0.052	0.037	0.109	0.038	0.017
	12	0.218	0.499	0.825	0.261	0.092	0.331	0.126	0.631	0.112	0.854	0.209	0.853	0.301	0.856	0.930
	13	0.922	0.233	0.795	0.041	0.229	0.804	0.380	0.121	0.178	0.685	0.848	0.825	0.467	0.690	0.277
	14	0.013	0.007	0.037	0.045	0.037	0.069	0.004	0.007	0.011	0.014	0.020	0.021	0.005	0.015	0.011
	15	0.337	0.056	0.755	0.104	0.094	0.128	0.035	0.028	0.025	0.396	0.082	0.569	0.035	0.405	0.112
	16	0.498	0.499	0.504	0.504	0.497	0.560	0.495	0.499	0.491	0.504	0.497	0.503	0.495	0.504	0.498
	Range	0.990	0.986	0.927	0.972	0.926	0.895	0.991	0.985	0.978	0.972	0.960	0.959	0.991	0.971	0.979
	1	0.303	0.476	0.891	0.143	0.459	0.983	0.950	0.783	0.941	0.840	0.805	0.248	0.068	0.257	0.208
	2	0.194	0.380	0.078	0.083	0.378	0.209	0.480	0.812	0.097	0.708	0.623	0.164	0.108	0.192	0.012
	3	0.157	0.079	0.885	0.032	0.103	0.001	0.298	0.028	0.619	0.075	0.027	0.295	0.003	0.054	0.097
	4	0.142	0.265	0.943	0.482	0.193	0.997	0.955	0.785	0.973	0.865	0.867	0.959	0.569	0.318	0.914
	5	0.972	0.986	0.867	0.878	0.987	0.999	0.985	0.965	0.986	0.963	0.987	0.057	0.813	0.951	0.727
	6	0.912	0.950	0.927	0.986	0.928	0.999	0.987	0.965	0.995	0.971	0.994	0.801	0.995	0.967	0.997
	7	0.922	0.805	0.859	0.645	0.855	0.567	0.498	0.187	0.824	0.260	0.295	0.075	0.337	0.756	0.546
	8	0.941	0.975	0.062	0.800	0.978	0.993	0.682	0.972	0.250	0.910	0.955	0.030	0.873	0.924	0.200
2	9	0.059	0.024	0.939	0.202	0.021	0.008	0.318	0.028	0.748	0.092	0.048	0.970	0.128	0.076	0.810
	10	0.078	0.192	0.142	0.357	0.141	0.445	0.503	0.814	0.175	0.743	0.715	0.926	0.666	0.245	0.468
	11	0.088	0.049	0.074	0.015	0.070	0.001	0.013	0.035	0.005	0.030	0.007	0.201	0.005	0.034	0.003
	12	0.805	0.615	0.923	0.918	0.616	0.800	0.521	0.189	0.902	0.296	0.388	0.838	0.893	0.809	0.989
	13	0.843	0.919	0.117	0.969	0.894	0.999	0.702	0.973	0.378	0.926	0.974	0.708	0.998	0.947	0.909
	14	0.028	0.013	0.135	0.123	0.013	0.001	0.015	0.035	0.014	0.038	0.013	0.944	0.189	0.050	0.285
	15	0.696	0.519	0.110	0.858	0.534	0.018	0.050	0.217	0.058	0.162	0.203	0.754	0.933	0.744	0.802
	16	0.499	0.497	0.501	0.501	0.497	0.506	0.500	0.501	0.499	0.502	0.506	0.502	0.502	0.501	0.507
	Range	0.944	0.973	0.881	0.971	0.974	0.999	0.974	0.945	0.989	0.942	0.987	0.940	0.995	0.933	0.994
	1	0.281	0.344	0.076	0.660	0.717	0.680	0.692	0.077	0.634	0.141	0.853	0.822	0.417	0.120	0.059
	2	0.161	0.160	0.033	0.410	0.590	0.476	0.509	0.057	0.465	0.072	0.822	0.079	0.170	0.085	0.087
	3	0.166	0.176	0.067	0.428	0.445	0.514	0.483	0.048	0.309	0.071	0.097	0.786	0.262	0.088	0.064
	4	0.095	0.175	0.883	0.097	0.112	0.085	0.092	0.076	0.101	0.099	0.728	0.786	0.095	0.048	0.087
	5	0.311	0.368	0.233	0.773	0.742	0.765	0.779	0.893	0.700	0.269	0.883	0.800	0.455	0.175	0.876
	6	0.977	0.975	0.078	0.985	0.985	0.979	0.979	0.194	0.990	0.941	0.959	0.960	0.991	0.963	0.052
	7	0.981	0.979	0.237	0.994	0.988	0.989	0.989	0.965	0.994	0.978	0.970	0.952	0.993	0.979	0.864
	8	0.895	0.924	0.886	0.675	0.646	0.576	0.584	0.192	0.762	0.912	0.903	0.947	0.897	0.904	0.078
	9	0.945	0.925	0.069	0.942	0.927	0.945	0.933	0.135	0.932	0.880	0.273	0.947	0.974	0.947	0.057
	10	0.943	0.915	0.034	0.936	0.966	0.934	0.941	0.154	0.971	0.881	0.947	0.279	0.947	0.945	0.078
	11	0.111	0.192	0.971	0.169	0.127	0.131	0.145	0.892	0.137	0.204	0.772	0.761	0.113	0.077	0.913
	12	0.189	0.194	0.213	0.561	0.475	0.614	0.589	0.842	0.376	0.157	0.123	0.761	0.294	0.134	0.885
	13	0.183	0.176	0.129	0.543	0.620	0.576	0.614	0.861	0.538	0.158	0.856	0.068	0.195	0.129	0.912
3	14	0.045	0.072	0.869	0.029	0.027	0.035	0.031	0.047	0.017	0.047	0.041	0.746	0.041	0.033	0.094
	15	0.043	0.063	0.785	0.026	0.059	0.029	0.036	0.056	0.044	0.047	0.684	0.062	0.020	0.032	0.123
	16	0.084	0.064	0.029	0.205	0.314	0.311	0.302	0.034	0.177	0.032	0.077	0.062	0.084	0.061	0.094
	17	0.911	0.933	0.972	0.785	0.674	0.672	0.684	0.964	0.814	0.965	0.925	0.937	0.913	0.939	0.904
	18	0.954	0.934	0.216	0.972	0.937	0.968	0.961	0.942	0.953	0.949	0.320	0.937	0.979	0.968	0.873
	19	0.952	0.925	0.132	0.968	0.971	0.961	0.966	0.951	0.981	0.949	0.960	0.252	0.957	0.967	0.903
	20	0.053	0.081	0.966	0.060	0.032	0.060	0.054	0.841	0.026	0.112	0.054	0.718	0.050	0.055	0.920
	21	0.051	0.072	0.932	0.055	0.069	0.050	0.062	0.860	0.064	0.112	0.732	0.052	0.025	0.053	0.941
	22	0.017	0.020	0.764	0.006	0.011	0.010	0.009	0.034	0.005	0.020	0.031	0.047	0.007	0.021	0.132
	23	0.830	0.834	0.967	0.577	0.397	0.505	0.474	0.941	0.522	0.922	0.181	0.919	0.824	0.915	0.911
	24	0.021	0.023	0.922	0.014	0.014	0.019	0.019	0.800	0.009	0.054	0.042	0.040	0.009	0.037	0.946
	25	0.706	0.647	0.924	0.328	0.272	0.303	0.294	0.920	0.354	0.850	0.150	0.176	0.574	0.880	0.939
	26	0.493	0.495	0.501	0.493	0.493	0.490	0.492	0.495	0.494	0.492	0.502	0.498	0.496	0.500	0.497
	Range	0.964	0.959	0.943	0.988	0.976	0.979	0.980	0.931	0.989	0.959	0.939	0.920	0.986	0.958	0.852
	1	0.288	0.037	0.101	0.028	0.095	0.039	0.279	0.847	0.792	0.149	0.118	0.101	0.068	0.826	0.090
	2	0.014	0.029	0.039	0.002	0.008	0.030	0.011	0.091	0.706	0.061	0.018	0.047	0.029	0.640	0.027
	3	0.644	0.108	0.311	0.916	0.758	0.147	0.789	0.933	0.869	0.832	0.360	0.276	0.854	0.945	0.889
	4	0.821	0.121	0.808	0.307	0.506	0.215	0.686	0.905	0.925	0.453	0.141	0.826	0.167	0.884	0.203
	5	0.198	0.033	0.035	0.001	0.034	0.012	0.181	0.649	0.046	0.009	0.078	0.034	0.039	0.069	0.044
	6	0.528	0.777	0.256	0.388	0.338	0.743	0.557	0.891	0.844	0.477	0.918	0.244	0.176	0.875	0.216
	7	0.413	0.764	0.117	0.035	0.175	0.564	0.429	0.722	0.069	0.081	0.876	0.107	0.115	0.102	0.124
	8	0.939	0.917	0.932	0.870	0.819	0.948	0.888	0.935	0.949	0.806	0.933	0.936	0.342	0.920	0.391
	9	0.841	0.906	0.551	0.999	0.945	0.915	0.937	0.956	0.907	0.974	0.987	0.497	0.946	0.965	0.962
	10	0.059	0.744	0.126	0.105	0.064	0.705	0.058	0.129	0.770	0.287	0.684	0.137	0.091	0.715	0.086
	11	0.736	0.112	0.631	0.021	0.308	0.100	0.563	0.748	0.145	0.072	0.094	0.651	0.109	0.110	0.115
	12	0.532	0.100	0.152	0.443	0.573	0.062	0.685	0.805	0.084	0.352	0.276	0.126	0.784	0.205	0.804
	13	0.006	0.026	0.011	0.001	0.002	0.009	0.004	0.024	0.025	0.002	0.010	0.013	0.015	0.020	0.011
4	14	0.968	0.269	0.951	0.997	0.979	0.471	0.970	0.963	0.960	0.970	0.401	0.948	0.943	0.968	0.958
	15	0.236	0.101	0.649	0.070	0.139	0.183	0.110	0.147	0.879	0.266	0.023	0.705	0.086	0.730	0.079
	16	0.102	0.090	0.163	0.659	0.344	0.123	0.182	0.195	0.802	0.676	0.102	0.160	0.742	0.846	0.739
	17	0.896	0.910	0.830	0.347	0.653	0.872	0.813	0.809	0.195	0.316	0.896	0.835	0.250	0.155	0.259
	18	0.761	0.899	0.342	0.932	0.860	0.810	0.887	0.857	0.119	0.727	0.976	0.288	0.911	0.270	0.921
	19	0.032	0.730	0.046	0.003	0.021	0.519	0.029	0.038	0.039	0.028	0.595	0.050	0.055	0.032	0.041
	20	0.940	0.255	0.868	0.898	0.935	0.287	0.939	0.874	0.227	0.706	0.313	0.858	0.905	0.285	0.914
	21	0.157	0.093	0.439	0.001	0.055	0.081	0.060	0.045	0.092	0.025	0.013	0.494	0.051	0.035	0.038
	22	0.583	0.235	0.878	0.966	0.823	0.426	0.564	0.283	0.930	0.916	0.122	0.889	0.880	0.899	0.875
	23	0.986	0.971	0.959	0.998	0.992	0.968	0.989	0.912	0.291	0.936	0.982	0.951	0.969	0.361	0.972
	24	0.469	0.221	0.735	0.618	0.660	0.249	0.436	0.112	0.153	0.514	0.080	0.748	0.818	0.126	0.783
	25	0.709	0.963	0.894	0.973	0.904	0.959	0.715	0.156	0.205	0.846	0.880	0.895	0.929	0.175	0.909
	26	0.498	0.499	0.495	0.503	0.499	0.495	0.496	0.503	0.498	0.496	0.498	0.496	0.495	0.500	0.499
	Range	0.979	0.945	0.948	0.998	0.990	0.959	0.984	0.939	0.935	0.972	0.977	0.938	0.954	0.949	0.961
	1	0.325	0.221	0.135	0.707	0.864	0.688	0.675	0.170	0.754	0.222	0.506	0.481	0.182	0.122	0.119
	2	0.303	0.114	0.987	0.971	0.865	0.624	0.223	0.171	0.927	0.135	0.564	0.598	0.130	0.296	0.222
	3	0.029	0.103	0.015	0.012	0.045	0.037	0.113	0.054	0.026	0.094	0.017	0.021	0.063	0.036	0.044
	4	0.974	0.957	0.118	0.821	0.955	0.975	0.992	0.946	0.878	0.952	0.976	0.958	0.960	0.879	0.901
5	5	0.025	0.044	0.881	0.180	0.045	0.025	0.008	0.054	0.121	0.049	0.024	0.041	0.040	0.120	0.098
	6	0.691	0.889	0.013	0.029	0.135	0.378	0.773	0.829	0.072	0.868	0.432	0.400	0.871	0.703	0.777
	7	0.970	0.900	0.984	0.988	0.955	0.963	0.885	0.946	0.973	0.907	0.983	0.978	0.938	0.964	0.955
	8	0.669	0.783	0.864	0.294	0.136	0.314	0.321	0.830	0.244	0.781	0.491	0.517	0.819	0.878	0.880
	9	0.497	0.503	0.499	0.501	0.500	0.501	0.498	0.500	0.499	0.502	0.498	0.499	0.501	0.499	0.499
	Range	0.950	0.912	0.975	0.976	0.910	0.950	0.985	0.893	0.947	0.903	0.966	0.957	0.920	0.928	0.911

e) $n = 20$

Condition no.	RHM no.	BD1	BD2	BD3	BD4	BD5	BD6	BD7	BD8	BD9	BD10	BD11	BD12	BD13	BD14	BD15	BD16	BD17	BD18	BD19	BD20
	1	0.044	0.780	0.141	0.575	0.286	0.116	0.079	0.103	0.087	0.020	0.150	0.122	0.116	0.130	0.445	0.001	0.120	0.229	0.017	0.397
	2	0.005	0.004	0.021	0.004	0.002	0.027	0.026	0.023	0.004	0.024	0.011	0.033	0.047	0.031	0.030	0.001	0.040	0.004	0.041	0.004
	3	0.110	0.782	0.217	0.740	0.396	0.169	0.862	0.217	0.402	0.271	0.270	0.109	0.137	0.142	0.939	0.033	0.155	0.320	0.420	0.527
	4	0.948	0.929	0.319	0.856	0.852	0.245	0.179	0.193	0.639	0.572	0.392	0.902	0.190	0.900	0.204	0.913	0.212	0.771	0.341	0.791
	5	0.114	0.971	0.869	0.912	0.804	0.879	0.135	0.867	0.408	0.044	0.865	0.284	0.895	0.268	0.800	0.619	0.889	0.799	0.028	0.897
	6	0.983	0.995	0.958	0.987	0.993	0.953	0.272	0.934	0.931	0.698	0.969	0.971	0.942	0.963	0.561	0.999	0.945	0.990	0.420	0.990
	7	0.232	0.972	0.921	0.965	0.876	0.920	0.920	0.944	0.810	0.393	0.936	0.263	0.913	0.286	0.994	0.965	0.916	0.868	0.502	0.945
	8	0.017	0.068	0.565	0.064	0.081	0.671	0.052	0.647	0.066	0.050	0.434	0.108	0.782	0.087	0.185	0.002	0.739	0.148	0.063	0.123
1	9	0.982	0.930	0.431	0.936	0.911	0.324	0.944	0.350	0.929	0.948	0.558	0.890	0.219	0.910	0.805	0.998	0.262	0.846	0.935	0.872
	10	0.763	0.027	0.077	0.035	0.113	0.078	0.074	0.055	0.180	0.599	0.061	0.734	0.088	0.706	0.005	0.032	0.084	0.127	0.491	0.053
	11	0.016	0.004	0.041	0.013	0.006	0.046	0.714	0.065	0.064	0.294	0.030	0.029	0.058	0.035	0.424	0.001	0.056	0.009	0.574	0.009
	12	0.995	0.995	0.978	0.996	0.997	0.972	0.971	0.977	0.995	0.975	0.989	0.966	0.953	0.967	0.967	0.999	0.960	0.995	0.957	0.996
	13	0.887	0.213	0.779	0.259	0.583	0.828	0.129	0.781	0.584	0.721	0.724	0.889	0.863	0.853	0.057	0.964	0.845	0.670	0.573	0.465
	14	0.883	0.028	0.129	0.088	0.182	0.119	0.855	0.132	0.577	0.954	0.131	0.712	0.105	0.724	0.190	0.365	0.112	0.193	0.971	0.099
	15	0.954	0.215	0.856	0.424	0.695	0.881	0.915	0.896	0.907	0.979	0.845	0.876	0.884	0.865	0.540	0.999	0.880	0.763	0.982	0.595
	16	0.497	0.496	0.498	0.499	0.489	0.497	0.492	0.499	0.493	0.496	0.496	0.498	0.500	0.495	0.492	0.491	0.501	0.495	0.497	0.496
	Range	0.991	0.991	0.957	0.993	0.995	0.944	0.945	0.954	0.991	0.958	0.978	0.942	0.906	0.937	0.989	0.999	0.921	0.991	0.965	0.993
	1	0.044	0.086	0.722	0.064	0.508	0.064	0.071	0.385	0.208	0.041	0.039	0.206	0.086	0.060	0.078	0.053	0.077	0.367	0.081	0.066
	2	0.128	0.107	0.691	0.253	0.707	0.160	0.088	0.563	0.622	0.286	0.508	0.879	0.183	0.464	0.131	0.793	0.544	0.601	0.526	0.208
	3	0.702	0.164	0.788	0.120	0.503	0.167	0.845	0.770	0.370	0.098	0.206	0.298	0.137	0.052	0.112	0.151	0.233	0.740	0.267	0.115
	4	0.007	0.033	0.009	0.010	0.012	0.011	0.040	0.009	0.002	0.006	0.001	0.032	0.027	0.157	0.035	0.004	0.002	0.008	0.001	0.012
	5	0.184	0.869	0.977	0.132	0.759	0.762	0.131	0.432	0.552	0.083	0.388	0.280	0.130	0.118	0.134	0.061	0.123	0.414	0.504	0.110
	6	0.117	0.124	0.799	0.773	0.856	0.153	0.114	0.782	0.664	0.709	0.268	0.368	0.835	0.209	0.845	0.331	0.624	0.757	0.250	0.837
	7	0.353	0.909	0.988	0.876	0.960	0.888	0.195	0.816	0.914	0.818	0.804	0.461	0.887	0.330	0.907	0.358	0.719	0.793	0.769	0.896
	8	0.027	0.052	0.017	0.473	0.112	0.036	0.068	0.096	0.042	0.403	0.007	0.085	0.659	0.398	0.732	0.069	0.138	0.088	0.012	0.596
	9	0.853	0.222	0.853	0.863	0.853	0.321	0.900	0.965	0.817	0.841	0.625	0.481	0.893	0.189	0.888	0.560	0.844	0.953	0.541	0.901
	10	0.270	0.151	0.772	0.946	0.944	0.311	0.138	0.891	0.939	0.958	0.876	0.951	0.924	0.744	0.905	0.977	0.968	0.902	0.785	0.953
	11	0.050	0.742	0.168	0.027	0.057	0.475	0.080	0.012	0.022	0.014	0.018	0.053	0.046	0.262	0.067	0.005	0.005	0.012	0.057	0.024
	12	0.910	0.934	0.986	0.220	0.755	0.898	0.914	0.806	0.730	0.174	0.744	0.386	0.196	0.104	0.182	0.169	0.321	0.778	0.785	0.178
	13	0.374	0.894	0.971	0.398	0.890	0.893	0.157	0.610	0.895	0.417	0.932	0.921	0.253	0.609	0.208	0.813	0.646	0.648	0.930	0.296
2	14	0.416	0.073	0.016	0.023	0.012	0.041	0.768	0.090	0.007	0.018	0.004	0.059	0.049	0.140	0.054	0.019	0.016	0.080	0.014	0.026
	15	0.030	0.043	0.007	0.069	0.041	0.038	0.051	0.027	0.033	0.086	0.036	0.555	0.071	0.677	0.065	0.409	0.098	0.037	0.064	0.060
	16	0.866	0.196	0.761	0.374	0.703	0.330	0.871	0.883	0.786	0.453	0.831	0.928	0.262	0.435	0.178	0.920	0.790	0.892	0.801	0.306
	17	0.131	0.806	0.238	0.632	0.296	0.670	0.126	0.118	0.218	0.543	0.167	0.129	0.742	0.543	0.824	0.079	0.205	0.109	0.197	0.699
	18	0.969	0.957	0.993	0.933	0.959	0.962	0.948	0.973	0.968	0.912	0.964	0.576	0.931	0.304	0.936	0.589	0.899	0.964	0.935	0.942
	19	0.578	0.927	0.984	0.978	0.988	0.959	0.228	0.912	0.994	0.981	0.996	0.971	0.953	0.847	0.947	0.981	0.983	0.921	0.986	0.975
	20	0.726	0.850	0.227	0.056	0.056	0.689	0.860	0.111	0.062	0.041	0.122	0.093	0.078	0.239	0.097	0.022	0.031	0.100	0.212	0.048
	21	0.144	0.780	0.146	0.141	0.146	0.679	0.098	0.036	0.186	0.157	0.372	0.647	0.109	0.796	0.114	0.437	0.151	0.048	0.455	0.101
	22	0.642	0.092	0.012	0.128	0.040	0.112	0.802	0.186	0.088	0.180	0.194	0.667	0.115	0.650	0.094	0.639	0.275	0.209	0.228	0.106
	23	0.869	0.894	0.308	0.752	0.292	0.840	0.910	0.441	0.383	0.711	0.490	0.201	0.820	0.514	0.871	0.205	0.449	0.402	0.470	0.796
	24	0.880	0.877	0.200	0.232	0.143	0.846	0.884	0.221	0.341	0.288	0.730	0.749	0.168	0.774	0.157	0.666	0.369	0.246	0.747	0.166
	25	0.955	0.915	0.277	0.938	0.491	0.936	0.927	0.619	0.796	0.959	0.960	0.876	0.916	0.933	0.923	0.947	0.921	0.637	0.918	0.936
	26	0.497	0.501	0.499	0.503	0.500	0.500	0.498	0.502	0.503	0.498	0.499	0.566	0.502	0.489	0.501	0.499	0.496	0.502	0.498	0.503
	Range	0.962	0.924	0.986	0.968	0.977	0.951	0.908	0.965	0.992	0.976	0.996	0.939	0.926	0.881	0.912	0.977	0.981	0.956	0.985	0.962
	1	0.275	0.977	0.873	0.894	0.557	0.882	0.899	0.861	0.881	0.835	0.953	0.563	0.821	0.950	0.854	0.949	0.931	0.970	0.866	0.952
	2	0.952	0.999	0.959	0.876	0.988	0.967	0.987	0.982	0.984	0.987	0.976	0.988	0.987	0.978	0.969	0.979	0.984	0.988	0.975	0.977
	3	0.065	0.110	0.724	0.908	0.190	0.701	0.194	0.552	0.176	0.135	0.692	0.260	0.130	0.172	0.632	0.694	0.362	0.301	0.633	0.785
	4	0.597	0.990	0.881	0.078	0.421	0.879	0.905	0.854	0.845	0.805	0.943	0.267	0.843	0.866	0.874	0.936	0.919	0.831	0.848	0.167
	5	0.055	0.337	0.111	0.923	0.176	0.123	0.448	0.132	0.544	0.478	0.239	0.246	0.396	0.865	0.108	0.218	0.406	0.851	0.134	0.933
	6	0.227	0.466	0.118	0.108	0.102	0.120	0.462	0.125	0.479	0.432	0.211	0.071	0.429	0.715	0.127	0.186	0.374	0.547	0.118	0.128
	7	0.006	0.001	0.038	0.934	0.026	0.034	0.012	0.019	0.023	0.016	0.030	0.068	0.010	0.069	0.025	0.028	0.019	0.087	0.030	0.732
	8	0.748	0.817	0.266	0.910	0.884	0.306	0.792	0.460	0.860	0.885	0.344	0.921	0.851	0.929	0.335	0.351	0.668	0.924	0.397	0.965
3	9	0.250	0.187	0.736	0.090	0.111	0.696	0.204	0.539	0.137	0.111	0.658	0.077	0.149	0.070	0.666	0.653	0.331	0.074	0.603	0.033
	10	0.994	0.999	0.962	0.066	0.973	0.966	0.988	0.981	0.977	0.983	0.970	0.930	0.990	0.930	0.975	0.972	0.981	0.911	0.970	0.259
	11	0.772	0.540	0.883	0.892	0.894	0.881	0.532	0.874	0.515	0.559	0.791	0.928	0.571	0.282	0.874	0.817	0.625	0.449	0.882	0.866
	12	0.047	0.001	0.041	0.123	0.011	0.033	0.013	0.018	0.015	0.012	0.024	0.012	0.013	0.022	0.032	0.022	0.015	0.011	0.025	0.022
	13	0.935	0.893	0.278	0.092	0.803	0.301	0.802	0.446	0.820	0.860	0.310	0.736	0.870	0.825	0.369	0.310	0.637	0.696	0.367	0.207
	14	0.944	0.669	0.890	0.076	0.818	0.878	0.547	0.867	0.451	0.512	0.763	0.750	0.604	0.133	0.892	0.785	0.593	0.146	0.866	0.063
	15	0.723	0.024	0.128	0.105	0.434	0.119	0.099	0.138	0.116	0.159	0.048	0.432	0.179	0.049	0.147	0.052	0.068	0.029	0.134	0.045
	16	0.499	0.503	0.501	0.499	0.495	0.501	0.497	0.499	0.497	0.495	0.501	0.498	0.500	0.498	0.500	0.502	0.499	0.498	0.500	0.495
	Range	0.988	0.999	0.924	0.869	0.977	0.933	0.976	0.965	0.969	0.975	0.952	0.976	0.979	0.956	0.949	0.957	0.969	0.977	0.949	0.955
	1	0.217	0.083	0.202	0.776	0.103	0.093	0.825	0.215	0.456	0.446	0.276	0.959	0.818	0.098	0.905	0.324	0.464	0.088	0.805	0.804
	2	0.280	0.166	0.939	0.887	0.136	0.076	0.917	0.367	0.642	0.510	0.323	0.941	0.892	0.113	0.884	0.694	0.828	0.213	0.896	0.916
	3	0.135	0.023	0.138	0.385	0.019	0.151	0.627	0.004	0.087	0.065	0.108	0.266	0.683	0.019	0.145	0.008	0.014	0.010	0.614	0.003
	4	0.231	0.865	0.255	0.917	0.691	0.909	0.835	0.681	0.613	0.669	0.294	0.958	0.840	0.687	0.944	0.627	0.654	0.463	0.841	0.908
	5	0.957	0.274	0.315	0.951	0.665	0.057	0.946	0.960	0.981	0.960	0.970	0.989	0.928	0.657	0.987	0.840	0.901	0.860	0.931	0.999
	6	0.048	0.042	0.034	0.045	0.057	0.098	0.068	0.057	0.042	0.128	0.073	0.591	0.074	0.066	0.486	0.214	0.234	0.025	0.073	0.011
	7	0.797	0.173	0.071	0.212	0.545	0.061	0.207	0.832	0.677	0.772	0.847	0.787	0.185	0.576	0.811	0.745	0.743	0.684	0.202	0.957
	8	0.053	0.777	0.050	0.141	0.573	0.914	0.074	0.375	0.092	0.287	0.081	0.588	0.086	0.609	0.596	0.495	0.406	0.244	0.094	0.036
	9	0.024	0.010	0.019	0.003	0.008	0.158	0.018	0.001	0.001	0.006	0.018	0.016	0.030	0.011	0.008	0.003	0.002	0.002	0.021	0.001
	10	0.072	0.094	0.712	0.106	0.079	0.080	0.149	0.130	0.106	0.165	0.093	0.521	0.132	0.077	0.440	0.568	0.623	0.081	0.145	0.040
	11	0.960	0.971	0.380	0.989	0.986	0.861	0.950	0.999	0.993	0.990	0.974	0.989	0.939	0.986	0.994	0.962	0.962	0.990	0.947	0.999
	12	0.918	0.114	0.231	0.728	0.348	0.099	0.840	0.447	0.795	0.644	0.893	0.476	0.849	0.352	0.444	0.166	0.208	0.549	0.819	0.893
	13	0.972	0.426	0.971	0.983	0.723	0.046	0.980	0.986	0.995	0.972	0.978	0.983	0.964	0.686	0.983	0.975	0.990	0.949	0.970	0.999
4	14	0.145	0.691	0.181	0.631	0.375	0.948	0.642	0.079	0.169	0.174	0.119	0.263	0.713	0.384	0.217	0.050	0.044	0.146	0.666	0.011
	15	0.295	0.936	0.957	0.967	0.746	0.891	0.923	0.821	0.777	0.725	0.343	0.940	0.907	0.716	0.930	0.901	0.924	0.678	0.919	0.968
	16	0.183	0.057	0.901	0.563	0.028	0.127	0.781	0.013	0.189	0.089	0.136	0.211	0.790	0.023	0.120	0.072	0.124	0.039	0.754	0.013
	17	0.810	0.939	0.098	0.430	0.970	0.868	0.219	0.987	0.804	0.906	0.860	0.784	0.209	0.976	0.877	0.925	0.873	0.959	0.243	0.986
	18	0.695	0.061	0.043	0.032	0.241	0.105	0.077	0.178	0.215	0.264	0.650	0.058	0.092	0.277	0.069	0.096	0.074	0.316	0.080	0.029
	19	0.849	0.299	0.819	0.363	0.609	0.049	0.356	0.921	0.825	0.818	0.877	0.732	0.287	0.607	0.779	0.948	0.955	0.849	0.331	0.988
	20	0.924	0.900	0.288	0.891	0.915	0.916	0.850	0.870	0.889	0.827	0.903	0.472	0.868	0.919	0.555	0.425	0.372	0.916	0.853	0.957
	21	0.975	0.989	0.981	0.997	0.991	0.836	0.982	0.999	0.998	0.993	0.981	0.983	0.970	0.988	0.992	0.997	0.998	0.998	0.978	0.999
	22	0.195	0.820	0.929	0.784	0.439	0.936	0.793	0.167	0.314	0.219	0.148	0.208	0.814	0.416	0.185	0.249	0.252	0.309	0.796	0.040
	23	0.711	0.827	0.061	0.110	0.855	0.920	0.083	0.632	0.348	0.478	0.669	0.057	0.107	0.883	0.114	0.300	0.168	0.782	0.103	0.078
	24	0.949	0.955	0.965	0.954	0.938	0.898	0.932	0.942	0.955	0.866	0.924	0.402	0.926	0.931	0.509	0.781	0.761	0.974	0.926	0.987
	25	0.775	0.913	0.798	0.219	0.889	0.903	0.175	0.784	0.534	0.542	0.717	0.039	0.182	0.898	0.093	0.670	0.530	0.909	0.193	0.186
	26	0.495	0.494	0.500	0.497	0.492	0.495	0.499	0.499	0.495	0.494	0.496	0.497	0.500	0.496	0.498	0.496	0.497	0.496	0.498	0.493
	Range	0.951	0.980	0.962	0.994	0.982	0.902	0.964	0.999	0.997	0.987	0.963	0.973	0.940	0.977	0.986	0.994	0.995	0.996	0.957	0.999
	1	0.019	0.038	0.190	0.018	0.029	0.027	0.549	0.030	0.124	0.544	0.040	0.031	0.046	0.118	0.052	0.291	0.066	0.691	0.048	0.033
	2	0.013	0.066	0.016	0.001	0.001	0.009	0.028	0.017	0.006	0.006	0.008	0.003	0.025	0.011	0.003	0.016	0.009	0.020	0.003	0.003
	3	0.318	0.744	0.219	0.049	0.015	0.199	0.623	0.180	0.165	0.474	0.147	0.151	0.141	0.171	0.539	0.207	0.017	0.766	0.179	0.157
	4	0.017	0.112	0.316	0.023	0.126	0.050	0.553	0.025	0.258	0.719	0.073	0.198	0.765	0.215	0.190	0.489	0.260	0.771	0.077	0.216
	5	0.221	0.089	0.309	0.186	0.331	0.134	0.826	0.771	0.352	0.773	0.228	0.308	0.072	0.332	0.109	0.490	0.784	0.790	0.721	0.319
	6	0.250	0.028	0.901	0.940	0.999	0.572	0.889	0.083	0.858	0.943	0.662	0.316	0.099	0.821	0.453	0.919	0.432	0.904	0.300	0.314
	7	0.739	0.068	0.952	0.997	0.999	0.842	0.979	0.893	0.968	0.987	0.923	0.813	0.143	0.953	0.609	0.973	0.983	0.947	0.958	0.812
	8	0.240	0.087	0.954	0.951	0.999	0.679	0.891	0.072	0.943	0.980	0.763	0.707	0.867	0.906	0.736	0.973	0.755	0.939	0.388	0.716
	9	0.826	0.695	0.917	0.977	0.997	0.897	0.920	0.338	0.895	0.920	0.869	0.641	0.247	0.876	0.946	0.871	0.215	0.937	0.588	0.636
	10	0.205	0.049	0.504	0.649	0.499	0.396	0.209	0.051	0.381	0.154	0.397	0.083	0.059	0.426	0.106	0.418	0.152	0.104	0.055	0.076
	11	0.211	0.215	0.459	0.216	0.624	0.205	0.828	0.746	0.551	0.889	0.328	0.698	0.827	0.484	0.315	0.691	0.950	0.853	0.796	0.721
	12	0.800	0.861	0.346	0.327	0.240	0.491	0.870	0.956	0.422	0.717	0.484	0.632	0.197	0.421	0.689	0.385	0.567	0.849	0.909	0.641
	13	0.179	0.140	0.038	0.020	0.001	0.060	0.137	0.689	0.040	0.032	0.077	0.080	0.042	0.061	0.009	0.051	0.471	0.040	0.313	0.077
5	14	0.307	0.887	0.353	0.060	0.078	0.287	0.627	0.159	0.320	0.656	0.227	0.496	0.908	0.289	0.802	0.385	0.104	0.833	0.249	0.519
	15	0.012	0.171	0.040	0.001	0.001	0.018	0.029	0.014	0.022	0.021	0.017	0.040	0.673	0.029	0.022	0.051	0.067	0.034	0.006	0.041
	16	0.267	0.822	0.020	0.002	0.001	0.098	0.043	0.122	0.009	0.004	0.042	0.026	0.089	0.020	0.152	0.008	0.001	0.033	0.023	0.025
	17	0.729	0.175	0.980	0.998	0.999	0.901	0.979	0.877	0.991	0.996	0.958	0.972	0.909	0.981	0.848	0.993	0.999	0.968	0.975	0.974
	18	0.988	0.826	0.961	0.999	0.999	0.982	0.987	0.986	0.979	0.980	0.983	0.958	0.322	0.972	0.977	0.951	0.934	0.967	0.993	0.957
	19	0.689	0.110	0.651	0.944	0.928	0.712	0.501	0.839	0.682	0.352	0.773	0.494	0.090	0.713	0.198	0.625	0.897	0.171	0.744	0.474
	20	0.791	0.949	0.500	0.365	0.518	0.603	0.872	0.948	0.622	0.851	0.603	0.913	0.939	0.577	0.893	0.592	0.849	0.899	0.942	0.922
	21	0.171	0.300	0.084	0.025	0.004	0.102	0.140	0.660	0.107	0.083	0.131	0.350	0.748	0.125	0.054	0.134	0.785	0.065	0.403	0.357
	22	0.257	0.930	0.049	0.003	0.001	0.157	0.044	0.106	0.033	0.014	0.077	0.180	0.854	0.048	0.390	0.029	0.017	0.056	0.040	0.183
	23	0.987	0.932	0.985	0.999	0.999	0.991	0.987	0.983	0.994	0.994	0.992	0.997	0.974	0.989	0.997	0.985	0.991	0.981	0.997	0.997
	24	0.746	0.972	0.101	0.065	0.002	0.427	0.186	0.916	0.144	0.059	0.338	0.675	0.899	0.180	0.547	0.085	0.569	0.099	0.692	0.680
	25	0.981	0.961	0.813	0.984	0.974	0.973	0.580	0.970	0.878	0.465	0.960	0.768	0.952	0.883	0.948	0.718	0.934	0.316	0.950	0.966
	26	0.498	0.497	0.502	0.508	0.509	0.499	0.565	0.499	0.501	0.504	0.500	0.495	0.497	0.501	0.500	0.505	0.500	0.504	0.495	0.496
	Range	0.976	0.944	0.969	0.999	0.999	0.982	0.959	0.973	0.989	0.993	0.985	0.994	0.948	0.978	0.994	0.985	0.997	0.962	0.994	0.995

A.1.2. Rectangular Method

a) $n = 5$

Condition no.	RHM no.	BD1	BD2	BD3	BD4	BD5
1	1	0.006	0.007	0.018	0.003	0.014
	2	0.385	0.915	0.928	0.020	0.010
	3	0.001	0.018	0.003	0.031	0.976
	4	0.789	0.039	0.192	0.890	0.033
	5	0.210	0.960	0.799	0.109	0.967
	6	0.999	0.981	0.996	0.969	0.024
	7	0.615	0.084	0.067	0.980	0.990
	8	0.994	0.993	0.981	0.997	0.986
	9	0.500	0.498	0.493	0.500	0.499
	Range	0.997	0.986	0.993	0.993	0.980
2	1	0.015	0.078	0.910	0.030	0.032
	2	0.082	0.878	0.983	0.975	0.881
	3	0.004	0.001	0.004	0.013	0.002
	4	0.967	0.662	0.968	0.051	0.468
	5	0.033	0.338	0.033	0.948	0.539
	6	0.996	0.999	0.996	0.986	0.998
	7	0.919	0.122	0.017	0.024	0.122
	8	0.985	0.922	0.091	0.969	0.969
	9	0.502	0.500	0.501	0.497	0.503
	Range	0.991	0.997	0.991	0.973	0.997
3	1	0.014	0.010	0.013	0.011	0.008
	2	0.902	0.850	0.088	0.332	0.798
	3	0.100	0.148	0.908	0.669	0.201
	4	0.986	0.990	0.986	0.989	0.992
	5	0.502	0.499	0.495	0.500	0.499
	Range	0.977	0.987	0.979	0.978	0.989
4	1	0.054	0.010	0.910	0.064	0.017
	2	0.983	0.623	0.994	0.982	0.042
	3	0.126	0.512	0.941	0.144	0.970
	4	0.005	0.004	0.003	0.005	0.011
	5	0.995	0.996	0.997	0.995	0.988
	6	0.870	0.485	0.057	0.854	0.029
	7	0.016	0.374	0.005	0.017	0.957
	8	0.943	0.989	0.087	0.934	0.982
	9	0.496	0.498	0.497	0.498	0.497
	Range	0.990	0.992	0.994	0.990	0.977
5	1	0.025	0.928	0.032	0.702	0.034
	2	0.683	0.987	0.095	0.904	0.982
	3	0.002	0.006	0.004	0.001	0.004
	4	0.690	0.961	0.983	0.988	0.094
	5	0.305	0.038	0.016	0.011	0.903
	6	0.998	0.994	0.996	0.999	0.995
	7	0.311	0.013	0.902	0.090	0.017
	8	0.975	0.071	0.967	0.286	0.965
	9	0.497	0.498	0.496	0.493	0.496
	Range	0.997	0.989	0.992	0.998	0.991

b) $n = 10$

Condition no.	RHM no.	BD1	BD2	BD3	BD4	BD5	BD6	BD7	BD8	BD9	BD10
1	1	0.010	0.012	0.002	0.010	0.001	0.001	0.002	0.005	0.004	0.002
	2	0.022	0.156	0.040	0.579	0.638	0.065	0.172	0.893	0.908	0.768
	3	0.902	0.831	0.012	0.130	0.058	0.814	0.468	0.032	0.031	0.107
	4	0.052	0.013	0.855	0.079	0.033	0.001	0.024	0.024	0.018	0.008
	5	0.944	0.986	0.142	0.919	0.964	0.999	0.974	0.976	0.981	0.992
	6	0.092	0.163	0.988	0.866	0.938	0.183	0.517	0.968	0.969	0.889
	7	0.976	0.838	0.959	0.415	0.350	0.934	0.818	0.106	0.091	0.225
	8	0.989	0.987	0.998	0.989	0.999	0.999	0.998	0.995	0.996	0.998
	9	0.493	0.495	0.498	0.497	0.493	0.498	0.493	0.500	0.498	0.496
	Range	0.979	0.975	0.997	0.979	0.997	0.999	0.997	0.990	0.991	0.996
2	1	0.011	0.007	0.012	0.011	0.019	0.009	0.009	0.018	0.007	0.009
	2	0.098	0.159	0.266	0.829	0.202	0.862	0.808	0.841	0.844	0.856
	3	0.900	0.840	0.731	0.173	0.794	0.139	0.193	0.160	0.157	0.144
	4	0.989	0.993	0.987	0.989	0.981	0.991	0.991	0.982	0.993	0.991
	5	0.498	0.498	0.498	0.502	0.497	0.501	0.501	0.501	0.500	0.500
	Range	0.978	0.985	0.975	0.978	0.962	0.983	0.983	0.964	0.986	0.982
3	1	0.132	0.059	0.134	0.421	0.013	0.328	0.946	0.583	0.057	0.036
	2	0.977	0.980	0.950	0.960	0.710	0.999	0.970	0.992	0.984	0.089
	3	0.005	0.005	0.025	0.004	0.003	0.001	0.009	0.002	0.005	0.004
	4	0.288	0.147	0.212	0.742	0.486	0.997	0.981	0.754	0.126	0.985
	5	0.701	0.850	0.787	0.249	0.495	0.003	0.019	0.237	0.871	0.014
	6	0.995	0.995	0.975	0.995	0.997	0.999	0.990	0.998	0.995	0.996
	7	0.022	0.019	0.050	0.038	0.274	0.001	0.029	0.007	0.016	0.907
	8	0.862	0.940	0.865	0.567	0.986	0.652	0.053	0.405	0.941	0.962
	9	0.494	0.497	0.499	0.494	0.491	0.489	0.498	0.494	0.497	0.495
	Range	0.990	0.990	0.949	0.991	0.995	0.999	0.981	0.996	0.990	0.991
4	1	0.967	0.993	0.990	0.997	0.995	0.997	0.997	0.996	0.948	0.990
	2	0.208	0.344	0.049	0.923	0.939	0.202	0.991	0.166	0.985	0.794
	3	0.999	0.995	0.993	0.986	0.208	0.943	0.811	0.996	0.020	0.987
	4	0.169	0.586	0.931	0.180	0.967	0.974	0.316	0.841	0.934	0.218
	5	0.826	0.403	0.066	0.807	0.031	0.025	0.677	0.154	0.067	0.772
	6	0.001	0.004	0.006	0.012	0.787	0.055	0.184	0.004	0.980	0.012
	7	0.785	0.645	0.948	0.070	0.059	0.792	0.008	0.828	0.015	0.196
	8	0.031	0.007	0.009	0.003	0.004	0.003	0.002	0.003	0.053	0.010
	9	0.495	0.494	0.495	0.490	0.496	0.496	0.496	0.496	0.501	0.493
	Range	0.999	0.991	0.987	0.995	0.991	0.993	0.995	0.993	0.970	0.980
5	1	0.992	0.998	0.675	0.987	0.995	0.929	0.992	0.978	0.978	0.138
	2	0.043	0.154	0.365	0.065	0.903	0.094	0.945	0.040	0.025	0.014
	3	0.959	0.816	0.034	0.834	0.985	0.872	0.040	0.969	0.971	0.123
	4	0.998	0.999	0.999	0.999	0.999	0.992	0.997	0.995	0.998	0.997
	5	0.970	0.989	0.447	0.974	0.050	0.754	0.985	0.900	0.887	0.056
	6	0.009	0.002	0.004	0.003	0.817	0.049	0.005	0.029	0.019	0.012
	7	0.104	0.351	0.992	0.233	0.979	0.359	0.976	0.125	0.134	0.951
	8	0.013	0.060	0.176	0.038	0.002	0.018	0.916	0.007	0.003	0.003
	9	0.986	0.938	0.817	0.960	0.998	0.982	0.084	0.993	0.997	0.996
	10	0.893	0.644	0.008	0.759	0.021	0.638	0.024	0.873	0.863	0.048
	11	0.991	0.998	0.995	0.997	0.179	0.950	0.995	0.970	0.980	0.988
	12	0.028	0.011	0.543	0.024	0.949	0.243	0.015	0.099	0.111	0.943
	13	0.039	0.180	0.964	0.159	0.015	0.126	0.960	0.030	0.028	0.875
	14	0.956	0.843	0.625	0.931	0.095	0.905	0.055	0.959	0.974	0.986
	15	0.497	0.497	0.495	0.495	0.497	0.498	0.500	0.498	0.498	0.498
	Range	0.989	0.998	0.995	0.996	0.998	0.975	0.992	0.989	0.995	0.994
6 (computer workstation)	1	0.050	0.905	0.043	0.914	0.244	0.072	0.957	0.985	0.142	0.952
	2	0.003	0.008	0.016	0.005	0.001	0.029	0.006	0.018	0.002	0.022
	3	0.958	0.999	0.108	0.956	0.878	0.985	0.989	0.965	0.966	0.999
	4	0.266	0.757	0.960	0.986	0.925	0.040	0.974	0.993	0.468	0.715
	5	0.739	0.239	0.050	0.013	0.088	0.959	0.025	0.007	0.559	0.273
	6	0.043	0.001	0.911	0.043	0.145	0.015	0.011	0.033	0.040	0.001
	7	0.997	0.991	0.987	0.995	1.000	0.970	0.994	0.982	0.998	0.974
	8	0.951	0.089	0.966	0.083	0.789	0.927	0.042	0.015	0.872	0.044
	9	0.503	0.498	0.515	0.485	0.522	0.506	0.491	0.496	0.498	0.486
	Range	0.994	0.998	0.971	0.989	0.999	0.971	0.989	0.986	0.996	0.998

c) $n = 11$ (application to ergonomic design of a computer workstation in Chapter 6)

RHM no.	BD1	BD2	BD3	BD4	BD5	BD6	BD7	BD8	BD9	BD10	BD11
1	0.992	0.743	0.549	0.902	0.171	0.967	0.966	0.150	0.983	0.081	0.312
2	0.996	0.990	0.994	0.999	0.997	0.998	0.960	0.997	0.998	0.992	0.997
3	0.331	0.653	0.587	0.719	0.173	0.778	0.026	0.005	0.364	0.178	0.307
4	0.580	0.020	0.004	0.010	0.002	0.036	0.979	0.104	0.358	0.002	0.003
5	0.421	0.981	0.996	0.990	0.997	0.965	0.022	0.893	0.642	0.998	0.997
6	0.670	0.350	0.409	0.277	0.822	0.223	0.975	0.994	0.637	0.814	0.685
7	0.004	0.010	0.005	0.001	0.002	0.002	0.041	0.003	0.002	0.007	0.003
8	0.008	0.260	0.447	0.096	0.825	0.033	0.035	0.847	0.017	0.915	0.680
9	0.500	0.502	0.498	0.498	0.497	0.500	0.503	0.497	0.500	0.494	0.495
Range	0.992	0.980	0.992	0.998	0.995	0.996	0.957	0.994	0.995	0.997	0.994

d) $n = 15$

Condition no.	RHM no.	BD1	BD2	BD3	BD4	BD5	BD6	BD7	BD8	BD9	BD10	BD11	BD12	BD13	BD14	BD15
	1	0.719	0.995	0.147	0.941	0.979	0.987	0.989	0.995	0.996	0.691	0.986	0.394	0.996	0.676	0.929
	2	0.998	0.999	0.998	0.982	0.997	0.997	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.997
	3	0.169	0.490	0.013	0.027	0.030	0.967	0.280	0.767	0.237	0.405	0.934	0.245	0.725	0.401	0.891
	4	0.029	0.880	0.103	0.984	0.873	0.161	0.642	0.942	0.885	0.204	0.048	0.057	0.532	0.196	0.756
	5	0.853	0.517	0.077	0.795	0.980	0.868	0.929	0.336	0.948	0.037	0.903	0.041	0.783	0.035	0.037
	6	0.922	0.916	0.952	0.082	0.121	0.992	0.672	0.926	0.401	0.999	0.995	0.999	0.962	0.999	0.995
	7	0.684	0.995	0.996	0.996	0.968	0.331	0.918	0.989	0.952	0.995	0.269	0.985	0.896	0.994	0.978
	8	0.999	0.926	0.993	0.912	0.997	0.952	0.994	0.614	0.982	0.944	0.991	0.978	0.975	0.943	0.321
1	9	0.001	0.073	0.007	0.092	0.003	0.086	0.006	0.383	0.016	0.059	0.009	0.023	0.024	0.059	0.676
	10	0.313	0.005	0.005	0.004	0.031	0.771	0.078	0.011	0.043	0.006	0.726	0.015	0.100	0.006	0.021
	11	0.077	0.083	0.050	0.921	0.875	0.018	0.318	0.074	0.581	0.001	0.005	0.001	0.036	0.001	0.005
	12	0.144	0.481	0.926	0.211	0.020	0.208	0.067	0.662	0.047	0.965	0.094	0.961	0.210	0.966	0.963
	13	0.829	0.508	0.988	0.974	0.969	0.062	0.711	0.231	0.748	0.603	0.064	0.760	0.266	0.607	0.107
	14	0.002	0.001	0.002	0.019	0.003	0.007	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.003
	15	0.278	0.005	0.858	0.062	0.020	0.028	0.010	0.005	0.004	0.316	0.013	0.612	0.004	0.331	0.070
	16	0.498	0.499	0.504	0.504	0.497	0.560	0.495	0.499	0.491	0.504	0.497	0.503	0.495	0.504	0.498
	Range	0.999	0.999	0.995	0.992	0.994	0.990	0.999	0.999	0.998	0.999	0.999	0.999	0.999	0.999	0.995
	1	0.190	0.460	0.970	0.041	0.436	0.999	0.989	0.847	0.952	0.945	0.916	0.142	0.054	0.125	0.168
	2	0.999	0.999	0.955	0.972	0.999	0.999	0.999	0.992	0.990	0.998	0.999	0.006	0.833	0.998	0.766
	3	0.036	0.177	0.992	0.464	0.098	0.999	0.991	0.849	0.980	0.962	0.963	0.997	0.568	0.201	0.946
	4	0.045	0.019	0.967	0.001	0.029	0.001	0.232	0.006	0.628	0.010	0.001	0.199	0.001	0.002	0.062
	5	0.072	0.323	0.015	0.012	0.318	0.072	0.468	0.877	0.083	0.808	0.688	0.061	0.091	0.063	0.004
	6	0.989	0.992	0.987	0.999	0.986	0.999	0.999	0.992	0.997	0.999	0.999	0.908	0.997	0.999	0.999
	7	0.991	0.899	0.951	0.733	0.944	0.627	0.500	0.122	0.840	0.151	0.192	0.011	0.331	0.889	0.560
	8	0.996	0.998	0.009	0.916	0.999	0.999	0.744	0.994	0.237	0.985	0.997	0.001	0.893	0.994	0.160
2	9	0.004	0.002	0.991	0.085	0.001	0.001	0.257	0.006	0.761	0.016	0.003	0.999	0.109	0.006	0.848
	10	0.009	0.099	0.050	0.268	0.054	0.385	0.500	0.878	0.158	0.852	0.816	0.989	0.672	0.112	0.454
	11	0.011	0.007	0.013	0.001	0.014	0.001	0.001	0.008	0.003	0.001	0.001	0.093	0.003	0.001	0.001
	12	0.927	0.673	0.985	0.989	0.676	0.932	0.532	0.124	0.916	0.195	0.322	0.940	0.910	0.937	0.997
	13	0.964	0.820	0.008	0.538	0.899	0.001	0.009	0.152	0.020	0.039	0.039	0.003	0.435	0.800	0.058
	14	0.001	0.001	0.045	0.029	0.001	0.001	0.001	0.009	0.010	0.002	0.001	0.994	0.169	0.002	0.245
	15	0.809	0.535	0.030	0.960	0.558	0.001	0.011	0.153	0.048	0.056	0.088	0.859	0.947	0.876	0.841
	16	0.499	0.497	0.501	0.501	0.497	0.506	0.500	0.501	0.499	0.502	0.506	0.502	0.502	0.501	0.507
	Range	0.999	0.999	0.984	0.999	0.999	0.999	0.998	0.988	0.993	0.998	0.999	0.997	0.996	0.999	0.999
	1	0.199	0.254	0.017	0.757	0.848	0.799	0.819	0.019	0.701	0.059	0.974	0.957	0.396	0.078	0.010
	2	0.072	0.047	0.003	0.355	0.660	0.462	0.521	0.011	0.451	0.016	0.956	0.005	0.103	0.049	0.020
	3	0.077	0.059	0.013	0.387	0.407	0.532	0.477	0.008	0.230	0.016	0.008	0.930	0.202	0.052	0.011
	4	0.027	0.059	0.961	0.017	0.017	0.009	0.010	0.019	0.029	0.030	0.870	0.930	0.043	0.023	0.021
	5	0.238	0.292	0.143	0.895	0.879	0.901	0.918	0.966	0.789	0.188	0.986	0.941	0.446	0.131	0.960
	6	0.998	0.999	0.018	0.999	0.999	0.999	0.999	0.104	0.999	0.989	0.999	0.999	0.999	0.984	0.007
	7	0.999	0.999	0.147	0.999	0.999	0.999	0.999	0.996	0.999	0.999	0.999	0.999	0.999	0.993	0.951
	8	0.970	0.993	0.962	0.778	0.752	0.640	0.656	0.102	0.860	0.977	0.992	0.999	0.954	0.942	0.017
	9	0.991	0.993	0.014	0.995	0.995	0.997	0.996	0.054	0.987	0.958	0.128	0.998	0.995	0.974	0.009
	10	0.990	0.990	0.003	0.994	0.999	0.996	0.997	0.068	0.998	0.959	0.999	0.138	0.984	0.972	0.016
	11	0.036	0.074	0.998	0.060	0.024	0.028	0.032	0.965	0.053	0.116	0.917	0.907	0.056	0.044	0.980
	12	0.098	0.074	0.121	0.607	0.462	0.701	0.662	0.930	0.322	0.072	0.016	0.907	0.240	0.091	0.965
	13	0.092	0.059	0.047	0.575	0.709	0.637	0.702	0.945	0.561	0.072	0.975	0.003	0.128	0.087	0.980
3	14	0.006	0.007	0.951	0.001	0.001	0.001	0.001	0.007	0.001	0.007	0.001	0.891	0.011	0.014	0.024
	15	0.005	0.005	0.876	0.001	0.003	0.001	0.001	0.010	0.006	0.007	0.813	0.002	0.003	0.013	0.041
	16	0.020	0.005	0.002	0.088	0.197	0.197	0.179	0.004	0.083	0.003	0.004	0.002	0.033	0.031	0.024
	17	0.978	0.995	0.998	0.907	0.793	0.790	0.810	0.996	0.912	0.996	0.996	0.998	0.965	0.969	0.975
	18	0.994	0.995	0.125	0.999	0.997	0.999	0.999	0.989	0.994	0.992	0.190	0.998	0.997	0.987	0.958
	19	0.993	0.993	0.049	0.999	0.999	0.999	0.999	0.992	0.999	0.992	0.999	0.107	0.988	0.986	0.975
	20	0.009	0.010	0.997	0.006	0.001	0.004	0.002	0.929	0.002	0.038	0.001	0.860	0.015	0.028	0.983
	21	0.008	0.007	0.986	0.004	0.005	0.002	0.003	0.944	0.012	0.038	0.874	0.001	0.005	0.026	0.991
	22	0.001	0.001	0.854	0.001	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.007	0.047
	23	0.923	0.951	0.997	0.632	0.328	0.518	0.463	0.989	0.536	0.982	0.045	0.995	0.893	0.951	0.979
	24	0.001	0.001	0.982	0.001	0.001	0.001	0.001	0.892	0.001	0.010	0.001	0.001	0.001	0.016	0.992
	25	0.791	0.738	0.983	0.233	0.144	0.187	0.170	0.980	0.288	0.937	0.027	0.043	0.595	0.921	0.990
	26	0.493	0.495	0.501	0.493	0.493	0.490	0.492	0.495	0.494	0.492	0.502	0.498	0.496	0.500	0.497
	Range	0.998	0.999	0.995	0.999	0.999	0.999	0.999	0.992	0.999	0.997	0.999	0.999	0.999	0.986	0.985
	1	0.149	0.002	0.009	0.012	0.034	0.004	0.157	0.964	0.907	0.072	0.048	0.009	0.011	0.943	0.024
	2	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.009	0.811	0.015	0.002	0.001	0.002	0.731	0.002
	3	0.733	0.024	0.170	0.940	0.821	0.055	0.907	0.996	0.965	0.906	0.295	0.129	0.943	0.996	0.962
	4	0.956	0.033	0.951	0.288	0.521	0.121	0.803	0.990	0.991	0.446	0.065	0.961	0.073	0.978	0.115
	5	0.058	0.002	0.001	0.001	0.005	0.001	0.059	0.745	0.003	0.001	0.023	0.001	0.004	0.006	0.006
	6	0.551	0.890	0.113	0.383	0.287	0.841	0.604	0.985	0.950	0.481	0.976	0.103	0.081	0.974	0.128
	7	0.343	0.876	0.014	0.018	0.100	0.607	0.385	0.849	0.008	0.025	0.950	0.011	0.035	0.016	0.046
	8	0.998	0.987	0.998	0.919	0.906	0.993	0.983	0.996	0.996	0.900	0.983	0.998	0.283	0.991	0.358
	9	0.963	0.981	0.582	0.999	0.986	0.979	0.995	0.999	0.984	0.997	0.999	0.482	0.993	0.999	0.995
	10	0.002	0.855	0.018	0.076	0.018	0.797	0.004	0.023	0.887	0.224	0.761	0.023	0.022	0.835	0.023
	11	0.880	0.028	0.747	0.009	0.252	0.029	0.617	0.880	0.044	0.020	0.033	0.773	0.031	0.020	0.040
	12	0.536	0.020	0.026	0.403	0.579	0.010	0.779	0.932	0.012	0.277	0.192	0.016	0.879	0.079	0.889
	13	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
4	14	0.999	0.160	0.999	0.999	0.997	0.449	0.999	0.999	0.998	0.996	0.348	0.999	0.992	0.999	0.994
	15	0.102	0.022	0.776	0.045	0.070	0.091	0.020	0.032	0.972	0.198	0.003	0.849	0.019	0.853	0.020
	16	0.009	0.016	0.032	0.663	0.273	0.039	0.056	0.062	0.915	0.728	0.036	0.032	0.833	0.955	0.818
	17	0.991	0.984	0.966	0.343	0.725	0.959	0.942	0.939	0.083	0.265	0.963	0.967	0.162	0.045	0.181
	18	0.896	0.978	0.216	0.957	0.929	0.905	0.979	0.969	0.027	0.795	0.997	0.146	0.980	0.147	0.980
	19	0.001	0.839	0.001	0.001	0.003	0.541	0.001	0.001	0.002	0.004	0.648	0.001	0.007	0.001	0.005
	20	0.998	0.144	0.981	0.927	0.981	0.196	0.996	0.978	0.111	0.769	0.236	0.976	0.977	0.166	0.977
	21	0.036	0.019	0.408	0.001	0.014	0.020	0.005	0.001	0.016	0.003	0.001	0.509	0.006	0.001	0.005
	22	0.654	0.123	0.985	0.983	0.899	0.384	0.608	0.155	0.992	0.974	0.049	0.988	0.963	0.984	0.954
	23	0.999	0.999	0.999	0.999	0.999	0.997	0.999	0.991	0.186	0.984	0.998	0.999	0.998	0.270	0.998
	24	0.446	0.109	0.882	0.623	0.711	0.153	0.390	0.015	0.049	0.510	0.024	0.893	0.916	0.026	0.871
	25	0.850	0.998	0.991	0.988	0.966	0.996	0.839	0.037	0.092	0.925	0.951	0.990	0.988	0.057	0.976
	26	0.498	0.499	0.495	0.503	0.499	0.495	0.496	0.503	0.498	0.496	0.498	0.496	0.495	0.500	0.499
	Range	0.999	0.998	0.999	0.999	0.999	0.997	0.999	0.999	0.997	0.997	0.998	0.999	0.998	0.999	0.997
	1	0.281	0.119	0.054	0.723	0.919	0.761	0.726	0.082	0.817	0.107	0.515	0.482	0.109	0.029	0.034
	2	0.995	0.996	0.042	0.837	0.984	0.997	0.999	0.991	0.935	0.997	0.992	0.994	0.992	0.972	0.977
	3	0.006	0.025	0.001	0.008	0.016	0.006	0.061	0.009	0.006	0.016	0.005	0.002	0.018	0.002	0.004
	4	0.254	0.031	0.999	0.979	0.920	0.678	0.170	0.083	0.971	0.036	0.585	0.648	0.063	0.194	0.119
5	5	0.741	0.970	0.001	0.022	0.080	0.323	0.827	0.917	0.028	0.965	0.411	0.350	0.938	0.805	0.880
	6	0.994	0.976	0.999	0.992	0.984	0.994	0.937	0.991	0.994	0.985	0.995	0.998	0.982	0.998	0.996
	7	0.005	0.004	0.957	0.163	0.016	0.003	0.001	0.009	0.064	0.003	0.008	0.006	0.008	0.028	0.022
	8	0.714	0.884	0.945	0.278	0.081	0.240	0.270	0.918	0.181	0.895	0.482	0.516	0.892	0.971	0.966
	9	0.497	0.503	0.499	0.501	0.500	0.501	0.498	0.500	0.499	0.502	0.498	0.499	0.501	0.499	0.499
	Range	0.991	0.992	0.999	0.984	0.968	0.994	0.998	0.982	0.988	0.993	0.990	0.997	0.984	0.997	0.992

e) $n = 20$

Condition no.	RHN no.	BD1	BD2	BD3	BD4	BD5	BD6	BD7	BD8	BD9	BD10	BD11	BD12	BD13	BD14	BD15	BD16	BD17	BD18	BD19	BD20
	1	0.073	0.742	0.032	0.580	0.253	0.024	0.010	0.020	0.017	0.001	0.054	0.034	0.024	0.034	0.401	0.001	0.024	0.171	0.001	0.388
	2	0.151	0.942	0.973	0.917	0.855	0.974	0.034	0.963	0.352	0.004	0.957	0.190	0.982	0.161	0.882	0.692	0.980	0.866	0.001	0.928
	3	0.915	0.887	0.209	0.862	0.900	0.127	0.061	0.079	0.698	0.582	0.334	0.980	0.072	0.982	0.104	0.987	0.089	0.835	0.226	0.824
	4	0.153	0.744	0.096	0.756	0.391	0.059	0.968	0.109	0.382	0.200	0.181	0.027	0.036	0.042	0.991	0.002	0.046	0.285	0.412	0.545
	5	0.012	0.015	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.003	0.001	0.002	0.001	0.002	0.001	0.002	0.001
	6	0.964	0.984	0.998	0.988	0.999	0.997	0.146	0.992	0.988	0.763	0.998	0.999	0.995	0.998	0.572	0.999	0.996	0.999	0.336	0.996
	7	0.274	0.942	0.993	0.970	0.926	0.991	0.990	0.996	0.926	0.369	0.992	0.162	0.988	0.185	0.999	0.999	0.990	0.932	0.543	0.968
	8	0.035	0.108	0.602	0.056	0.042	0.763	0.004	0.720	0.009	0.006	0.387	0.026	0.900	0.013	0.080	0.001	0.856	0.083	0.006	0.089
1	9	0.964	0.889	0.393	0.943	0.952	0.233	0.996	0.278	0.990	0.994	0.605	0.974	0.100	0.986	0.914	0.999	0.145	0.913	0.994	0.908
	10	0.721	0.055	0.007	0.030	0.067	0.009	0.009	0.004	0.069	0.622	0.008	0.835	0.012	0.808	0.001	0.001	0.010	0.065	0.450	0.030
	11	0.035	0.016	0.001	0.011	0.001	0.003	0.845	0.007	0.011	0.230	0.002	0.001	0.005	0.002	0.414	0.001	0.004	0.001	0.658	0.004
	12	0.987	0.984	0.999	0.997	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.998	0.997	0.999	0.997	0.999	0.998	0.999	0.998	0.999
	13	0.082	0.109	0.787	0.137	0.091	0.871	0.934	0.921	0.289	0.409	0.658	0.020	0.928	0.017	0.889	0.011	0.911	0.158	0.769	0.170
	14	0.845	0.056	0.026	0.083	0.133	0.025	0.963	0.036	0.634	0.996	0.041	0.807	0.018	0.834	0.111	0.293	0.020	0.128	0.999	0.070
	15	0.925	0.252	0.967	0.419	0.729	0.975	0.989	0.980	0.982	0.999	0.943	0.965	0.976	0.964	0.585	0.999	0.976	0.822	0.999	0.604
	16	0.497	0.496	0.498	0.499	0.489	0.497	0.492	0.499	0.493	0.496	0.496	0.498	0.500	0.495	0.492	0.491	0.501	0.495	0.497	0.496
	Range	0.975	0.968	0.999	0.994	0.999	0.999	0.998	0.999	0.999	0.998	0.999	0.997	0.995	0.998	0.999	0.999	0.997	0.999	0.999	0.998
	1	0.002	0.009	0.714	0.006	0.487	0.003	0.005	0.290	0.134	0.004	0.029	0.097	0.006	0.020	0.006	0.019	0.019	0.258	0.020	0.003
	2	0.029	0.015	0.681	0.129	0.787	0.036	0.009	0.578	0.636	0.191	0.492	0.945	0.047	0.459	0.022	0.845	0.548	0.644	0.519	0.068
	3	0.805	0.044	0.785	0.024	0.479	0.041	0.961	0.879	0.315	0.025	0.184	0.192	0.022	0.015	0.015	0.091	0.141	0.850	0.176	0.015
	4	0.001	0.001	0.007	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.088	0.001	0.001	0.001	0.001	0.001	0.001
	5	0.066	0.973	0.980	0.031	0.853	0.893	0.025	0.363	0.548	0.018	0.371	0.172	0.019	0.059	0.024	0.023	0.045	0.330	0.493	0.013
	6	0.023	0.022	0.797	0.887	0.947	0.033	0.018	0.892	0.691	0.791	0.246	0.277	0.960	0.145	0.963	0.283	0.664	0.870	0.156	0.959
	7	0.261	0.989	0.990	0.970	0.997	0.983	0.067	0.925	0.958	0.910	0.809	0.405	0.986	0.286	0.990	0.315	0.790	0.909	0.847	0.987
	8	0.001	0.003	0.014	0.463	0.031	0.001	0.005	0.017	0.014	0.366	0.006	0.021	0.777	0.363	0.867	0.031	0.064	0.012	0.001	0.676
	9	0.957	0.090	0.854	0.962	0.945	0.197	0.987	0.998	0.870	0.931	0.619	0.434	0.988	0.124	0.984	0.570	0.923	0.998	0.544	0.989
	10	0.150	0.036	0.769	0.996	0.993	0.183	0.029	0.977	0.975	0.995	0.881	0.989	0.995	0.816	0.990	0.994	0.996	0.984	0.862	0.999
	11	0.004	0.872	0.168	0.001	0.008	0.468	0.008	0.001	0.005	0.001	0.015	0.008	0.001	0.196	0.004	0.001	0.001	0.001	0.013	0.001
	12	0.986	0.995	0.989	0.096	0.849	0.987	0.991	0.916	0.773	0.078	0.747	0.301	0.057	0.048	0.052	0.107	0.243	0.893	0.865	0.046
	13	0.291	0.983	0.975	0.323	0.970	0.985	0.040	0.656	0.943	0.368	0.938	0.974	0.108	0.652	0.072	0.866	0.692	0.719	0.981	0.160
2	14	0.373	0.006	0.013	0.001	0.001	0.001	0.901	0.015	0.001	0.001	0.003	0.010	0.001	0.074	0.002	0.004	0.001	0.009	0.001	0.001
	15	0.001	0.002	0.005	0.007	0.004	0.001	0.002	0.001	0.010	0.021	0.031	0.559	0.004	0.728	0.004	0.392	0.034	0.001	0.016	0.003
	16	0.965	0.068	0.756	0.287	0.781	0.209	0.975	0.973	0.835	0.421	0.834	0.978	0.118	0.421	0.049	0.961	0.869	0.980	0.878	0.173
	17	0.034	0.933	0.243	0.719	0.219	0.791	0.024	0.028	0.168	0.576	0.164	0.045	0.885	0.558	0.952	0.038	0.127	0.020	0.120	0.831
	18	0.999	0.998	0.995	0.993	0.996	0.999	0.998	0.999	0.991	0.978	0.969	0.573	0.996	0.254	0.997	0.606	0.965	0.999	0.984	0.997
	19	0.622	0.994	0.987	0.999	0.999	0.999	0.097	0.986	0.999	0.999	0.997	0.996	0.999	0.918	0.998	0.996	0.999	0.991	0.999	0.999
	20	0.847	0.964	0.230	0.005	0.007	0.817	0.971	0.024	0.026	0.005	0.117	0.024	0.005	0.170	0.011	0.006	0.004	0.016	0.136	0.002
	21	0.041	0.911	0.145	0.039	0.055	0.802	0.013	0.002	0.133	0.068	0.378	0.691	0.013	0.865	0.016	0.428	0.074	0.003	0.452	0.012
	22	0.735	0.011	0.010	0.031	0.003	0.016	0.931	0.076	0.043	0.088	0.189	0.717	0.015	0.695	0.010	0.682	0.205	0.092	0.151	0.013
	23	0.970	0.985	0.318	0.874	0.213	0.963	0.990	0.425	0.369	0.806	0.506	0.103	0.954	0.519	0.979	0.154	0.445	0.359	0.478	0.934
	24	0.976	0.978	0.202	0.116	0.053	0.967	0.982	0.110	0.314	0.207	0.752	0.822	0.041	0.842	0.037	0.715	0.329	0.132	0.841	0.042
	25	0.998	0.991	0.285	0.995	0.512	0.997	0.995	0.713	0.869	0.996	0.970	0.948	0.994	0.978	0.995	0.981	0.980	0.745	0.979	0.997
	26	0.497	0.501	0.499	0.503	0.500	0.500	0.498	0.502	0.503	0.498	0.499	0.566	0.502	0.489	0.501	0.499	0.496	0.502	0.498	0.503
	Range	0.998	0.997	0.989	0.999	0.999	0.998	0.995	0.998	0.999	0.998	0.994	0.986	0.997	0.930	0.996	0.991	0.997	0.997	0.998	0.999
	1	0.167	0.896	0.979	0.962	0.592	0.981	0.974	0.964	0.977	0.942	0.995	0.592	0.922	0.993	0.968	0.994	0.994	0.997	0.976	0.988
	2	0.003	0.403	0.015	0.980	0.066	0.021	0.427	0.033	0.574	0.469	0.133	0.113	0.349	0.950	0.016	0.115	0.345	0.933	0.024	0.977
	3	0.651	0.926	0.982	0.021	0.392	0.980	0.977	0.960	0.960	0.919	0.993	0.163	0.938	0.958	0.977	0.991	0.991	0.932	0.968	0.113
	4	0.005	0.227	0.856	0.971	0.077	0.823	0.098	0.588	0.057	0.039	0.782	0.128	0.044	0.071	0.726	0.780	0.276	0.202	0.729	0.835
	5	0.999	0.981	0.999	0.949	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.997
	6	0.086	0.478	0.018	0.039	0.022	0.020	0.447	0.030	0.474	0.402	0.106	0.008	0.395	0.818	0.023	0.087	0.300	0.596	0.017	0.073
	7	0.001	0.012	0.001	0.985	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.005	0.001	0.011	0.001	0.002	0.001	0.019	0.001	0.768
	8	0.890	0.717	0.133	0.972	0.972	0.184	0.891	0.430	0.965	0.972	0.262	0.990	0.944	0.986	0.228	0.274	0.764	0.981	0.315	0.993
3	9	0.109	0.288	0.869	0.027	0.027	0.818	0.106	0.568	0.034	0.027	0.740	0.009	0.056	0.014	0.773	0.730	0.235	0.018	0.685	0.007
	10	0.999	0.988	0.999	0.014	0.999	0.999	0.999	0.999	0.999	0.999	0.998	0.995	0.999	0.989	0.999	0.998	0.999	0.981	0.999	0.224
	11	0.913	0.528	0.983	0.961	0.977	0.981	0.548	0.970	0.520	0.589	0.895	0.992	0.605	0.180	0.977	0.915	0.700	0.399	0.983	0.924
	12	0.001	0.020	0.001	0.051	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.003
	13	0.347	0.076	0.018	0.979	0.600	0.020	0.022	0.040	0.039	0.077	0.007	0.834	0.061	0.041	0.023	0.010	0.009	0.067	0.032	0.882
	14	0.997	0.603	0.985	0.020	0.931	0.980	0.568	0.966	0.420	0.521	0.869	0.885	0.651	0.049	0.984	0.887	0.654	0.066	0.976	0.021
	15	0.831	0.107	0.021	0.038	0.399	0.019	0.025	0.036	0.022	0.055	0.005	0.403	0.078	0.007	0.032	0.006	0.006	0.003	0.024	0.012
	16	0.499	0.503	0.501	0.499	0.495	0.501	0.497	0.499	0.497	0.495	0.501	0.498	0.500	0.498	0.500	0.502	0.499	0.498	0.500	0.495
	Range	0.999	0.976	0.998	0.971	0.999	0.999	0.999	0.999	0.999	0.999	0.998	0.999	0.999	0.998	0.999	0.998	0.999	0.999	0.999	0.993
	1	0.111	0.017	0.085	0.843	0.018	0.022	0.931	0.102	0.445	0.410	0.157	0.991	0.948	0.019	0.962	0.241	0.440	0.051	0.937	0.909
	2	0.183	0.069	0.994	0.946	0.035	0.014	0.986	0.289	0.667	0.516	0.219	0.984	0.987	0.026	0.947	0.773	0.912	0.167	0.987	0.985
	3	0.043	0.001	0.037	0.353	0.001	0.057	0.700	0.001	0.054	0.007	0.019	0.202	0.805	0.001	0.078	0.001	0.001	0.003	0.700	0.001
	4	0.125	0.955	0.139	0.967	0.799	0.980	0.939	0.768	0.632	0.765	0.180	0.991	0.962	0.785	0.984	0.682	0.711	0.455	0.962	0.981
	5	0.996	0.178	0.212	0.986	0.759	0.008	0.995	0.997	0.993	0.998	0.999	0.999	0.996	0.737	0.999	0.929	0.967	0.902	0.996	0.999
	6	0.005	0.004	0.001	0.011	0.005	0.024	0.009	0.006	0.020	0.030	0.007	0.618	0.005	0.008	0.474	0.114	0.143	0.009	0.005	0.001
	7	0.905	0.074	0.008	0.140	0.573	0.009	0.094	0.933	0.703	0.889	0.959	0.860	0.054	0.616	0.882	0.833	0.822	0.714	0.068	0.996
	8	0.006	0.879	0.004	0.075	0.625	0.982	0.010	0.303	0.056	0.176	0.009	0.613	0.007	0.673	0.623	0.488	0.359	0.200	0.009	0.002
	9	0.001	0.001	0.001	0.001	0.001	0.062	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	10	0.011	0.022	0.821	0.047	0.010	0.016	0.048	0.035	0.068	0.053	0.013	0.522	0.022	0.011	0.411	0.597	0.670	0.045	0.030	0.003
	11	0.997	0.998	0.305	0.999	0.999	0.953	0.996	0.999	0.998	0.999	0.999	0.999	0.997	0.999	0.999	0.996	0.995	0.998	0.998	0.999
	12	0.986	0.033	0.114	0.793	0.263	0.025	0.944	0.420	0.839	0.736	0.983	0.477	0.968	0.274	0.433	0.075	0.123	0.559	0.948	0.978
	13	0.999	0.387	0.999	0.998	0.836	0.005	0.999	0.999	0.999	0.999	0.999	0.998	0.999	0.778	0.998	0.998	0.999	0.975	0.999	0.999
4	14	0.050	0.782	0.067	0.677	0.309	0.994	0.722	0.013	0.129	0.065	0.023	0.198	0.844	0.327	0.149	0.007	0.007	0.105	0.780	0.001
	15	0.201	0.990	0.998	0.993	0.867	0.971	0.988	0.926	0.818	0.839	0.247	0.983	0.991	0.821	0.977	0.973	0.980	0.712	0.994	0.998
	16	0.080	0.008	0.983	0.590	0.001	0.040	0.893	0.001	0.150	0.014	0.032	0.140	0.927	0.001	0.057	0.015	0.050	0.017	0.892	0.001
	17	0.916	0.991	0.017	0.404	0.999	0.958	0.106	0.999	0.844	0.985	0.966	0.856	0.072	0.999	0.941	0.984	0.948	0.982	0.107	0.999
	18	0.791	0.009	0.002	0.007	0.124	0.027	0.011	0.073	0.175	0.154	0.746	0.016	0.009	0.173	0.022	0.026	0.019	0.282	0.006	0.002
	19	0.948	0.209	0.933	0.317	0.676	0.006	0.277	0.987	0.865	0.931	0.975	0.797	0.155	0.665	0.848	0.992	0.992	0.892	0.218	0.999
	20	0.988	0.976	0.179	0.951	0.989	0.983	0.951	0.964	0.929	0.943	0.987	0.471	0.977	0.988	0.584	0.396	0.325	0.953	0.969	0.997
	21	0.999	0.999	0.999	0.999	0.999	0.935	0.999	0.999	0.999	0.999	0.999	0.998	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999
	22	0.091	0.922	0.992	0.856	0.411	0.990	0.905	0.066	0.288	0.106	0.039	0.137	0.946	0.376	0.116	0.163	0.175	0.280	0.931	0.003
	23	0.810	0.927	0.006	0.052	0.962	0.985	0.014	0.710	0.324	0.472	0.774	0.016	0.013	0.972	0.052	0.222	0.085	0.829	0.012	0.014
	24	0.995	0.995	0.999	0.988	0.995	0.975	0.991	0.994	0.979	0.968	0.993	0.375	0.995	0.992	0.521	0.883	0.854	0.991	0.995	0.999
	25	0.884	0.982	0.915	0.153	0.980	0.977	0.069	0.898	0.545	0.578	0.837	0.008	0.052	0.980	0.037	0.753	0.554	0.947	0.062	0.086
	26	0.495	0.494	0.500	0.497	0.492	0.495	0.499	0.499	0.495	0.494	0.496	0.497	0.500	0.496	0.498	0.496	0.497	0.496	0.498	0.493
	Range	0.998	0.999	0.999	0.999	0.999	0.989	0.999	0.999	0.999	0.999	0.999	0.997	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999
	1	0.001	0.001	0.066	0.002	0.001	0.001	0.547	0.004	0.048	0.552	0.002	0.001	0.002	0.019	0.006	0.182	0.030	0.776	0.012	0.001
	2	0.001	0.005	0.001	0.001	0.001	0.001	0.006	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.001
	3	0.207	0.864	0.092	0.011	0.001	0.073	0.639	0.098	0.080	0.470	0.039	0.036	0.030	0.047	0.551	0.091	0.004	0.863	0.104	0.041
	4	0.001	0.020	0.205	0.003	0.022	0.003	0.552	0.003	0.176	0.754	0.008	0.073	0.899	0.083	0.092	0.479	0.209	0.870	0.027	0.091
	5	0.103	0.011	0.196	0.112	0.219	0.031	0.879	0.854	0.294	0.813	0.109	0.199	0.006	0.225	0.030	0.480	0.835	0.890	0.793	0.214
	6	0.133	0.001	0.986	0.983	0.999	0.628	0.937	0.027	0.938	0.970	0.760	0.209	0.013	0.947	0.437	0.988	0.412	0.976	0.241	0.207
	7	0.866	0.006	0.998	0.999	0.999	0.958	0.995	0.960	0.996	0.996	0.992	0.942	0.032	0.998	0.675	0.999	0.996	0.993	0.991	0.939
	8	0.122	0.010	0.998	0.988	0.999	0.791	0.939	0.021	0.989	0.992	0.887	0.833	0.975	0.990	0.841	0.999	0.803	0.990	0.354	0.843
	9	0.941	0.802	0.991	0.997	0.999	0.984	0.962	0.275	0.964	0.953	0.969	0.733	0.116	0.978	0.993	0.967	0.165	0.990	0.616	0.724
	10	0.087	0.002	0.505	0.698	0.486	0.332	0.137	0.011	0.330	0.111	0.334	0.009	0.003	0.370	0.029	0.362	0.098	0.028	0.015	0.007
	11	0.093	0.093	0.431	0.141	0.706	0.084	0.881	0.827	0.576	0.926	0.233	0.824	0.951	0.475	0.237	0.790	0.980	0.944	0.874	0.849
	12	0.920	0.967	0.248	0.267	0.108	0.479	0.920	0.991	0.388	0.753	0.471	0.721	0.068	0.362	0.770	0.317	0.587	0.941	0.965	0.732
	13	0.065	0.034	0.001	0.002	0.001	0.004	0.073	0.760	0.006	0.014	0.009	0.008	0.001	0.003	0.001	0.004	0.462	0.004	0.258	0.007
5	14	0.192	0.980	0.258	0.016	0.007	0.166	0.644	0.079	0.250	0.685	0.104	0.492	0.990	0.164	0.901	0.316	0.059	0.928	0.176	0.531
	15	0.001	0.055	0.001	0.001	0.001	0.001	0.006	0.001	0.002	0.008	0.001	0.001	0.787	0.001	0.001	0.004	0.030	0.003	0.001	0.001
	16	0.143	0.940	0.001	0.001	0.001	0.013	0.012	0.050	0.001	0.001	0.002	0.001	0.009	0.001	0.053	0.001	0.001	0.003	0.003	0.001
	17	0.854	0.058	0.999	0.999	0.999	0.986	0.995	0.949	0.999	0.999	0.998	0.999	0.990	0.999	0.946	0.999	0.999	0.998	0.997	0.999
	18	0.999	0.944	0.999	0.999	0.999	0.999	0.998	0.999	0.998	0.992	0.999	0.999	0.209	0.999	0.999	0.997	0.970	0.997	0.999	0.998
	19	0.805	0.019	0.745	0.985	0.994	0.833	0.483	0.920	0.752	0.323	0.896	0.498	0.010	0.838	0.099	0.693	0.941	0.075	0.818	0.462
	20	0.911	0.997	0.500	0.315	0.532	0.667	0.922	0.988	0.673	0.893	0.666	0.991	0.997	0.633	0.971	0.648	0.902	0.973	0.984	0.993
	21	0.058	0.195	0.009	0.004	0.001	0.016	0.074	0.723	0.037	0.050	0.031	0.259	0.882	0.022	0.007	0.035	0.836	0.011	0.374	0.270
	22	0.131	0.994	0.002	0.001	0.001	0.042	0.012	0.039	0.004	0.004	0.008	0.056	0.967	0.002	0.325	0.001	0.004	0.008	0.008	0.059
	23	0.999	0.995	0.999	0.999	0.999	0.999	0.998	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.998	0.999	0.999	0.999
	24	0.864	0.999	0.014	0.019	0.001	0.371	0.114	0.973	0.062	0.032	0.240	0.784	0.987	0.054	0.563	0.012	0.589	0.025	0.752	0.788
	25	0.999	0.999	0.935	0.998	0.999	0.999	0.583	0.996	0.953	0.457	0.998	0.999	0.998	0.981	0.994	0.824	0.970	0.230	0.987	0.999
	26	0.498	0.497	0.502	0.508	0.509	0.499	0.565	0.499	0.501	0.504	0.500	0.495	0.497	0.501	0.500	0.505	0.500	0.504	0.495	0.496
	Range	0.999	0.999	0.999	0.999	0.999	0.999	0.992	0.998	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.998	0.999	0.999

A.1.3. Circular Method

a) $n = 5$

Condition no.	RHM no.	BD1	BD2	BD3	BD4	BD5
	1	0.103	0.009	0.010	0.360	0.528
	2	0.247	0.032	0.088	0.280	0.062
	3	0.616	0.406	0.651	0.321	0.012
	4	0.865	0.934	0.971	0.469	0.050
	5	0.897	0.991	0.989	0.639	0.470
	6	0.753	0.967	0.907	0.719	0.938
	7	0.384	0.591	0.336	0.678	0.988
	8	0.135	0.065	0.027	0.530	0.949
	9	0.012	0.023	0.014	0.035	0.466
1	10	0.028	0.328	0.207	0.014	0.424
	11	0.322	0.913	0.851	0.095	0.425
	12	0.988	0.976	0.985	0.965	0.531
	13	0.972	0.669	0.783	0.986	0.574
	14	0.677	0.086	0.141	0.904	0.572
	15	0.126	0.315	0.384	0.029	0.042
	16	0.059	0.440	0.192	0.109	0.927
	17	0.874	0.682	0.603	0.970	0.957
	18	0.941	0.556	0.798	0.891	0.072
	19	0.500	0.498	0.493	0.500	0.499
	Range	0.975	0.982	0.978	0.973	0.975
	1	0.336	0.032	0.342	0.009	0.021
	2	0.451	0.314	0.890	0.064	0.182
	3	0.599	0.877	0.984	0.582	0.776
	4	0.685	0.983	0.964	0.965	0.976
	5	0.667	0.968	0.660	0.991	0.980
	6	0.552	0.686	0.111	0.934	0.822
	7	0.404	0.123	0.016	0.413	0.230
	8	0.318	0.017	0.036	0.034	0.025
	9	0.032	0.013	0.317	0.038	0.011
2	10	0.014	0.095	0.396	0.439	0.119
	11	0.107	0.648	0.541	0.940	0.730
	12	0.968	0.987	0.684	0.961	0.989
	13	0.986	0.905	0.606	0.556	0.885
	14	0.894	0.352	0.460	0.058	0.276
	15	0.086	0.459	0.908	0.516	0.381
	16	0.043	0.040	0.045	0.397	0.087
	17	0.916	0.541	0.093	0.479	0.626
	18	0.958	0.960	0.956	0.598	0.916
	19	0.502	0.500	0.501	0.497	0.503
	Range	0.971	0.974	0.968	0.982	0.978
	1	0.036	0.039	0.323	0.122	0.043
	2	0.054	0.043	0.053	0.021	0.036
	3	0.320	0.250	0.033	0.043	0.204
	4	0.829	0.778	0.163	0.348	0.733
	5	0.965	0.960	0.669	0.879	0.956
	6	0.947	0.957	0.944	0.979	0.963
	7	0.683	0.748	0.965	0.957	0.795
	8	0.174	0.221	0.831	0.652	0.265
	9	0.502	0.499	0.495	0.500	0.499
3	Range	0.929	0.921	0.931	0.959	0.927
	1	0.009	0.027	0.266	0.008	0.412
	2	0.031	0.005	0.299	0.028	0.038
	3	0.382	0.041	0.450	0.379	0.011
	4	0.925	0.549	0.635	0.928	0.071
	5	0.990	0.972	0.729	0.991	0.582
	6	0.968	0.995	0.695	0.971	0.960
	7	0.611	0.958	0.543	0.617	0.988
	8	0.072	0.447	0.358	0.070	0.927
	9	0.109	0.119	0.851	0.113	0.462
4	10	0.727	0.597	0.982	0.749	0.534
	11	0.981	0.937	0.972	0.985	0.583
	12	0.887	0.880	0.145	0.885	0.532
	13	0.267	0.399	0.018	0.247	0.460
	14	0.018	0.062	0.027	0.015	0.411
	15	0.587	0.146	0.918	0.602	0.060
	16	0.736	0.919	0.940	0.755	0.952
	17	0.406	0.852	0.079	0.394	0.938
	18	0.258	0.080	0.058	0.242	0.046
	19	0.496	0.498	0.497	0.498	0.497
	Range	0.981	0.990	0.964	0.983	0.977
	1	0.034	0.326	0.370	0.314	0.010
	2	0.216	0.900	0.539	0.874	0.093
	3	0.761	0.988	0.679	0.982	0.673
	4	0.963	0.972	0.710	0.965	0.974
	5	0.965	0.670	0.622	0.673	0.989
	6	0.780	0.099	0.452	0.118	0.904
	7	0.235	0.012	0.313	0.016	0.320
	8	0.036	0.027	0.283	0.033	0.024
	9	0.005	0.330	0.032	0.143	0.032
5	10	0.036	0.430	0.011	0.150	0.381
	11	0.505	0.575	0.080	0.341	0.922
	12	0.994	0.667	0.967	0.849	0.967
	13	0.963	0.566	0.989	0.841	0.612
	14	0.489	0.421	0.917	0.645	0.075
	15	0.222	0.930	0.098	0.775	0.543
	16	0.038	0.042	0.025	0.013	0.294
	17	0.774	0.069	0.899	0.214	0.450
	18	0.961	0.957	0.974	0.986	0.699
	19	0.497	0.498	0.496	0.493	0.496
	Range	0.989	0.976	0.978	0.973	0.979

b) $n = 10$

Condition no.	RHM no.	BD1	BD2	BD3	BD4	BD5	BD6	BD7	BD8	BD9	BD10
1	1	0.415	0.164	0.261	0.069	0.018	0.064	0.083	0.012	0.015	0.020
	2	0.031	0.006	0.237	0.060	0.017	0.001	0.009	0.029	0.033	0.017
	3	0.008	0.005	0.354	0.235	0.178	0.001	0.023	0.332	0.335	0.169
	4	0.057	0.130	0.572	0.703	0.791	0.104	0.325	0.899	0.891	0.776
	5	0.571	0.830	0.735	0.929	0.980	0.934	0.911	0.987	0.985	0.978
	6	0.966	0.993	0.759	0.938	0.982	0.999	0.991	0.971	0.966	0.982
	7	0.992	0.994	0.642	0.760	0.813	0.999	0.975	0.667	0.662	0.825
	8	0.939	0.864	0.424	0.292	0.200	0.894	0.662	0.100	0.108	0.217
	9	0.319	0.238	0.027	0.077	0.023	0.084	0.074	0.034	0.041	0.051
	10	0.322	0.486	0.018	0.298	0.232	0.331	0.251	0.364	0.385	0.390
	11	0.424	0.744	0.150	0.748	0.828	0.777	0.686	0.910	0.907	0.892
	12	0.668	0.754	0.973	0.920	0.975	0.915	0.920	0.966	0.958	0.947
	13	0.665	0.504	0.981	0.697	0.757	0.664	0.737	0.635	0.611	0.601
	14	0.562	0.248	0.847	0.247	0.164	0.220	0.301	0.090	0.091	0.104
	15	0.021	0.034	0.041	0.189	0.122	0.004	0.030	0.290	0.306	0.192
	16	0.915	0.961	0.111	0.550	0.548	0.978	0.821	0.524	0.536	0.680
	17	0.977	0.964	0.958	0.807	0.871	0.996	0.967	0.709	0.690	0.801
	18	0.080	0.037	0.887	0.443	0.439	0.021	0.169	0.475	0.460	0.312
	19	0.493	0.495	0.498	0.497	0.493	0.498	0.493	0.500	0.498	0.496
	Range	0.984	0.989	0.963	0.879	0.965	0.999	0.982	0.975	0.970	0.965
2	1	0.313	0.243	0.160	0.041	0.199	0.045	0.045	0.029	0.051	0.045
	2	0.059	0.049	0.026	0.041	0.024	0.050	0.039	0.035	0.050	0.049
	3	0.042	0.049	0.040	0.235	0.025	0.263	0.215	0.251	0.247	0.259
	4	0.189	0.248	0.295	0.765	0.213	0.775	0.741	0.807	0.749	0.771
	5	0.683	0.754	0.838	0.960	0.797	0.956	0.956	0.971	0.949	0.955
	6	0.940	0.950	0.973	0.960	0.975	0.951	0.961	0.965	0.950	0.951
	7	0.957	0.950	0.959	0.767	0.974	0.738	0.786	0.750	0.754	0.741
	8	0.808	0.749	0.702	0.238	0.783	0.226	0.261	0.194	0.251	0.229
	9	0.498	0.498	0.498	0.502	0.497	0.501	0.501	0.501	0.500	0.500
	Range	0.915	0.902	0.947	0.919	0.952	0.911	0.922	0.942	0.899	0.910
3	1	0.012	0.017	0.060	0.053	0.029	0.001	0.436	0.091	0.017	0.399
	2	0.192	0.139	0.221	0.593	0.138	0.776	0.925	0.637	0.133	0.549
	3	0.845	0.718	0.680	0.974	0.637	0.999	0.986	0.965	0.710	0.663
	4	0.989	0.971	0.923	0.994	0.942	0.999	0.951	0.987	0.971	0.679
	5	0.987	0.982	0.940	0.944	0.968	0.999	0.560	0.904	0.983	0.590
	6	0.799	0.858	0.778	0.395	0.851	0.207	0.074	0.352	0.863	0.440
	7	0.148	0.278	0.319	0.024	0.346	0.001	0.014	0.032	0.284	0.327
	8	0.010	0.028	0.076	0.006	0.053	0.001	0.048	0.012	0.028	0.311
	9	0.030	0.044	0.111	0.051	0.009	0.001	0.384	0.127	0.047	0.051
	10	0.341	0.382	0.432	0.242	0.070	0.052	0.398	0.385	0.401	0.019
	11	0.901	0.899	0.836	0.738	0.610	0.875	0.471	0.765	0.907	0.098
	12	0.967	0.955	0.888	0.946	0.990	0.999	0.612	0.867	0.952	0.946
	13	0.648	0.613	0.567	0.748	0.923	0.942	0.598	0.603	0.592	0.979
	14	0.094	0.098	0.163	0.252	0.372	0.114	0.526	0.226	0.091	0.897
	15	0.668	0.578	0.583	0.813	0.216	0.974	0.914	0.861	0.587	0.123
	16	0.154	0.265	0.325	0.030	0.095	0.001	0.041	0.066	0.282	0.038
	17	0.321	0.416	0.415	0.179	0.770	0.023	0.084	0.132	0.407	0.871
	18	0.839	0.730	0.674	0.968	0.897	0.999	0.958	0.930	0.712	0.960
	19	0.494	0.497	0.499	0.494	0.491	0.489	0.498	0.494	0.497	0.495
	Range	0.979	0.965	0.880	0.988	0.981	0.999	0.972	0.974	0.966	0.960
4	1	0.934	0.966	0.977	0.757	0.740	0.980	0.589	0.971	0.373	0.853
	2	0.635	0.888	0.912	0.759	0.976	0.973	0.823	0.913	0.909	0.781
	3	0.153	0.454	0.466	0.612	0.984	0.744	0.860	0.506	0.987	0.515
	4	0.036	0.083	0.069	0.376	0.853	0.158	0.724	0.090	0.964	0.232
	5	0.063	0.032	0.022	0.228	0.255	0.019	0.403	0.028	0.629	0.139
	6	0.357	0.107	0.083	0.225	0.023	0.026	0.172	0.084	0.091	0.209
	7	0.841	0.534	0.524	0.369	0.016	0.250	0.136	0.485	0.014	0.471
	8	0.962	0.913	0.928	0.605	0.143	0.837	0.269	0.906	0.036	0.757
	9	0.985	0.989	0.956	0.970	0.782	0.961	0.925	0.975	0.429	0.989
	10	0.942	0.921	0.660	0.974	0.675	0.668	0.965	0.804	0.529	0.985
	11	0.514	0.378	0.128	0.805	0.443	0.123	0.866	0.228	0.611	0.781
	12	0.014	0.010	0.041	0.027	0.213	0.037	0.072	0.024	0.572	0.010
	13	0.056	0.075	0.330	0.023	0.319	0.325	0.034	0.190	0.472	0.014
	14	0.477	0.610	0.866	0.182	0.550	0.872	0.130	0.765	0.390	0.209
	15	0.652	0.821	0.593	0.944	0.967	0.781	0.980	0.733	0.947	0.941
	16	0.966	0.856	0.633	0.875	0.115	0.434	0.693	0.721	0.065	0.932
	17	0.340	0.171	0.396	0.051	0.032	0.213	0.019	0.260	0.053	0.055
	18	0.033	0.137	0.357	0.115	0.881	0.558	0.300	0.272	0.935	0.064
	19	0.495	0.494	0.495	0.490	0.496	0.496	0.496	0.496	0.501	0.493
	Range	0.971	0.979	0.956	0.951	0.968	0.961	0.960	0.950	0.973	0.978
5	1	0.994	0.986	0.728	0.994	0.751	0.957	0.689	0.996	0.992	0.756
	2	0.980	0.990	0.952	0.991	0.734	0.913	0.984	0.973	0.961	0.698
	3	0.649	0.860	0.960	0.795	0.581	0.580	0.995	0.537	0.526	0.515
	4	0.066	0.215	0.786	0.115	0.366	0.140	0.927	0.036	0.047	0.320
	5	0.006	0.014	0.264	0.006	0.244	0.042	0.311	0.004	0.007	0.240
	6	0.020	0.010	0.045	0.009	0.261	0.086	0.016	0.026	0.038	0.297
	7	0.344	0.137	0.038	0.198	0.413	0.417	0.005	0.459	0.469	0.480
	8	0.932	0.781	0.206	0.880	0.628	0.858	0.073	0.963	0.952	0.676
	9	0.941	0.900	0.134	0.917	0.576	0.785	0.572	0.940	0.910	0.103
	10	0.023	0.034	0.024	0.015	0.219	0.049	0.304	0.015	0.018	0.012
	11	0.057	0.098	0.860	0.079	0.418	0.213	0.428	0.059	0.088	0.895
	12	0.610	0.643	0.984	0.701	0.654	0.725	0.593	0.665	0.700	0.993
	13	0.976	0.965	0.975	0.984	0.777	0.950	0.697	0.985	0.982	0.987
	14	0.976	0.961	0.773	0.971	0.982	0.941	0.672	0.987	0.981	0.762
	15	0.059	0.090	0.450	0.048	0.872	0.190	0.401	0.066	0.084	0.392
	16	0.023	0.038	0.220	0.027	0.017	0.058	0.328	0.013	0.019	0.234
	17	0.939	0.908	0.540	0.949	0.125	0.807	0.599	0.933	0.914	0.604
	18	0.526	0.691	0.382	0.578	0.443	0.387	0.949	0.405	0.370	0.042
	19	0.384	0.352	0.015	0.290	0.341	0.272	0.407	0.332	0.296	0.006
	20	0.313	0.149	0.003	0.162	0.329	0.282	0.025	0.353	0.333	0.037
	21	0.467	0.305	0.608	0.412	0.551	0.609	0.051	0.591	0.625	0.957
	22	0.681	0.848	0.997	0.831	0.665	0.715	0.976	0.644	0.662	0.962
	23	0.687	0.836	0.940	0.760	0.962	0.687	0.971	0.666	0.654	0.599
	24	0.618	0.618	0.672	0.567	0.989	0.686	0.555	0.695	0.689	0.623
	25	0.473	0.289	0.176	0.317	0.929	0.578	0.044	0.614	0.617	0.575
	26	0.307	0.161	0.057	0.231	0.037	0.310	0.029	0.331	0.341	0.396
	27	0.376	0.377	0.319	0.422	0.010	0.311	0.446	0.302	0.307	0.373
	28	0.520	0.707	0.818	0.673	0.069	0.419	0.956	0.382	0.379	0.421
	29	0.503	0.479	0.111	0.395	0.909	0.466	0.473	0.522	0.489	0.063
	30	0.660	0.683	0.967	0.691	0.972	0.779	0.604	0.747	0.765	0.976
	31	0.491	0.516	0.884	0.594	0.089	0.530	0.528	0.474	0.506	0.936
	32	0.334	0.313	0.031	0.300	0.027	0.219	0.396	0.250	0.231	0.024
	33	0.497	0.497	0.495	0.495	0.497	0.498	0.500	0.498	0.498	0.498
	Range	0.988	0.980	0.994	0.988	0.979	0.915	0.989	0.992	0.985	0.987
6 (computer workstation)	1	0.023	0.148	0.413	0.419	0.145	0.015	0.356	0.581	0.040	0.197
	2	0.032	0.013	0.371	0.043	0.041	0.043	0.025	0.059	0.028	0.020
	3	0.278	0.016	0.428	0.013	0.085	0.406	0.008	0.008	0.179	0.018
	4	0.839	0.212	0.544	0.075	0.435	0.917	0.071	0.031	0.727	0.188
	5	0.978	0.842	0.629	0.574	0.878	0.985	0.628	0.412	0.960	0.793
	6	0.969	0.986	0.656	0.956	0.967	0.956	0.974	0.938	0.976	0.978
	7	0.727	0.982	0.615	0.986	0.930	0.591	0.991	0.992	0.838	0.980
	8	0.164	0.776	0.500	0.923	0.608	0.088	0.927	0.968	0.295	0.803
	9	0.266	0.652	0.016	0.294	0.097	0.577	0.446	0.424	0.270	0.750
	10	0.839	0.835	0.101	0.397	0.449	0.953	0.549	0.389	0.797	0.856
	11	0.978	0.842	0.629	0.574	0.878	0.985	0.628	0.412	0.960	0.793
	12	0.969	0.664	0.966	0.700	0.963	0.922	0.628	0.484	0.960	0.528
	13	0.173	0.155	0.917	0.596	0.586	0.047	0.434	0.604	0.222	0.136
	14	0.032	0.321	0.043	0.294	0.045	0.082	0.356	0.508	0.047	0.443
	15	0.192	0.110	0.047	0.026	0.028	0.492	0.035	0.033	0.126	0.160
	16	0.517	0.035	0.928	0.112	0.500	0.379	0.054	0.056	0.408	0.026
	17	0.739	0.344	0.988	0.700	0.920	0.420	0.549	0.569	0.752	0.239
	18	0.812	0.882	0.960	0.973	0.978	0.520	0.964	0.968	0.872	0.831
	19	0.489	0.961	0.089	0.885	0.536	0.619	0.945	0.942	0.588	0.972
	Range	0.955	0.973	0.972	0.973	0.950	0.971	0.984	0.984	0.948	0.962

c) $n = 11$ (application to ergonomic design of a computer workstation in Chapter 6)

RHM no.	BD1	BD2	BD3	BD4	BD5	BD6	BD7	BD8	BD9	BD10	BD11
1	0.448	0.178	0.089	0.166	0.018	0.282	0.521	0.017	0.346	0.016	0.035
2	0.864	0.293	0.160	0.348	0.069	0.516	0.946	0.192	0.772	0.043	0.100
3	0.954	0.563	0.475	0.661	0.495	0.737	0.987	0.810	0.927	0.384	0.499
4	0.901	0.779	0.817	0.835	0.928	0.804	0.939	0.982	0.904	0.902	0.898
5	0.553	0.825	0.910	0.831	0.981	0.719	0.486	0.982	0.654	0.983	0.963
6	0.136	0.711	0.838	0.648	0.929	0.485	0.056	0.803	0.228	0.954	0.896
7	0.046	0.442	0.521	0.335	0.499	0.264	0.014	0.186	0.074	0.605	0.492
8	0.100	0.224	0.180	0.162	0.070	0.196	0.063	0.017	0.096	0.093	0.098
9	0.783	0.661	0.554	0.770	0.229	0.848	0.484	0.080	0.757	0.181	0.348
10	0.892	0.935	0.938	0.978	0.850	0.979	0.459	0.546	0.916	0.800	0.895
11	0.834	0.958	0.979	0.982	0.986	0.968	0.459	0.942	0.896	0.982	0.985
12	0.217	0.342	0.442	0.226	0.766	0.152	0.523	0.918	0.243	0.811	0.643
13	0.108	0.066	0.061	0.022	0.147	0.021	0.548	0.448	0.084	0.192	0.101
14	0.167	0.043	0.020	0.017	0.013	0.033	0.547	0.057	0.105	0.017	0.015
15	0.981	0.881	0.852	0.957	0.766	0.970	0.933	0.760	0.977	0.653	0.813
16	0.376	0.833	0.870	0.869	0.768	0.839	0.051	0.292	0.481	0.785	0.810
17	0.019	0.121	0.145	0.042	0.229	0.030	0.069	0.235	0.023	0.336	0.181
18	0.624	0.170	0.128	0.128	0.227	0.162	0.951	0.702	0.520	0.206	0.184
19	0.500	0.502	0.498	0.498	0.497	0.500	0.503	0.497	0.500	0.494	0.495
Range	0.961	0.916	0.959	0.965	0.973	0.958	0.973	0.966	0.955	0.967	0.970

d) $n = 15$

Condition no.	RHM no.	BD1	BD2	BD3	BD4	BD5	BD6	BD7	BD8	BD9	BD10	BD11	BD12	BD13	BD14	BD15
	1	0.051	0.215	0.013	0.348	0.333	0.434	0.226	0.314	0.368	0.041	0.270	0.023	0.230	0.040	0.161
	2	0.336	0.679	0.134	0.940	0.905	0.531	0.817	0.701	0.907	0.168	0.438	0.105	0.640	0.164	0.281
	3	0.849	0.925	0.751	0.995	0.989	0.642	0.978	0.891	0.986	0.651	0.651	0.590	0.892	0.645	0.567
	4	0.970	0.942	0.981	0.983	0.972	0.700	0.974	0.886	0.961	0.935	0.759	0.943	0.917	0.934	0.793
	5	0.948	0.783	0.988	0.659	0.661	0.680	0.766	0.683	0.614	0.961	0.726	0.978	0.762	0.962	0.837
	6	0.660	0.320	0.870	0.062	0.092	0.589	0.176	0.296	0.086	0.837	0.557	0.898	0.350	0.841	0.717
	7	0.149	0.074	0.255	0.005	0.011	0.476	0.020	0.108	0.013	0.357	0.344	0.416	0.103	0.363	0.430
	8	0.029	0.057	0.020	0.018	0.027	0.412	0.024	0.112	0.035	0.067	0.237	0.059	0.079	0.068	0.205
	9	0.511	0.499	0.068	0.280	0.525	0.887	0.668	0.555	0.664	0.227	0.869	0.178	0.720	0.224	0.382
	10	0.990	0.866	0.954	0.493	0.746	0.951	0.930	0.793	0.807	0.958	0.976	0.972	0.946	0.958	0.864
	11	0.485	0.499	0.935	0.727	0.469	0.182	0.322	0.443	0.319	0.779	0.129	0.826	0.271	0.782	0.615
	12	0.047	0.215	0.456	0.673	0.297	0.048	0.083	0.247	0.166	0.252	0.014	0.248	0.057	0.255	0.283
	13	0.010	0.133	0.048	0.515	0.249	0.088	0.066	0.205	0.181	0.044	0.023	0.029	0.051	0.044	0.135
	14	0.083	0.679	0.077	0.550	0.378	0.647	0.457	0.865	0.593	0.351	0.475	0.197	0.619	0.346	0.849
	15	0.820	0.942	0.960	0.755	0.613	0.796	0.826	0.963	0.751	0.982	0.787	0.977	0.908	0.982	0.992
	16	0.916	0.319	0.925	0.458	0.617	0.470	0.532	0.133	0.389	0.656	0.520	0.807	0.371	0.661	0.149
1	17	0.177	0.057	0.041	0.251	0.381	0.300	0.168	0.037	0.234	0.019	0.209	0.024	0.088	0.019	0.007
	18	0.972	0.942	0.715	0.937	0.976	0.943	0.992	0.911	0.987	0.775	0.966	0.743	0.976	0.770	0.699
	19	0.952	0.784	0.552	0.334	0.697	0.975	0.913	0.751	0.822	0.754	0.986	0.757	0.940	0.752	0.714
	20	0.672	0.320	0.353	0.017	0.105	0.900	0.315	0.347	0.178	0.588	0.898	0.633	0.584	0.591	0.609
	21	0.027	0.057	0.292	0.066	0.023	0.100	0.008	0.088	0.012	0.231	0.033	0.263	0.022	0.236	0.298
	22	0.324	0.678	0.654	0.984	0.893	0.163	0.676	0.651	0.809	0.420	0.100	0.373	0.406	0.418	0.388
	23	0.691	0.979	0.738	0.987	0.946	0.774	0.968	0.990	0.978	0.870	0.741	0.766	0.955	0.865	0.968
	24	0.370	0.926	0.591	0.717	0.495	0.785	0.723	0.980	0.744	0.886	0.699	0.789	0.877	0.884	0.993
	25	0.166	0.499	0.380	0.078	0.051	0.675	0.153	0.717	0.134	0.723	0.535	0.660	0.472	0.723	0.946
	26	0.306	0.020	0.268	0.013	0.052	0.327	0.030	0.010	0.019	0.135	0.255	0.239	0.042	0.140	0.031
	27	0.626	0.074	0.417	0.290	0.499	0.314	0.268	0.020	0.241	0.118	0.297	0.216	0.118	0.120	0.007
	28	0.831	0.499	0.628	0.925	0.947	0.441	0.841	0.281	0.856	0.284	0.460	0.345	0.517	0.284	0.053
	29	0.828	0.943	0.599	0.539	0.640	0.970	0.917	0.973	0.870	0.909	0.973	0.855	0.973	0.907	0.984
	30	0.078	0.679	0.532	0.764	0.351	0.248	0.289	0.832	0.416	0.647	0.117	0.532	0.384	0.646	0.908
	31	0.169	0.057	0.409	0.469	0.354	0.057	0.079	0.027	0.121	0.094	0.026	0.149	0.025	0.097	0.016
	32	0.921	0.320	0.476	0.243	0.643	0.837	0.701	0.166	0.566	0.360	0.880	0.474	0.606	0.362	0.091
	33	0.498	0.499	0.504	0.504	0.497	0.560	0.495	0.499	0.491	0.504	0.497	0.503	0.495	0.504	0.498
	Range	0.980	0.959	0.975	0.990	0.978	0.927	0.984	0.980	0.975	0.963	0.972	0.955	0.954	0.962	0.986
	1	0.016	0.022	0.544	0.025	0.020	0.002	0.322	0.183	0.290	0.244	0.115	0.787	0.018	0.021	0.109
	2	0.122	0.143	0.446	0.022	0.163	0.007	0.359	0.260	0.268	0.289	0.158	0.172	0.006	0.061	0.013
	3	0.687	0.689	0.382	0.185	0.747	0.282	0.480	0.498	0.373	0.465	0.417	0.017	0.072	0.438	0.029
	4	0.968	0.961	0.387	0.775	0.972	0.948	0.614	0.738	0.563	0.668	0.763	0.020	0.673	0.907	0.324
	5	0.984	0.977	0.459	0.975	0.979	0.998	0.678	0.818	0.708	0.760	0.891	0.216	0.982	0.979	0.897
	6	0.877	0.855	0.557	0.979	0.832	0.993	0.642	0.741	0.730	0.715	0.849	0.830	0.994	0.939	0.988
	7	0.312	0.307	0.621	0.816	0.248	0.728	0.521	0.503	0.624	0.540	0.594	0.984	0.929	0.564	0.974
	8	0.032	0.038	0.616	0.227	0.027	0.055	0.386	0.263	0.434	0.336	0.246	0.981	0.330	0.093	0.689
	9	0.114	0.281	0.540	0.186	0.232	0.890	0.848	0.851	0.653	0.848	0.812	0.683	0.254	0.201	0.287
	10	0.965	0.988	0.479	0.970	0.985	0.999	0.953	0.990	0.879	0.978	0.995	0.260	0.989	0.979	0.885
	11	0.885	0.714	0.463	0.815	0.762	0.116	0.153	0.149	0.345	0.155	0.196	0.320	0.749	0.800	0.725
	12	0.332	0.116	0.490	0.244	0.150	0.001	0.028	0.009	0.133	0.016	0.007	0.551	0.126	0.200	0.341
	13	0.035	0.012	0.524	0.030	0.015	0.001	0.047	0.010	0.119	0.023	0.005	0.742	0.011	0.021	0.122
	14	0.098	0.102	0.958	0.118	0.092	0.424	0.767	0.241	0.918	0.417	0.306	0.773	0.051	0.097	0.514
	15	0.958	0.941	0.943	0.944	0.942	0.999	0.916	0.719	0.985	0.782	0.888	0.356	0.908	0.942	0.964
	16	0.902	0.896	0.043	0.883	0.905	0.588	0.234	0.759	0.081	0.587	0.704	0.230	0.950	0.904	0.500
2	17	0.042	0.058	0.058	0.056	0.056	0.001	0.084	0.282	0.015	0.221	0.118	0.647	0.094	0.058	0.039
	18	0.742	0.883	0.424	0.444	0.884	0.998	0.906	0.953	0.711	0.927	0.944	0.056	0.414	0.687	0.150
	19	0.667	0.882	0.513	0.758	0.846	0.999	0.972	0.991	0.866	0.984	0.993	0.452	0.876	0.801	0.672
	20	0.484	0.686	0.594	0.871	0.595	0.999	0.918	0.954	0.843	0.944	0.971	0.923	0.968	0.761	0.953
	21	0.256	0.115	0.579	0.558	0.113	0.002	0.094	0.047	0.287	0.075	0.060	0.945	0.589	0.315	0.858
	22	0.515	0.310	0.408	0.130	0.398	0.001	0.083	0.046	0.155	0.057	0.030	0.078	0.032	0.240	0.050
	23	0.712	0.691	0.925	0.333	0.725	0.922	0.846	0.474	0.940	0.586	0.577	0.093	0.117	0.510	0.331
	24	0.619	0.583	0.990	0.613	0.570	0.995	0.932	0.465	0.994	0.656	0.689	0.605	0.413	0.576	0.902
	25	0.448	0.418	0.969	0.799	0.361	0.988	0.862	0.477	0.978	0.638	0.695	0.955	0.811	0.598	0.989
	26	0.286	0.305	0.076	0.669	0.269	0.082	0.154	0.527	0.059	0.418	0.434	0.908	0.885	0.492	0.682
	27	0.379	0.412	0.010	0.389	0.424	0.005	0.068	0.536	0.006	0.348	0.321	0.399	0.590	0.425	0.105
	28	0.551	0.577	0.031	0.202	0.632	0.013	0.138	0.524	0.022	0.367	0.315	0.046	0.191	0.403	0.013
	29	0.699	0.838	0.953	0.757	0.801	0.999	0.992	0.947	0.995	0.964	0.981	0.540	0.745	0.768	0.889
	30	0.463	0.243	0.949	0.386	0.273	0.080	0.383	0.041	0.840	0.109	0.084	0.609	0.166	0.323	0.731
	31	0.300	0.158	0.048	0.245	0.194	0.001	0.008	0.053	0.005	0.037	0.020	0.463	0.257	0.233	0.118
	32	0.535	0.753	0.052	0.616	0.721	0.924	0.618	0.960	0.158	0.893	0.920	0.394	0.836	0.678	0.281
	33	0.499	0.497	0.501	0.501	0.497	0.506	0.500	0.501	0.499	0.502	0.506	0.502	0.502	0.501	0.507
	Range	0.967	0.976	0.980	0.957	0.970	0.999	0.984	0.983	0.990	0.968	0.990	0.967	0.988	0.958	0.976
	1	0.025	0.022	0.525	0.382	0.316	0.116	0.055	0.019	0.348	0.025	0.056	0.075	0.016	0.029	0.023
	2	0.290	0.129	0.742	0.919	0.897	0.678	0.431	0.137	0.890	0.141	0.541	0.546	0.122	0.164	0.132
	3	0.878	0.659	0.804	0.989	0.988	0.968	0.911	0.703	0.983	0.673	0.958	0.946	0.695	0.696	0.663
	4	0.986	0.957	0.712	0.966	0.974	0.984	0.981	0.967	0.962	0.957	0.990	0.984	0.970	0.956	0.956
	5	0.974	0.978	0.473	0.619	0.684	0.884	0.944	0.981	0.649	0.976	0.943	0.925	0.985	0.971	0.977
	6	0.705	0.875	0.256	0.081	0.103	0.324	0.565	0.862	0.109	0.861	0.456	0.452	0.879	0.835	0.867
	7	0.118	0.347	0.195	0.011	0.012	0.033	0.087	0.297	0.017	0.330	0.041	0.054	0.307	0.302	0.335
	8	0.013	0.044	0.287	0.034	0.026	0.016	0.018	0.033	0.037	0.044	0.009	0.015	0.030	0.044	0.043
	9	0.089	0.122	0.031	0.162	0.367	0.229	0.332	0.071	0.237	0.116	0.113	0.117	0.081	0.044	0.049
3	10	0.517	0.641	0.003	0.137	0.499	0.557	0.836	0.499	0.266	0.610	0.451	0.405	0.571	0.304	0.368
	11	0.920	0.954	0.025	0.288	0.632	0.828	0.965	0.929	0.432	0.944	0.849	0.801	0.951	0.836	0.880
	12	0.909	0.881	0.969	0.838	0.633	0.772	0.664	0.929	0.761	0.886	0.885	0.882	0.920	0.955	0.950
	13	0.477	0.364	0.997	0.863	0.501	0.445	0.161	0.501	0.732	0.394	0.546	0.593	0.431	0.695	0.630
	14	0.078	0.048	0.975	0.712	0.368	0.173	0.034	0.071	0.565	0.057	0.149	0.197	0.050	0.163	0.119
	15	0.805	0.706	0.095	0.799	0.945	0.920	0.950	0.646	0.856	0.696	0.873	0.833	0.686	0.501	0.524
	16	0.211	0.490	0.006	0.009	0.054	0.115	0.396	0.353	0.026	0.454	0.094	0.095	0.409	0.233	0.295
	17	0.191	0.299	0.904	0.202	0.055	0.080	0.049	0.354	0.143	0.308	0.126	0.166	0.315	0.498	0.474
	18	0.785	0.516	0.994	0.991	0.946	0.886	0.600	0.647	0.974	0.550	0.904	0.904	0.593	0.765	0.704
	19	0.497	0.503	0.499	0.501	0.500	0.501	0.498	0.500	0.499	0.502	0.498	0.499	0.501	0.499	0.499
	Range	0.973	0.956	0.993	0.983	0.976	0.968	0.963	0.962	0.967	0.951	0.981	0.969	0.969	0.942	0.954

Condition no.	RHM no.	BD1	BD2	BD3	BD4	BD5	BD6	BD7	BD8	BD9	BD10	BD11	BD12	BD13	BD14	BD15
	1	0.003	0.005	0.496	0.029	0.042	0.044	0.047	0.268	0.016	0.002	0.230	0.188	0.003	0.001	0.522
	2	0.021	0.031	0.295	0.055	0.100	0.080	0.082	0.007	0.048	0.009	0.266	0.286	0.021	0.007	0.021
	3	0.455	0.467	0.226	0.353	0.460	0.383	0.380	0.002	0.416	0.305	0.443	0.534	0.455	0.398	0.002
	4	0.969	0.959	0.301	0.854	0.871	0.834	0.828	0.054	0.912	0.949	0.665	0.753	0.969	0.981	0.017
	5	0.997	0.994	0.506	0.969	0.955	0.951	0.949	0.724	0.983	0.998	0.773	0.810	0.997	0.999	0.471
	6	0.977	0.967	0.707	0.941	0.894	0.912	0.911	0.993	0.949	0.990	0.738	0.711	0.978	0.993	0.978
	7	0.530	0.524	0.775	0.635	0.527	0.598	0.605	0.998	0.571	0.682	0.561	0.463	0.536	0.602	0.998
	8	0.029	0.039	0.700	0.138	0.122	0.154	0.162	0.944	0.083	0.047	0.339	0.245	0.029	0.019	0.982
	9	0.079	0.080	0.023	0.481	0.553	0.573	0.579	0.332	0.383	0.031	0.428	0.299	0.130	0.030	0.453
	10	0.778	0.712	0.002	0.965	0.972	0.974	0.974	0.498	0.957	0.582	0.686	0.554	0.879	0.699	0.410
	11	0.994	0.986	0.024	0.995	0.995	0.995	0.994	0.664	0.997	0.984	0.808	0.764	0.997	0.996	0.417
	12	0.915	0.916	0.977	0.506	0.434	0.407	0.405	0.660	0.604	0.966	0.577	0.699	0.866	0.970	0.540
	13	0.211	0.280	0.998	0.032	0.026	0.023	0.024	0.493	0.040	0.403	0.319	0.442	0.117	0.301	0.583
	14	0.006	0.013	0.976	0.004	0.005	0.005	0.005	0.328	0.003	0.015	0.196	0.233	0.003	0.004	0.576
	15	0.047	0.079	0.518	0.186	0.247	0.188	0.219	0.398	0.187	0.042	0.897	0.299	0.051	0.017	0.501
	16	0.655	0.710	0.530	0.733	0.773	0.670	0.713	0.597	0.812	0.655	0.994	0.555	0.673	0.573	0.478
	17	0.987	0.986	0.525	0.961	0.958	0.932	0.941	0.726	0.983	0.989	0.990	0.764	0.988	0.991	0.466
	18	0.949	0.917	0.484	0.805	0.742	0.798	0.769	0.593	0.804	0.954	0.106	0.699	0.947	0.983	0.492
	19	0.331	0.282	0.472	0.256	0.218	0.313	0.273	0.394	0.180	0.331	0.006	0.442	0.319	0.426	0.515
	20	0.012	0.014	0.476	0.036	0.039	0.062	0.055	0.267	0.015	0.010	0.011	0.233	0.011	0.009	0.528
	21	0.049	0.087	0.617	0.196	0.168	0.209	0.205	0.374	0.115	0.042	0.336	0.873	0.081	0.018	0.454
	22	0.664	0.734	0.668	0.749	0.638	0.707	0.689	0.562	0.671	0.653	0.557	0.994	0.785	0.582	0.412
	23	0.988	0.987	0.624	0.964	0.927	0.941	0.934	0.704	0.966	0.989	0.735	0.992	0.994	0.992	0.419
	24	0.947	0.909	0.384	0.795	0.823	0.777	0.784	0.617	0.879	0.955	0.669	0.125	0.915	0.982	0.539
	25	0.323	0.258	0.334	0.241	0.349	0.277	0.297	0.429	0.317	0.333	0.448	0.006	0.209	0.417	0.581
4	26	0.011	0.012	0.377	0.034	0.069	0.053	0.060	0.288	0.032	0.010	0.269	0.008	0.006	0.008	0.574
	27	0.681	0.634	0.006	0.847	0.900	0.881	0.878	0.021	0.859	0.418	0.594	0.563	0.774	0.574	0.013
	28	0.727	0.671	0.073	0.938	0.919	0.941	0.942	0.978	0.912	0.688	0.673	0.513	0.815	0.709	0.971
	29	0.306	0.357	0.994	0.145	0.094	0.110	0.114	0.978	0.134	0.567	0.411	0.434	0.220	0.426	0.986
	30	0.261	0.320	0.928	0.058	0.076	0.053	0.054	0.021	0.083	0.299	0.331	0.484	0.179	0.290	0.028
	31	0.583	0.632	0.316	0.571	0.679	0.544	0.575	0.032	0.685	0.471	0.954	0.563	0.595	0.479	0.018
	32	0.635	0.670	0.721	0.755	0.720	0.690	0.724	0.986	0.776	0.734	0.971	0.513	0.650	0.623	0.978
	33	0.402	0.359	0.685	0.416	0.309	0.436	0.409	0.967	0.303	0.513	0.047	0.434	0.396	0.520	0.982
	34	0.352	0.322	0.280	0.235	0.269	0.293	0.263	0.013	0.214	0.254	0.030	0.484	0.342	0.377	0.021
	35	0.590	0.651	0.411	0.585	0.574	0.573	0.556	0.027	0.568	0.470	0.499	0.966	0.685	0.486	0.013
	36	0.641	0.688	0.799	0.766	0.620	0.716	0.707	0.984	0.673	0.732	0.582	0.956	0.734	0.629	0.971
	37	0.396	0.340	0.590	0.402	0.413	0.408	0.428	0.971	0.419	0.515	0.506	0.033	0.307	0.514	0.986
	38	0.346	0.304	0.202	0.224	0.368	0.268	0.279	0.015	0.316	0.255	0.423	0.043	0.258	0.370	0.027
	39	0.797	0.786	0.026	0.958	0.970	0.956	0.962	0.570	0.968	0.669	0.983	0.578	0.874	0.691	0.422
	40	0.391	0.493	0.979	0.194	0.202	0.137	0.160	0.566	0.271	0.546	0.927	0.498	0.301	0.406	0.545
	41	0.193	0.207	0.974	0.039	0.028	0.040	0.034	0.421	0.030	0.317	0.017	0.419	0.121	0.308	0.571
	42	0.595	0.497	0.021	0.796	0.789	0.852	0.830	0.425	0.718	0.439	0.075	0.498	0.691	0.594	0.448
	43	0.802	0.800	0.046	0.961	0.946	0.962	0.958	0.545	0.938	0.668	0.670	0.969	0.917	0.697	0.376
	44	0.397	0.513	0.989	0.204	0.133	0.154	0.148	0.541	0.179	0.544	0.407	0.952	0.390	0.412	0.498
	45	0.188	0.193	0.954	0.036	0.051	0.034	0.038	0.446	0.058	0.318	0.335	0.030	0.079	0.303	0.617
	46	0.589	0.477	0.011	0.786	0.860	0.834	0.842	0.450	0.813	0.440	0.598	0.047	0.602	0.587	0.495
	47	0.722	0.799	0.640	0.821	0.784	0.760	0.775	0.614	0.828	0.715	0.970	0.969	0.810	0.610	0.424
	48	0.499	0.515	0.601	0.507	0.384	0.520	0.472	0.470	0.371	0.491	0.047	0.952	0.591	0.506	0.449
	49	0.266	0.194	0.361	0.170	0.206	0.225	0.213	0.377	0.164	0.272	0.031	0.030	0.184	0.390	0.570
	50	0.486	0.475	0.401	0.480	0.603	0.461	0.512	0.521	0.616	0.494	0.955	0.047	0.400	0.493	0.544
	51	0.493	0.495	0.501	0.493	0.493	0.490	0.492	0.495	0.494	0.492	0.502	0.498	0.496	0.500	0.497
	Range	0.994	0.989	0.995	0.991	0.990	0.990	0.989	0.996	0.994	0.995	0.988	0.988	0.995	0.999	0.996
	1	0.249	0.003	0.249	0.041	0.168	0.005	0.215	0.415	0.414	0.144	0.003	0.262	0.271	0.411	0.277
	2	0.397	0.029	0.469	0.470	0.386	0.071	0.376	0.632	0.958	0.603	0.038	0.485	0.408	0.953	0.443
	3	0.620	0.518	0.712	0.949	0.708	0.696	0.632	0.756	0.996	0.923	0.598	0.719	0.608	0.995	0.652
	4	0.755	0.975	0.805	0.992	0.856	0.986	0.784	0.742	0.979	0.960	0.983	0.802	0.730	0.977	0.756
	5	0.748	0.997	0.742	0.960	0.830	0.995	0.780	0.590	0.582	0.851	0.997	0.731	0.721	0.590	0.722
	6	0.600	0.971	0.520	0.536	0.612	0.926	0.617	0.374	0.041	0.389	0.961	0.506	0.583	0.048	0.555
	7	0.377	0.480	0.279	0.053	0.290	0.296	0.361	0.249	0.004	0.074	0.398	0.274	0.383	0.005	0.347
	8	0.243	0.025	0.188	0.009	0.142	0.013	0.210	0.263	0.020	0.038	0.017	0.192	0.262	0.023	0.243
	9	0.055	0.008	0.018	0.011	0.046	0.005	0.085	0.357	0.265	0.073	0.021	0.017	0.203	0.362	0.210
	10	0.057	0.253	0.011	0.066	0.077	0.146	0.125	0.383	0.250	0.160	0.453	0.009	0.284	0.393	0.293
	11	0.259	0.928	0.122	0.569	0.370	0.860	0.395	0.479	0.371	0.514	0.969	0.107	0.506	0.487	0.513
	12	0.944	0.992	0.981	0.990	0.953	0.995	0.912	0.648	0.732	0.923	0.978	0.982	0.790	0.638	0.789
	13	0.943	0.746	0.989	0.936	0.922	0.849	0.872	0.623	0.747	0.835	0.543	0.991	0.708	0.608	0.706
	14	0.738	0.072	0.873	0.438	0.627	0.135	0.598	0.527	0.625	0.477	0.031	0.889	0.485	0.514	0.486
	15	0.119	0.009	0.141	0.001	0.014	0.009	0.054	0.305	0.349	0.012	0.005	0.166	0.009	0.256	0.009
	16	0.160	0.276	0.198	0.001	0.016	0.218	0.067	0.308	0.369	0.016	0.187	0.229	0.003	0.241	0.003
	17	0.409	0.934	0.446	0.106	0.198	0.899	0.306	0.422	0.465	0.217	0.906	0.466	0.065	0.368	0.064
	18	0.880	0.991	0.853	0.999	0.986	0.991	0.944	0.700	0.647	0.988	0.995	0.829	0.990	0.745	0.991
	19	0.839	0.723	0.795	0.999	0.984	0.775	0.930	0.698	0.627	0.983	0.810	0.764	0.997	0.760	0.997
	20	0.588	0.065	0.544	0.897	0.800	0.097	0.688	0.584	0.531	0.776	0.092	0.525	0.932	0.633	0.935
	21	0.776	0.032	0.455	0.311	0.561	0.040	0.768	0.949	0.520	0.355	0.104	0.440	0.448	0.610	0.507
	22	0.960	0.545	0.695	0.852	0.880	0.543	0.966	0.994	0.612	0.702	0.834	0.662	0.662	0.733	0.732
	23	0.956	0.978	0.795	0.976	0.934	0.971	0.967	0.974	0.637	0.867	0.996	0.769	0.763	0.725	0.804
	24	0.222	0.968	0.534	0.695	0.437	0.958	0.226	0.053	0.476	0.637	0.895	0.551	0.543	0.391	0.491
	25	0.040	0.454	0.296	0.152	0.119	0.447	0.033	0.006	0.384	0.291	0.163	0.330	0.330	0.268	0.267
5	26	0.043	0.022	0.197	0.025	0.065	0.027	0.032	0.027	0.359	0.128	0.004	0.224	0.230	0.275	0.195
	27	0.183	0.331	0.109	0.536	0.268	0.352	0.283	0.609	0.921	0.621	0.537	0.102	0.418	0.949	0.457
	28	0.090	0.307	0.021	0.013	0.081	0.131	0.144	0.244	0.009	0.042	0.396	0.018	0.271	0.022	0.253
	29	0.815	0.668	0.886	0.470	0.729	0.639	0.711	0.397	0.078	0.371	0.459	0.894	0.573	0.051	0.542
	30	0.909	0.692	0.978	0.987	0.918	0.864	0.852	0.761	0.991	0.956	0.600	0.981	0.721	0.979	0.746
	31	0.313	0.349	0.421	0.091	0.128	0.427	0.207	0.553	0.951	0.305	0.326	0.456	0.042	0.909	0.048
	32	0.178	0.325	0.156	0.001	0.028	0.177	0.096	0.201	0.017	0.006	0.209	0.172	0.016	0.010	0.013
	33	0.684	0.649	0.569	0.911	0.871	0.563	0.787	0.453	0.048	0.687	0.670	0.535	0.956	0.092	0.951
	34	0.820	0.674	0.837	0.999	0.972	0.816	0.901	0.803	0.983	0.994	0.788	0.822	0.983	0.990	0.987
	35	0.927	0.545	0.777	0.971	0.889	0.672	0.937	0.989	0.982	0.917	0.806	0.761	0.689	0.988	0.763
	36	0.845	0.518	0.481	0.341	0.670	0.383	0.851	0.904	0.046	0.260	0.694	0.450	0.536	0.082	0.563
	37	0.072	0.454	0.215	0.030	0.110	0.320	0.061	0.012	0.018	0.079	0.191	0.232	0.303	0.012	0.236
	38	0.153	0.480	0.509	0.665	0.328	0.608	0.145	0.098	0.953	0.733	0.303	0.541	0.455	0.918	0.435
	39	0.034	0.187	0.013	0.001	0.006	0.098	0.031	0.285	0.238	0.013	0.239	0.014	0.010	0.245	0.010
	40	0.660	0.519	0.846	0.079	0.301	0.573	0.401	0.446	0.593	0.204	0.291	0.874	0.062	0.381	0.060
	41	0.965	0.812	0.986	0.999	0.994	0.898	0.968	0.721	0.759	0.986	0.758	0.985	0.989	0.756	0.990
	42	0.337	0.479	0.148	0.924	0.697	0.418	0.592	0.560	0.403	0.790	0.705	0.121	0.935	0.620	0.940
	43	0.546	0.348	0.103	0.371	0.431	0.253	0.683	0.942	0.392	0.373	0.728	0.083	0.458	0.597	0.521
	44	0.991	0.708	0.976	0.965	0.967	0.791	0.982	0.978	0.750	0.857	0.778	0.975	0.754	0.737	0.794
	45	0.451	0.650	0.892	0.635	0.567	0.739	0.311	0.059	0.604	0.619	0.269	0.913	0.532	0.404	0.478
	46	0.009	0.290	0.022	0.036	0.033	0.202	0.017	0.023	0.247	0.138	0.219	0.023	0.238	0.264	0.205
	47	0.702	0.367	0.407	0.040	0.244	0.319	0.592	0.924	0.487	0.127	0.524	0.411	0.052	0.476	0.067
	48	0.974	0.691	0.829	0.999	0.991	0.731	0.990	0.984	0.668	0.970	0.905	0.791	0.987	0.826	0.991
	49	0.295	0.631	0.583	0.961	0.754	0.672	0.401	0.078	0.509	0.869	0.472	0.580	0.946	0.524	0.933
	50	0.026	0.308	0.165	0.001	0.009	0.261	0.009	0.016	0.329	0.028	0.093	0.203	0.013	0.175	0.009
	51	0.498	0.499	0.495	0.503	0.499	0.495	0.496	0.503	0.498	0.496	0.498	0.496	0.495	0.500	0.499
	Range	0.981	0.994	0.978	0.999	0.988	0.990	0.981	0.988	0.992	0.989	0.994	0.982	0.993	0.990	0.994

e) $n = 20$

Condition no.	RHM no.	BD1	BD2	BD3	BD4	BD5	BD6	BD7	BD8	BD9	BD10	BD11	BD12	BD13	BD14	BD15	BD16	BD17	BD18	BD19	BD20
	1	0.319	0.144	0.020	0.138	0.088	0.013	0.377	0.013	0.142	0.373	0.022	0.287	0.011	0.314	0.175	0.001	0.013	0.068	0.420	0.075
	2	0.006	0.112	0.032	0.089	0.021	0.029	0.290	0.033	0.029	0.044	0.027	0.022	0.034	0.026	0.416	0.001	0.034	0.021	0.101	0.042
	3	0.001	0.255	0.284	0.206	0.063	0.317	0.315	0.354	0.053	0.018	0.236	0.011	0.384	0.012	0.733	0.001	0.363	0.081	0.054	0.156
	4	0.030	0.609	0.852	0.574	0.439	0.889	0.444	0.904	0.342	0.104	0.816	0.108	0.921	0.103	0.860	0.236	0.909	0.520	0.158	0.615
	5	0.676	0.852	0.980	0.861	0.903	0.986	0.607	0.987	0.850	0.619	0.976	0.709	0.989	0.678	0.815	0.999	0.987	0.928	0.573	0.922
	6	0.994	0.884	0.967	0.911	0.976	0.970	0.696	0.966	0.969	0.954	0.971	0.978	0.966	0.972	0.569	0.999	0.966	0.978	0.896	0.956
	7	0.999	0.739	0.712	0.793	0.930	0.679	0.670	0.644	0.943	0.981	0.758	0.989	0.616	0.987	0.254	0.999	0.638	0.915	0.944	0.839
	8	0.969	0.384	0.146	0.424	0.539	0.109	0.540	0.095	0.644	0.892	0.179	0.890	0.079	0.893	0.131	0.751	0.092	0.469	0.838	0.377
	9	0.258	0.224	0.049	0.142	0.122	0.043	0.030	0.029	0.067	0.118	0.045	0.361	0.046	0.351	0.038	0.001	0.046	0.107	0.079	0.108
	10	0.503	0.768	0.894	0.679	0.761	0.919	0.071	0.894	0.497	0.230	0.869	0.666	0.940	0.613	0.314	0.918	0.930	0.802	0.127	0.783
	11	0.737	0.771	0.949	0.857	0.866	0.956	0.967	0.970	0.928	0.877	0.953	0.635	0.954	0.640	0.959	0.999	0.954	0.887	0.919	0.888
	12	0.668	0.499	0.606	0.665	0.600	0.584	0.990	0.672	0.846	0.909	0.649	0.474	0.538	0.516	0.940	0.917	0.560	0.597	0.963	0.617
	13	0.491	0.227	0.104	0.320	0.222	0.079	0.923	0.105	0.488	0.763	0.127	0.329	0.060	0.378	0.672	0.076	0.070	0.191	0.869	0.211
	14	0.604	0.931	0.205	0.871	0.700	0.139	0.548	0.139	0.531	0.391	0.280	0.517	0.096	0.557	0.685	0.379	0.116	0.574	0.344	0.720
	15	0.821	0.999	0.981	0.996	0.992	0.979	0.703	0.980	0.941	0.566	0.987	0.797	0.973	0.792	0.962	0.999	0.975	0.989	0.449	0.995
	16	0.390	0.067	0.792	0.129	0.281	0.858	0.435	0.860	0.455	0.601	0.713	0.479	0.904	0.434	0.302	0.605	0.885	0.415	0.649	0.273
	17	0.175	0.001	0.018	0.004	0.007	0.020	0.283	0.020	0.054	0.425	0.012	0.200	0.027	0.202	0.035	0.001	0.025	0.011	0.544	0.004
1	18	0.006	0.318	0.274	0.189	0.099	0.311	0.023	0.280	0.030	0.007	0.215	0.056	0.392	0.051	0.249	0.001	0.362	0.120	0.008	0.175
	19	0.327	0.494	0.389	0.334	0.379	0.411	0.009	0.326	0.145	0.088	0.343	0.522	0.463	0.475	0.056	0.076	0.441	0.393	0.036	0.376
	20	0.970	0.672	0.579	0.609	0.798	0.568	0.089	0.477	0.648	0.695	0.585	0.952	0.557	0.938	0.056	0.982	0.557	0.784	0.442	0.684
	21	0.994	0.676	0.722	0.810	0.891	0.685	0.975	0.718	0.968	0.992	0.779	0.942	0.609	0.947	0.739	0.999	0.639	0.875	0.992	0.820
	22	0.029	0.322	0.416	0.390	0.187	0.427	0.904	0.521	0.338	0.297	0.407	0.047	0.443	0.059	0.939	0.016	0.444	0.208	0.551	0.308
	23	0.054	0.962	0.589	0.906	0.655	0.556	0.500	0.586	0.378	0.063	0.627	0.117	0.543	0.133	0.943	0.157	0.554	0.599	0.081	0.812
	24	0.800	0.999	0.812	0.996	0.981	0.749	0.681	0.752	0.879	0.470	0.880	0.732	0.672	0.752	0.946	0.999	0.706	0.960	0.356	0.988
	25	0.997	0.996	0.847	0.993	0.994	0.790	0.743	0.772	0.975	0.922	0.908	0.980	0.700	0.981	0.750	0.999	0.736	0.986	0.807	0.989
	26	0.944	0.037	0.406	0.093	0.325	0.439	0.483	0.411	0.608	0.934	0.365	0.880	0.458	0.862	0.053	0.833	0.447	0.391	0.916	0.183
	27	0.196	0.001	0.184	0.004	0.017	0.247	0.304	0.246	0.114	0.521	0.116	0.264	0.328	0.241	0.050	0.001	0.295	0.038	0.638	0.011
	28	0.003	0.003	0.150	0.007	0.005	0.206	0.243	0.227	0.023	0.075	0.088	0.019	0.300	0.018	0.238	0.001	0.265	0.013	0.189	0.010
	29	0.610	0.987	0.667	0.945	0.897	0.625	0.092	0.565	0.535	0.157	0.708	0.684	0.598	0.671	0.506	0.865	0.609	0.853	0.063	0.915
	30	0.817	0.987	0.794	0.986	0.952	0.735	0.976	0.788	0.940	0.814	0.866	0.653	0.649	0.697	0.987	0.999	0.688	0.921	0.842	0.965
	31	0.384	0.012	0.329	0.055	0.094	0.370	0.901	0.433	0.450	0.837	0.285	0.312	0.402	0.321	0.478	0.126	0.392	0.141	0.935	0.081
	32	0.179	0.012	0.203	0.014	0.043	0.261	0.022	0.210	0.056	0.180	0.130	0.343	0.351	0.295	0.011	0.001	0.313	0.075	0.154	0.034
	33	0.497	0.496	0.498	0.499	0.489	0.497	0.492	0.499	0.493	0.496	0.496	0.498	0.500	0.495	0.492	0.491	0.501	0.495	0.497	0.496
	Range	0.998	0.998	0.963	0.993	0.989	0.973	0.981	0.973	0.952	0.985	0.975	0.978	0.978	0.975	0.976	0.999	0.975	0.978	0.984	0.991
	1	0.295	0.416	0.399	0.011	0.144	0.304	0.392	0.138	0.105	0.010	0.122	0.372	0.009	0.215	0.007	0.113	0.037	0.146	0.228	0.006
	2	0.167	0.026	0.116	0.027	0.107	0.024	0.328	0.196	0.059	0.028	0.030	0.361	0.032	0.203	0.024	0.182	0.073	0.203	0.061	0.023
	3	0.202	0.006	0.076	0.343	0.243	0.011	0.360	0.452	0.169	0.357	0.066	0.469	0.406	0.344	0.377	0.469	0.390	0.452	0.075	0.391
	4	0.414	0.051	0.202	0.912	0.602	0.105	0.474	0.754	0.586	0.918	0.403	0.634	0.936	0.597	0.937	0.787	0.855	0.746	0.309	0.945
	5	0.700	0.587	0.599	0.990	0.856	0.696	0.603	0.864	0.898	0.990	0.877	0.745	0.992	0.768	0.993	0.886	0.961	0.856	0.769	0.995
	6	0.830	0.974	0.883	0.974	0.893	0.976	0.668	0.807	0.943	0.972	0.970	0.754	0.969	0.781	0.976	0.817	0.925	0.799	0.938	0.977
	7	0.794	0.994	0.924	0.663	0.757	0.989	0.636	0.551	0.834	0.640	0.933	0.659	0.599	0.636	0.626	0.529	0.603	0.551	0.924	0.614
	8	0.580	0.950	0.797	0.091	0.397	0.895	0.522	0.248	0.419	0.081	0.595	0.496	0.066	0.382	0.064	0.211	0.141	0.256	0.688	0.056
	9	0.561	0.576	0.974	0.149	0.814	0.578	0.504	0.769	0.747	0.139	0.687	0.713	0.102	0.168	0.072	0.460	0.401	0.769	0.732	0.105
	10	0.773	0.686	0.999	0.800	0.990	0.786	0.612	0.983	0.986	0.791	0.968	0.888	0.720	0.278	0.658	0.857	0.923	0.982	0.947	0.777
	11	0.817	0.690	0.990	0.987	0.992	0.822	0.651	0.989	0.993	0.987	0.983	0.896	0.982	0.546	0.979	0.946	0.988	0.987	0.952	0.990
	12	0.434	0.427	0.025	0.854	0.186	0.421	0.492	0.234	0.258	0.859	0.310	0.409	0.900	0.818	0.929	0.538	0.592	0.234	0.265	0.898
	13	0.223	0.316	0.001	0.205	0.010	0.214	0.384	0.017	0.014	0.207	0.032	0.188	0.284	0.703	0.345	0.142	0.075	0.019	0.052	0.227
	14	0.180	0.312	0.010	0.013	0.008	0.178	0.344	0.012	0.007	0.013	0.016	0.177	0.018	0.433	0.021	0.053	0.011	0.013	0.047	0.010
	15	0.023	0.334	0.369	0.030	0.228	0.222	0.023	0.065	0.109	0.024	0.067	0.347	0.031	0.304	0.029	0.100	0.039	0.073	0.138	0.022
	16	0.011	0.347	0.414	0.366	0.505	0.285	0.006	0.147	0.314	0.322	0.168	0.448	0.394	0.519	0.420	0.274	0.236	0.159	0.212	0.380
	17	0.106	0.451	0.510	0.919	0.776	0.484	0.054	0.513	0.709	0.908	0.556	0.620	0.933	0.713	0.946	0.665	0.772	0.517	0.482	0.943
	18	0.976	0.668	0.629	0.971	0.771	0.777	0.976	0.936	0.894	0.976	0.933	0.766	0.970	0.677	0.971	0.899	0.960	0.928	0.860	0.978
	19	0.989	0.655	0.585	0.640	0.495	0.715	0.994	0.855	0.691	0.675	0.830	0.679	0.610	0.459	0.583	0.724	0.759	0.843	0.785	0.625
	20	0.891	0.551	0.489	0.084	0.223	0.515	0.945	0.491	0.296	0.091	0.442	0.511	0.069	0.268	0.054	0.333	0.223	0.486	0.514	0.058
	21	0.212	0.406	0.454	0.012	0.129	0.229	0.390	0.137	0.045	0.006	0.018	0.053	0.022	0.052	0.025	0.004	0.009	0.120	0.057	0.011
	22	0.276	0.451	0.536	0.193	0.296	0.295	0.451	0.324	0.127	0.114	0.035	0.031	0.322	0.064	0.383	0.006	0.058	0.273	0.067	0.242
	23	0.481	0.527	0.596	0.848	0.645	0.493	0.540	0.674	0.535	0.788	0.321	0.178	0.913	0.293	0.939	0.182	0.555	0.626	0.295	0.904
	24	0.783	0.597	0.545	0.988	0.871	0.771	0.605	0.865	0.956	0.994	0.982	0.974	0.978	0.941	0.976	0.995	0.991	0.881	0.942	0.989
	25	0.719	0.551	0.462	0.811	0.704	0.705	0.544	0.679	0.876	0.884	0.965	0.986	0.682	0.929	0.619	0.993	0.940	0.730	0.932	0.762
	26	0.513	0.476	0.403	0.156	0.354	0.507	0.455	0.329	0.471	0.209	0.676	0.895	0.089	0.688	0.062	0.816	0.437	0.377	0.702	0.099
2	27	0.477	0.073	0.868	0.620	0.875	0.146	0.480	0.922	0.809	0.623	0.597	0.769	0.595	0.246	0.526	0.758	0.792	0.918	0.549	0.633
	28	0.867	0.984	0.999	0.813	0.984	0.985	0.673	0.945	0.987	0.796	0.991	0.860	0.721	0.437	0.696	0.790	0.884	0.942	0.985	0.771
	29	0.517	0.927	0.131	0.386	0.124	0.854	0.516	0.079	0.195	0.373	0.401	0.343	0.410	0.737	0.477	0.240	0.203	0.083	0.447	0.372
	30	0.130	0.016	0.001	0.191	0.016	0.015	0.323	0.056	0.013	0.202	0.009	0.226	0.283	0.541	0.307	0.209	0.112	0.059	0.015	0.233
	31	0.014	0.019	0.122	0.297	0.314	0.022	0.020	0.204	0.153	0.279	0.041	0.414	0.359	0.405	0.358	0.316	0.241	0.214	0.057	0.339
	32	0.150	0.936	0.805	0.521	0.692	0.887	0.061	0.257	0.633	0.471	0.649	0.551	0.494	0.614	0.533	0.354	0.374	0.269	0.674	0.495
	33	0.986	0.981	0.878	0.708	0.685	0.978	0.979	0.799	0.850	0.718	0.959	0.708	0.645	0.573	0.645	0.682	0.753	0.789	0.942	0.665
	34	0.847	0.065	0.194	0.486	0.308	0.113	0.938	0.746	0.372	0.525	0.348	0.581	0.511	0.365	0.470	0.644	0.619	0.734	0.323	0.511
	35	0.157	0.030	0.171	0.184	0.192	0.023	0.367	0.341	0.069	0.134	0.009	0.074	0.310	0.089	0.333	0.035	0.095	0.303	0.019	0.244
	36	0.565	0.956	0.859	0.375	0.545	0.891	0.564	0.408	0.451	0.276	0.413	0.136	0.440	0.206	0.506	0.044	0.177	0.368	0.482	0.385
	37	0.840	0.970	0.828	0.820	0.808	0.977	0.628	0.662	0.933	0.864	0.990	0.962	0.695	0.902	0.670	0.965	0.901	0.700	0.981	0.760
	38	0.430	0.044	0.140	0.631	0.455	0.109	0.431	0.595	0.555	0.722	0.585	0.924	0.565	0.777	0.497	0.956	0.818	0.635	0.514	0.620
	39	0.138	0.526	0.976	0.637	0.951	0.563	0.055	0.777	0.886	0.598	0.736	0.758	0.587	0.355	0.557	0.629	0.692	0.780	0.719	0.626
	40	0.016	0.269	0.011	0.204	0.051	0.168	0.023	0.012	0.029	0.183	0.023	0.215	0.276	0.663	0.335	0.119	0.064	0.015	0.043	0.227
	41	0.858	0.477	0.024	0.369	0.049	0.437	0.943	0.226	0.116	0.399	0.262	0.357	0.418	0.624	0.446	0.369	0.302	0.222	0.278	0.379
	42	0.984	0.733	0.989	0.801	0.949	0.832	0.977	0.988	0.972	0.814	0.977	0.869	0.728	0.317	0.668	0.880	0.934	0.986	0.956	0.777
	43	0.545	0.601	0.986	0.492	0.897	0.571	0.546	0.881	0.772	0.391	0.511	0.299	0.533	0.069	0.530	0.158	0.459	0.853	0.533	0.517
	44	0.169	0.335	0.019	0.115	0.021	0.173	0.384	0.034	0.009	0.077	0.005	0.022	0.232	0.246	0.311	0.006	0.017	0.029	0.014	0.152
	45	0.450	0.402	0.014	0.514	0.103	0.428	0.449	0.120	0.233	0.606	0.486	0.805	0.472	0.923	0.473	0.841	0.534	0.149	0.463	0.489
	46	0.827	0.667	0.981	0.888	0.978	0.827	0.611	0.967	0.991	0.922	0.995	0.991	0.771	0.736	0.692	0.994	0.983	0.972	0.986	0.851
	47	0.021	0.357	0.465	0.196	0.356	0.217	0.030	0.143	0.125	0.120	0.025	0.069	0.302	0.151	0.362	0.014	0.053	0.128	0.052	0.238
	48	0.883	0.577	0.586	0.359	0.349	0.508	0.956	0.664	0.324	0.298	0.272	0.145	0.448	0.128	0.475	0.091	0.270	0.611	0.309	0.393
	49	0.978	0.645	0.534	0.809	0.644	0.783	0.969	0.859	0.878	0.879	0.975	0.965	0.702	0.835	0.641	0.985	0.945	0.874	0.947	0.766
	50	0.114	0.426	0.413	0.647	0.651	0.492	0.043	0.339	0.681	0.699	0.726	0.918	0.557	0.860	0.528	0.908	0.724	0.392	0.688	0.612
	51	0.497	0.501	0.499	0.503	0.500	0.500	0.498	0.502	0.503	0.498	0.499	0.566	0.502	0.489	0.501	0.499	0.496	0.502	0.498	0.503
	Range	0.978	0.989	0.998	0.979	0.983	0.978	0.989	0.977	0.985	0.988	0.991	0.969	0.983	0.889	0.987	0.991	0.982	0.974	0.972	0.989

Condition no.	RHM no.	BD1	BD2	BD3	BD4	BD5	BD6	BD7	BD8	BD9	BD10	BD11	BD12	BD13	BD14	BD15	BD16	BD17	BD18	BD19	BD20
3	1	0.829	0.990	0.988	0.431	0.844	0.987	0.909	0.982	0.844	0.834	0.989	0.789	0.871	0.695	0.986	0.990	0.950	0.786	0.983	0.559
	2	0.540	0.921	0.942	0.953	0.827	0.945	0.821	0.934	0.795	0.777	0.953	0.863	0.771	0.764	0.931	0.957	0.888	0.882	0.939	0.970
	3	0.209	0.378	0.488	0.995	0.624	0.506	0.484	0.512	0.559	0.540	0.537	0.770	0.467	0.693	0.465	0.545	0.531	0.809	0.530	0.994
	4	0.107	0.032	0.053	0.973	0.307	0.058	0.164	0.071	0.268	0.265	0.062	0.480	0.195	0.496	0.054	0.061	0.134	0.521	0.075	0.951
	5	0.170	0.011	0.012	0.568	0.150	0.013	0.089	0.018	0.152	0.160	0.012	0.208	0.129	0.301	0.015	0.011	0.050	0.210	0.017	0.431
	6	0.458	0.081	0.058	0.047	0.167	0.056	0.176	0.065	0.201	0.216	0.048	0.135	0.229	0.233	0.069	0.044	0.111	0.116	0.061	0.028
	7	0.789	0.628	0.515	0.005	0.367	0.496	0.511	0.486	0.435	0.451	0.466	0.226	0.533	0.303	0.536	0.459	0.468	0.188	0.470	0.006
	8	0.892	0.969	0.948	0.027	0.685	0.942	0.833	0.928	0.727	0.727	0.939	0.515	0.805	0.500	0.946	0.940	0.865	0.475	0.925	0.047
	9	0.902	0.999	0.975	0.430	0.919	0.979	0.991	0.983	0.984	0.982	0.992	0.866	0.985	0.982	0.979	0.992	0.992	0.985	0.978	0.756
	10	0.478	0.709	0.111	0.527	0.481	0.128	0.687	0.199	0.757	0.757	0.208	0.485	0.720	0.916	0.145	0.194	0.530	0.853	0.164	0.679
	11	0.098	0.001	0.025	0.569	0.077	0.022	0.008	0.016	0.016	0.017	0.008	0.132	0.015	0.017	0.021	0.009	0.008	0.014	0.022	0.235
	12	0.189	0.001	0.302	0.529	0.162	0.266	0.020	0.180	0.022	0.023	0.133	0.220	0.025	0.007	0.248	0.142	0.040	0.011	0.232	0.197
	13	0.520	0.296	0.891	0.472	0.510	0.873	0.308	0.800	0.239	0.236	0.794	0.510	0.280	0.083	0.856	0.809	0.469	0.144	0.836	0.311
	14	0.196	0.771	0.884	0.476	0.235	0.874	0.620	0.788	0.524	0.436	0.920	0.197	0.467	0.545	0.841	0.914	0.760	0.616	0.822	0.455
	15	0.014	0.006	0.023	0.572	0.015	0.022	0.056	0.015	0.083	0.060	0.035	0.023	0.046	0.269	0.018	0.029	0.053	0.201	0.019	0.366
	16	0.803	0.233	0.117	0.523	0.758	0.127	0.375	0.211	0.470	0.555	0.081	0.799	0.532	0.451	0.159	0.087	0.239	0.380	0.178	0.535
	17	0.986	0.994	0.977	0.427	0.984	0.979	0.943	0.985	0.915	0.937	0.965	0.976	0.954	0.728	0.982	0.971	0.947	0.795	0.981	0.624
	18	0.519	0.975	0.636	0.960	0.818	0.675	0.921	0.747	0.937	0.929	0.804	0.856	0.907	0.982	0.663	0.801	0.902	0.987	0.716	0.991
	19	0.809	0.999	0.700	0.470	0.832	0.735	0.979	0.819	0.978	0.976	0.869	0.776	0.975	0.993	0.753	0.861	0.960	0.989	0.768	0.796
	20	0.883	0.992	0.654	0.032	0.672	0.669	0.928	0.732	0.904	0.905	0.767	0.503	0.925	0.916	0.708	0.755	0.881	0.840	0.679	0.116
	21	0.479	0.026	0.366	0.040	0.176	0.326	0.077	0.251	0.062	0.068	0.198	0.141	0.093	0.017	0.338	0.202	0.097	0.012	0.285	0.009
	22	0.116	0.008	0.348	0.968	0.320	0.333	0.070	0.266	0.093	0.091	0.235	0.492	0.075	0.082	0.293	0.248	0.118	0.158	0.321	0.879
	23	0.018	0.133	0.336	0.969	0.112	0.334	0.252	0.253	0.290	0.218	0.444	0.185	0.174	0.543	0.272	0.427	0.345	0.638	0.302	0.939
	24	0.015	0.104	0.286	0.534	0.021	0.267	0.182	0.165	0.175	0.114	0.386	0.022	0.106	0.362	0.221	0.355	0.260	0.352	0.210	0.375
	25	0.169	0.254	0.354	0.041	0.047	0.327	0.268	0.239	0.220	0.175	0.395	0.026	0.205	0.270	0.315	0.368	0.305	0.186	0.266	0.022
	26	0.982	0.870	0.666	0.031	0.883	0.668	0.744	0.746	0.705	0.775	0.559	0.811	0.826	0.453	0.729	0.577	0.654	0.358	0.698	0.058
	27	0.984	0.899	0.717	0.465	0.978	0.735	0.814	0.833	0.821	0.882	0.617	0.977	0.894	0.635	0.780	0.649	0.739	0.644	0.791	0.614
	28	0.830	0.751	0.649	0.959	0.951	0.675	0.728	0.760	0.776	0.819	0.608	0.974	0.795	0.727	0.686	0.636	0.694	0.811	0.734	0.976
	29	0.182	0.901	0.488	0.503	0.224	0.502	0.788	0.483	0.777	0.708	0.721	0.189	0.692	0.932	0.476	0.692	0.784	0.911	0.478	0.643
	30	0.016	0.001	0.221	0.545	0.016	0.189	0.018	0.091	0.018	0.012	0.160	0.025	0.012	0.023	0.152	0.153	0.045	0.029	0.138	0.206
	31	0.817	0.102	0.514	0.496	0.769	0.500	0.208	0.515	0.219	0.284	0.281	0.808	0.308	0.066	0.525	0.312	0.215	0.087	0.522	0.348
	32	0.984	0.999	0.781	0.454	0.983	0.812	0.981	0.908	0.981	0.987	0.841	0.975	0.988	0.977	0.848	0.849	0.955	0.970	0.862	0.787
	33	0.499	0.503	0.501	0.499	0.495	0.501	0.497	0.499	0.497	0.495	0.501	0.498	0.500	0.498	0.500	0.502	0.499	0.498	0.500	0.495
	Range	0.972	0.999	0.976	0.989	0.969	0.975	0.983	0.970	0.968	0.975	0.983	0.955	0.976	0.986	0.971	0.983	0.984	0.978	0.965	0.988
4	1	0.809	0.629	0.839	0.993	0.616	0.483	0.993	0.786	0.947	0.840	0.804	0.935	0.991	0.581	0.911	0.629	0.736	0.725	0.990	0.999
	2	0.123	0.370	0.673	0.865	0.159	0.558	0.894	0.106	0.338	0.260	0.122	0.747	0.900	0.143	0.617	0.211	0.295	0.094	0.886	0.263
	3	0.006	0.210	0.361	0.180	0.042	0.595	0.249	0.005	0.013	0.028	0.006	0.282	0.288	0.043	0.176	0.071	0.081	0.007	0.265	0.001
	4	0.008	0.206	0.170	0.008	0.074	0.574	0.014	0.009	0.003	0.019	0.008	0.068	0.019	0.085	0.053	0.100	0.075	0.015	0.018	0.001
	5	0.184	0.359	0.161	0.006	0.368	0.507	0.007	0.213	0.051	0.153	0.190	0.063	0.009	0.411	0.087	0.364	0.259	0.269	0.010	0.001
	6	0.872	0.618	0.326	0.131	0.831	0.432	0.106	0.894	0.653	0.730	0.874	0.248	0.099	0.852	0.378	0.784	0.700	0.902	0.113	0.725
	7	0.994	0.781	0.639	0.815	0.954	0.395	0.750	0.995	0.986	0.970	0.994	0.713	0.712	0.955	0.821	0.927	0.916	0.993	0.733	0.999
	8	0.992	0.785	0.830	0.991	0.920	0.416	0.986	0.991	0.996	0.979	0.991	0.929	0.981	0.911	0.946	0.897	0.923	0.984	0.982	0.999
	9	0.720	0.061	0.718	0.903	0.147	0.027	0.955	0.368	0.803	0.614	0.714	0.859	0.947	0.130	0.775	0.372	0.539	0.317	0.939	0.970
	10	0.477	0.006	0.430	0.262	0.036	0.004	0.483	0.102	0.339	0.276	0.474	0.501	0.465	0.036	0.387	0.213	0.309	0.101	0.443	0.310
	11	0.251	0.021	0.204	0.014	0.067	0.029	0.039	0.072	0.074	0.128	0.254	0.141	0.041	0.076	0.122	0.211	0.210	0.091	0.040	0.005
	12	0.271	0.935	0.282	0.094	0.844	0.972	0.045	0.631	0.190	0.375	0.279	0.138	0.053	0.866	0.221	0.621	0.455	0.677	0.060	0.028
	13	0.512	0.994	0.570	0.733	0.960	0.996	0.516	0.898	0.651	0.713	0.517	0.493	0.534	0.963	0.608	0.782	0.685	0.896	0.554	0.677
	14	0.740	0.977	0.796	0.986	0.928	0.969	0.960	0.927	0.922	0.866	0.739	0.856	0.959	0.921	0.875	0.784	0.785	0.906	0.959	0.995
	15	0.800	0.746	0.811	0.994	0.784	0.405	0.985	0.971	0.979	0.953	0.855	0.997	0.977	0.758	0.996	0.948	0.974	0.865	0.980	0.999
	16	0.622	0.724	0.601	0.853	0.789	0.380	0.730	0.971	0.893	0.915	0.737	0.991	0.668	0.782	0.991	0.976	0.983	0.831	0.716	0.999
	17	0.340	0.568	0.301	0.156	0.632	0.421	0.098	0.782	0.392	0.599	0.434	0.726	0.085	0.654	0.765	0.875	0.850	0.597	0.106	0.626
	18	0.193	0.245	0.189	0.006	0.204	0.585	0.015	0.028	0.020	0.044	0.140	0.003	0.023	0.236	0.004	0.050	0.025	0.131	0.020	0.001
	19	0.368	0.266	0.399	0.143	0.199	0.611	0.269	0.029	0.102	0.081	0.256	0.008	0.331	0.212	0.008	0.023	0.017	0.165	0.281	0.001
	20	0.650	0.420	0.699	0.840	0.352	0.569	0.902	0.217	0.598	0.389	0.558	0.268	0.915	0.338	0.231	0.121	0.146	0.396	0.892	0.360
	21	0.681	0.473	0.160	0.923	0.534	0.517	0.920	0.595	0.788	0.720	0.694	0.884	0.925	0.533	0.850	0.324	0.384	0.510	0.913	0.967
	22	0.415	0.332	0.008	0.322	0.426	0.538	0.324	0.325	0.311	0.429	0.442	0.568	0.369	0.463	0.544	0.164	0.146	0.285	0.343	0.292
	23	0.217	0.289	0.008	0.019	0.359	0.534	0.020	0.189	0.067	0.200	0.236	0.169	0.028	0.413	0.189	0.175	0.116	0.202	0.026	0.004
	24	0.309	0.515	0.839	0.075	0.449	0.473	0.080	0.404	0.205	0.270	0.299	0.113	0.074	0.458	0.148	0.670	0.610	0.483	0.085	0.030
	25	0.574	0.657	0.992	0.672	0.558	0.452	0.674	0.674	0.680	0.559	0.550	0.426	0.631	0.528	0.451	0.832	0.850	0.709	0.654	0.695
	26	0.775	0.700	0.992	0.981	0.626	0.456	0.980	0.810	0.930	0.792	0.758	0.827	0.972	0.579	0.808	0.820	0.882	0.792	0.973	0.995
	27	0.034	0.009	0.353	0.137	0.007	0.042	0.305	0.003	0.032	0.039	0.035	0.343	0.324	0.006	0.195	0.055	0.091	0.004	0.293	0.001
	28	0.958	0.109	0.550	0.574	0.471	0.018	0.673	0.819	0.896	0.820	0.957	0.656	0.631	0.471	0.674	0.680	0.735	0.796	0.633	0.994
	29	0.964	0.990	0.646	0.859	0.993	0.956	0.694	0.997	0.966	0.959	0.964	0.651	0.676	0.993	0.801	0.943	0.907	0.996	0.704	0.999
	30	0.039	0.885	0.449	0.420	0.512	0.980	0.225	0.180	0.100	0.172	0.041	0.338	0.369	0.520	0.322	0.313	0.260	0.199	0.364	0.006
	31	0.059	0.443	0.472	0.540	0.261	0.484	0.482	0.320	0.248	0.353	0.093	0.899	0.465	0.254	0.848	0.639	0.694	0.145	0.484	0.384
	32	0.977	0.835	0.667	0.916	0.961	0.345	0.819	0.999	0.992	0.989	0.987	0.981	0.759	0.960	0.990	0.992	0.993	0.992	0.801	0.999
	33	0.937	0.545	0.528	0.453	0.726	0.506	0.517	0.679	0.743	0.635	0.903	0.098	0.534	0.738	0.149	0.354	0.301	0.851	0.513	0.602
	34	0.022	0.157	0.333	0.081	0.035	0.646	0.180	0.001	0.007	0.010	0.013	0.018	0.241	0.038	0.009	0.007	0.006	0.008	0.197	0.001
	35	0.027	0.192	0.026	0.166	0.090	0.596	0.212	0.017	0.028	0.071	0.030	0.388	0.263	0.101	0.281	0.042	0.042	0.016	0.233	0.001
	36	0.947	0.598	0.075	0.622	0.857	0.454	0.562	0.932	0.886	0.887	0.952	0.699	0.563	0.872	0.767	0.633	0.593	0.908	0.561	0.993
	37	0.972	0.800	0.974	0.830	0.903	0.394	0.788	0.983	0.970	0.925	0.968	0.606	0.736	0.895	0.714	0.956	0.957	0.983	0.765	0.999
	38	0.050	0.390	0.925	0.372	0.134	0.536	0.437	0.068	0.109	0.107	0.046	0.295	0.437	0.123	0.229	0.361	0.401	0.089	0.436	0.006
	39	0.573	0.087	0.522	0.616	0.244	0.017	0.657	0.672	0.723	0.711	0.658	0.954	0.597	0.235	0.931	0.798	0.873	0.412	0.619	0.987
	40	0.597	0.986	0.620	0.882	0.965	0.953	0.678	0.987	0.877	0.915	0.686	0.953	0.644	0.965	0.970	0.974	0.967	0.942	0.692	0.998
	41	0.417	0.908	0.478	0.378	0.743	0.982	0.342	0.327	0.268	0.279	0.334	0.044	0.402	0.758	0.067	0.197	0.124	0.581	0.378	0.012
	42	0.392	0.013	0.380	0.115	0.032	0.044	0.321	0.013	0.118	0.080	0.306	0.046	0.356	0.033	0.029	0.025	0.032	0.056	0.305	0.002
	43	0.426	0.018	0.034	0.219	0.082	0.033	0.362	0.112	0.263	0.295	0.442	0.550	0.383	0.090	0.451	0.105	0.137	0.097	0.350	0.233
	44	0.451	0.928	0.058	0.546	0.868	0.975	0.385	0.718	0.473	0.610	0.473	0.544	0.430	0.885	0.608	0.445	0.345	0.689	0.425	0.478
	45	0.563	0.980	0.966	0.776	0.912	0.965	0.636	0.888	0.729	0.694	0.549	0.444	0.617	0.906	0.544	0.891	0.860	0.900	0.647	0.756
	46	0.539	0.068	0.942	0.447	0.123	0.024	0.614	0.281	0.517	0.379	0.519	0.449	0.569	0.111	0.387	0.548	0.650	0.305	0.572	0.507
	47	0.529	0.548	0.065	0.663	0.672	0.443	0.545	0.847	0.704	0.802	0.637	0.964	0.528	0.687	0.961	0.759	0.774	0.610	0.547	0.985
	48	0.351	0.229	0.030	0.140	0.236	0.607	0.225	0.048	0.107	0.134	0.286	0.058	0.293	0.265	0.053	0.018	0.012	0.138	0.244	0.002
	49	0.460	0.440	0.935	0.331	0.314	0.547	0.454	0.153	0.287	0.190	0.355	0.034	0.471	0.305	0.038	0.235	0.222	0.383	0.450	0.013
	50	0.639	0.762	0.970	0.856	0.751	0.384	0.774	0.952	0.888	0.860	0.706	0.940	0.707	0.727	0.945	0.981	0.987	0.858	0.754	0.998
	51	0.495	0.494	0.500	0.497	0.492	0.495	0.499	0.499	0.495	0.494	0.496	0.497	0.500	0.496	0.498	0.496	0.497	0.496	0.498	0.493
	Range	0.988	0.988	0.983	0.988	0.986	0.993	0.985	0.998	0.993	0.980	0.988	0.994	0.982	0.987	0.992	0.985	0.987	0.991	0.980	0.999

Condition no.	RHM no.	BD1	BD2	BD3	BD4	BD5	BD6	BD7	BD8	BD9	BD10	BD11	BD12	BD13	BD14	BD15	BD16	BD17	BD18	BD19	BD20
5	1	0.078	0.555	0.015	0.001	0.001	0.017	0.175	0.308	0.013	0.071	0.015	0.079	0.345	0.017	0.065	0.026	0.090	0.212	0.124	0.085
	2	0.026	0.418	0.036	0.001	0.001	0.019	0.117	0.013	0.017	0.068	0.012	0.024	0.330	0.022	0.088	0.041	0.005	0.218	0.008	0.026
	3	0.092	0.332	0.354	0.116	0.074	0.204	0.257	0.004	0.219	0.264	0.156	0.083	0.410	0.227	0.345	0.304	0.011	0.382	0.012	0.083
	4	0.524	0.340	0.898	0.960	0.993	0.819	0.642	0.066	0.849	0.727	0.795	0.502	0.545	0.833	0.785	0.847	0.249	0.641	0.212	0.493
	5	0.921	0.439	0.985	0.999	0.999	0.983	0.897	0.691	0.987	0.932	0.985	0.917	0.650	0.983	0.935	0.976	0.910	0.793	0.871	0.912
	6	0.973	0.577	0.965	0.999	0.999	0.981	0.935	0.987	0.984	0.935	0.988	0.974	0.665	0.979	0.912	0.962	0.995	0.788	0.992	0.973
	7	0.905	0.664	0.650	0.891	0.932	0.795	0.836	0.996	0.784	0.743	0.844	0.913	0.585	0.775	0.654	0.705	0.989	0.625	0.988	0.914
	8	0.471	0.656	0.104	0.043	0.008	0.180	0.485	0.934	0.153	0.281	0.205	0.489	0.449	0.169	0.214	0.159	0.752	0.366	0.781	0.500
	9	0.163	0.383	0.035	0.004	0.001	0.044	0.267	0.383	0.026	0.086	0.040	0.042	0.023	0.038	0.054	0.041	0.060	0.231	0.160	0.043
	10	0.510	0.286	0.347	0.466	0.231	0.387	0.561	0.532	0.306	0.323	0.382	0.150	0.008	0.347	0.225	0.304	0.194	0.407	0.400	0.143
	11	0.845	0.307	0.896	0.994	0.999	0.902	0.825	0.659	0.889	0.765	0.908	0.599	0.076	0.888	0.705	0.847	0.632	0.658	0.735	0.581
	12	0.834	0.612	0.966	0.996	0.999	0.955	0.829	0.616	0.974	0.918	0.960	0.956	0.976	0.962	0.946	0.961	0.941	0.774	0.834	0.956
	13	0.485	0.709	0.657	0.549	0.782	0.612	0.569	0.467	0.696	0.685	0.618	0.845	0.992	0.655	0.774	0.705	0.807	0.600	0.591	0.853
	14	0.152	0.688	0.106	0.006	0.002	0.097	0.272	0.340	0.112	0.241	0.092	0.392	0.922	0.113	0.295	0.159	0.369	0.349	0.258	0.412
	15	0.016	0.052	0.055	0.002	0.001	0.012	0.227	0.149	0.044	0.181	0.021	0.055	0.237	0.049	0.011	0.119	0.306	0.235	0.088	0.059
	16	0.052	0.007	0.461	0.336	0.615	0.138	0.490	0.166	0.429	0.574	0.240	0.196	0.269	0.408	0.042	0.610	0.732	0.414	0.223	0.199
	17	0.441	0.033	0.929	0.989	0.999	0.767	0.790	0.369	0.927	0.881	0.851	0.648	0.437	0.908	0.439	0.944	0.917	0.663	0.606	0.642
	18	0.984	0.947	0.947	0.998	0.999	0.988	0.859	0.850	0.957	0.824	0.979	0.942	0.758	0.952	0.989	0.886	0.695	0.770	0.908	0.939
	19	0.947	0.992	0.543	0.678	0.402	0.861	0.638	0.833	0.574	0.434	0.760	0.797	0.726	0.594	0.958	0.400	0.268	0.593	0.770	0.796
	20	0.555	0.966	0.073	0.012	0.001	0.233	0.316	0.629	0.074	0.123	0.149	0.343	0.558	0.093	0.561	0.059	0.083	0.344	0.385	0.352
	21	0.184	0.464	0.266	0.041	0.093	0.118	0.796	0.429	0.274	0.792	0.145	0.360	0.464	0.241	0.393	0.409	0.368	0.895	0.476	0.383
	22	0.557	0.393	0.900	0.884	0.999	0.672	0.986	0.598	0.916	0.996	0.752	0.815	0.605	0.868	0.871	0.948	0.805	0.995	0.856	0.828
	23	0.864	0.383	0.993	0.999	0.999	0.965	0.991	0.701	0.995	0.998	0.978	0.947	0.679	0.989	0.969	0.994	0.940	0.992	0.940	0.948
	24	0.813	0.531	0.737	0.963	0.914	0.881	0.309	0.569	0.729	0.214	0.855	0.631	0.531	0.761	0.607	0.601	0.633	0.108	0.515	0.610
	25	0.438	0.603	0.102	0.124	0.001	0.327	0.031	0.401	0.085	0.005	0.248	0.179	0.389	0.134	0.129	0.055	0.195	0.005	0.138	0.168
	26	0.133	0.612	0.008	0.001	0.001	0.035	0.020	0.297	0.005	0.002	0.022	0.050	0.316	0.011	0.031	0.006	0.060	0.009	0.057	0.050
	27	0.180	0.241	0.293	0.181	0.060	0.216	0.337	0.035	0.182	0.219	0.176	0.044	0.031	0.209	0.208	0.232	0.013	0.351	0.037	0.042
	28	0.829	0.461	0.497	0.789	0.700	0.648	0.768	0.972	0.577	0.553	0.692	0.593	0.060	0.601	0.400	0.506	0.845	0.522	0.922	0.584
	29	0.817	0.755	0.711	0.829	0.945	0.783	0.773	0.964	0.820	0.787	0.823	0.954	0.968	0.793	0.792	0.776	0.987	0.656	0.961	0.957
	30	0.168	0.534	0.508	0.222	0.315	0.351	0.342	0.027	0.425	0.456	0.308	0.398	0.938	0.402	0.599	0.505	0.155	0.485	0.075	0.409
	31	0.019	0.021	0.369	0.125	0.205	0.088	0.292	0.005	0.249	0.375	0.112	0.057	0.276	0.244	0.066	0.432	0.118	0.356	0.016	0.058
	32	0.414	0.077	0.579	0.713	0.895	0.426	0.728	0.880	0.665	0.722	0.585	0.642	0.390	0.644	0.172	0.717	0.981	0.527	0.855	0.645
	33	0.981	0.978	0.636	0.883	0.807	0.912	0.809	0.995	0.753	0.633	0.888	0.940	0.719	0.759	0.934	0.578	0.883	0.651	0.983	0.940
	34	0.581	0.921	0.425	0.300	0.114	0.573	0.390	0.119	0.337	0.285	0.415	0.349	0.605	0.358	0.827	0.292	0.020	0.480	0.140	0.349
	35	0.202	0.309	0.739	0.497	0.868	0.394	0.848	0.046	0.665	0.920	0.407	0.367	0.512	0.602	0.698	0.782	0.155	0.946	0.198	0.380
	36	0.849	0.543	0.880	0.956	0.999	0.815	0.985	0.979	0.937	0.990	0.884	0.945	0.634	0.907	0.860	0.936	0.987	0.980	0.991	0.949
	37	0.794	0.686	0.264	0.518	0.141	0.605	0.242	0.954	0.338	0.083	0.593	0.625	0.482	0.401	0.302	0.226	0.846	0.056	0.796	0.613
	38	0.148	0.452	0.122	0.048	0.001	0.184	0.032	0.021	0.064	0.011	0.116	0.052	0.360	0.094	0.140	0.067	0.013	0.021	0.009	0.049
	39	0.130	0.017	0.363	0.356	0.374	0.166	0.509	0.264	0.314	0.422	0.238	0.091	0.016	0.329	0.039	0.433	0.431	0.373	0.238	0.089
	40	0.120	0.091	0.585	0.413	0.773	0.285	0.515	0.228	0.593	0.680	0.387	0.547	0.897	0.547	0.244	0.717	0.853	0.509	0.355	0.560
	41	0.868	0.983	0.641	0.658	0.642	0.834	0.620	0.734	0.689	0.586	0.762	0.905	0.983	0.673	0.961	0.578	0.569	0.634	0.755	0.909
	42	0.877	0.907	0.420	0.602	0.240	0.714	0.614	0.770	0.410	0.327	0.613	0.444	0.100	0.456	0.755	0.292	0.147	0.499	0.636	0.434
	43	0.548	0.278	0.735	0.781	0.947	0.545	0.945	0.592	0.732	0.937	0.606	0.462	0.065	0.695	0.605	0.783	0.499	0.951	0.718	0.467
	44	0.531	0.579	0.883	0.822	0.996	0.697	0.946	0.546	0.910	0.986	0.756	0.912	0.971	0.858	0.909	0.936	0.889	0.977	0.821	0.922
	45	0.447	0.718	0.269	0.230	0.057	0.454	0.102	0.407	0.271	0.066	0.394	0.528	0.934	0.307	0.395	0.225	0.502	0.051	0.274	0.526
	46	0.465	0.416	0.119	0.188	0.004	0.302	0.100	0.452	0.092	0.015	0.244	0.084	0.028	0.144	0.091	0.067	0.112	0.024	0.173	0.076
	47	0.148	0.028	0.799	0.704	0.991	0.325	0.929	0.305	0.802	0.976	0.492	0.514	0.404	0.734	0.335	0.910	0.852	0.952	0.587	0.530
	48	0.893	0.937	0.837	0.878	0.975	0.861	0.959	0.805	0.866	0.959	0.837	0.890	0.731	0.831	0.979	0.832	0.568	0.977	0.900	0.896
	49	0.849	0.972	0.205	0.309	0.011	0.674	0.127	0.694	0.200	0.025	0.508	0.477	0.591	0.269	0.665	0.094	0.148	0.050	0.404	0.463
	50	0.105	0.062	0.166	0.130	0.027	0.139	0.079	0.194	0.136	0.043	0.163	0.106	0.264	0.171	0.021	0.174	0.433	0.025	0.096	0.101
	51	0.498	0.497	0.502	0.508	0.509	0.499	0.565	0.499	0.501	0.504	0.500	0.495	0.497	0.501	0.500	0.505	0.500	0.504	0.495	0.496
	Range	0.968	0.985	0.985	0.999	0.999	0.977	0.971	0.992	0.989	0.996	0.976	0.950	0.984	0.977	0.978	0.988	0.990	0.990	0.984	0.947

A.1.4. BZ Method

a) $n = 5$

Condition no.	RHM no.	BD1	BD2	BD3	BD4	BD5
1	1	0.900	0.647	0.642	0.571	0.004
	2	0.993	0.829	0.901	0.941	0.847
	3	0.797	0.994	0.986	0.486	0.685
	4	0.408	0.790	0.289	0.937	0.968
	5	0.934	0.994	0.795	0.965	0.899
	6	0.077	0.647	0.154	0.078	0.970
	7	0.989	0.647	0.795	0.840	0.088
	8	0.082	0.028	0.154	0.239	0.029
	9	0.983	0.916	0.642	0.986	0.198
	10	0.014	0.479	0.154	0.008	0.128
	11	0.523	0.221	0.026	0.848	0.287
	12	0.300	0.892	0.462	0.323	0.032
	Range	0.979	0.967	0.960	0.978	0.966
2	1	0.469	0.571	0.663	0.019	0.061
	2	0.237	0.553	0.018	0.213	0.078
	3	0.977	0.983	0.790	0.992	0.898
	4	0.088	0.794	0.094	0.252	0.190
	5	0.712	0.871	0.293	0.986	0.525
	6	0.967	0.631	0.975	0.523	0.938
	7	0.595	0.978	0.943	0.939	0.997
	8	0.993	0.695	0.363	0.944	0.768
	9	0.993	0.991	0.841	0.623	0.920
	10	0.150	0.370	0.514	0.909	0.078
	11	0.191	0.639	0.985	0.147	0.471
	12	0.406	0.091	0.176	0.928	0.126
	13	0.191	0.181	0.029	0.655	0.025
	14	0.116	0.050	0.590	0.070	0.525
	15	0.088	0.111	0.007	0.157	0.471
	16	0.935	0.950	0.995	0.623	0.981
	17	0.065	0.588	0.029	0.770	0.367
	18	0.346	0.239	0.790	0.178	0.872
	19	0.532	0.935	0.066	0.356	0.630
	20	0.088	0.876	0.293	0.840	0.920
	21	0.150	0.353	0.962	0.266	0.078
	Range	0.928	0.940	0.988	0.973	0.972
3	1	0.754	0.351	0.741	0.108	0.257
	2	0.544	0.290	0.701	0.897	0.135
	3	0.897	0.824	0.423	0.990	0.800
	4	0.077	0.007	0.013	0.140	0.061
	5	0.226	0.606	0.039	0.133	0.588
	6	0.701	0.377	0.982	0.524	0.597
	7	0.050	0.271	0.566	0.278	0.026
	8	0.923	0.997	0.932	0.912	0.977
	9	0.008	0.052	0.613	0.087	0.074
	10	0.885	0.548	0.871	0.731	0.961
	11	0.310	0.057	0.124	0.014	0.285
	12	0.256	0.619	0.124	0.879	0.538
	13	0.368	0.493	0.423	0.009	0.285
	14	0.678	0.114	0.039	0.185	0.171
	15	0.417	0.912	0.932	0.620	0.538
	Range	0.915	0.990	0.969	0.981	0.951
4	1	0.873	0.077	0.071	0.950	0.768
	2	0.270	0.125	0.322	0.934	0.864
	3	0.474	0.004	0.147	0.167	0.986
	4	0.575	0.048	0.543	0.990	0.009
	5	0.518	0.170	0.135	0.008	0.886
	6	0.011	0.515	0.252	0.008	0.473
	7	0.115	0.437	0.004	0.056	0.517
	8	0.037	0.774	0.564	0.482	0.165
	9	0.982	0.978	0.759	0.652	0.684
	10	0.985	0.976	0.858	0.985	0.953
	11	0.346	0.125	0.020	0.013	0.109
	12	0.459	0.976	0.435	0.822	0.174
	13	0.822	0.263	0.987	0.945	
	14	0.924	0.303	0.906	0.540	
	15	0.068	0.133	0.246	0.482	
	16	0.969	0.990	0.955	0.955	
	Range	0.974	0.987	0.983	0.982	0.976
5	1	0.847	0.701	0.460	0.968	0.768
	2	0.661	0.143	0.973	0.713	0.864
	3	0.996	0.987	0.957	0.991	0.986
	4	0.314	0.042	0.420	0.246	0.009
	5	0.998	0.560	0.953	0.723	0.886
	6	0.994	0.560	0.888	0.632	0.473
	7	0.963	0.412	0.994	0.797	0.517
	8	0.003	0.143	0.007	0.024	0.165
	9	0.015	0.412	0.440	0.289	0.684
	10	0.338	0.486	0.856	0.882	0.953
	11	0.781	0.216	0.639	0.063	0.109
	12	0.042	0.882	0.657	0.855	0.174
	Range	0.994	0.944	0.988	0.968	0.976

b) $n = 10$

Condition no.	RHM no.	BD1	BD2	BD3	BD4	BD5	BD6	BD7	BD8	BD9	BD10
	1	0.671	0.164	0.975	0.740	0.895	0.513	0.396	0.987	0.977	0.891
	2	0.333	0.313	0.293	0.232	0.098	0.857	0.136	0.012	0.020	0.098
	3	0.992	0.874	0.363	0.232	0.127	0.719	0.529	0.077	0.033	0.054
	4	0.517	0.909	0.293	0.698	0.628	0.940	0.462	0.946	0.968	0.987
	5	0.864	0.866	0.176	0.377	0.301	0.028	0.232	0.116	0.048	0.118
	6	0.333	0.921	0.231	0.653	0.880	0.586	0.321	0.308	0.304	0.444
	7	0.444	0.173	0.943	0.425	0.415	0.011	0.383	0.704	0.431	0.556
	8	0.116	0.533	0.917	0.409	0.446	0.016	0.091	0.461	0.719	0.512
	9	0.990	0.705	0.176	0.232	0.098	0.870	0.859	0.453	0.396	0.388
	10	0.038	0.533	0.293	0.232	0.112	0.417	0.029	0.089	0.267	0.246
	11	0.879	0.997	0.293	0.846	0.846	0.997	0.835	0.922	0.964	0.963
	12	0.430	0.398	0.730	0.541	0.274	0.940	0.905	0.080	0.142	0.220
	13	0.957	0.889	0.231	0.727	0.931	0.976	0.645	0.445	0.383	0.636
	14	0.855	0.988	0.917	0.698	0.657	0.998	0.950	0.328	0.250	0.560
	15	0.015	0.004	0.007	0.109	0.074	0.013	0.212	0.145	0.119	0.024
	16	0.247	0.313	0.514	0.441	0.415	0.513	0.905	0.086	0.112	0.092
	17	0.079	0.849	0.131	0.590	0.685	0.061	0.086	0.922	0.923	0.889
	18	0.886	0.896	0.131	0.541	0.301	0.976	0.939	0.620	0.424	0.608
	19	0.374	0.789	0.841	0.945	0.995	0.655	0.658	0.999	0.999	0.994
1	20	0.893	0.840	0.884	0.924	0.920	0.513	0.993	0.946	0.940	0.939
	21	0.893	0.915	0.991	0.524	0.598	0.998	0.843	0.760	0.831	0.864
	22	0.979	0.896	0.884	0.541	0.507	0.843	0.422	0.952	0.923	0.836
	23	0.416	0.010	0.514	0.425	0.203	0.795	0.620	0.453	0.574	0.298
	24	0.779	0.341	0.943	0.912	0.990	0.968	0.985	0.805	0.807	0.722
	25	0.973	0.993	0.514	0.425	0.328	0.243	0.489	0.183	0.150	0.416
	26	0.165	0.369	0.995	0.300	0.274	0.513	0.243	0.612	0.453	0.498
	27	0.984	0.995	0.884	0.740	0.880	0.999	0.965	0.736	0.616	0.821
	28	0.589	0.355	0.730	0.825	0.657	0.370	0.705	0.854	0.906	0.909
	29	0.060	0.488	0.231	0.524	0.685	0.489	0.515	0.163	0.342	0.186
	30	0.871	0.087	0.514	0.491	0.356	0.777	0.930	0.491	0.517	0.575
	31	0.079	0.518	0.590	0.185	0.046	0.010	0.396	0.020	0.045	0.086
	32	0.165	0.533	0.131	0.055	0.144	0.004	0.151	0.032	0.017	0.176
	33	0.416	0.992	0.293	0.377	0.386	0.924	0.396	0.663	0.560	0.784
	34	0.997	0.789	0.176	0.803	0.846	0.994	0.967	0.748	0.581	0.636
	35	0.282	0.413	0.841	0.968	0.996	0.894	0.750	0.986	0.994	0.927
	36	0.502	0.204	0.094	0.272	0.085	0.777	0.800	0.204	0.431	0.250
	37	0.963	0.778	0.790	0.638	0.598	0.932	0.835	0.072	0.163	0.464
	38	0.295	0.413	0.917	0.491	0.507	0.144	0.275	0.215	0.060	0.216
	Range	0.983	0.994	0.988	0.914	0.949	0.996	0.965	0.987	0.982	0.970
	1	0.988	0.956	0.901	0.668	0.995	0.897	0.965	0.623	0.848	0.797
	2	0.443	0.184	0.154	0.028	0.073	0.047	0.009	0.013	0.012	0.047
	3	0.117	0.212	0.289	0.979	0.459	0.847	0.558	0.916	0.827	0.819
	4	0.084	0.222	0.462	0.486	0.035	0.047	0.033	0.572	0.120	0.036
	5	0.795	0.873	0.960	0.882	0.792	0.941	0.808	0.673	0.803	0.938
	6	0.497	0.568	0.154	0.376	0.887	0.875	0.541	0.572	0.757	0.927
	7	0.925	0.956	0.986	0.998	0.926	0.958	0.988	0.972	0.988	0.980
	8	0.341	0.243	0.462	0.523	0.351	0.436	0.132	0.465	0.400	0.129
	9	0.030	0.103	0.462	0.376	0.035	0.800	0.415	0.267	0.567	0.713
	10	0.692	0.818	0.642	0.929	0.097	0.914	0.831	0.719	0.887	0.913
	11	0.682	0.800	0.795	0.899	0.942	0.970	0.907	0.519	0.930	0.897
	12	0.831	0.790	0.901	0.668	0.743	0.238	0.381	0.623	0.611	0.351
	13	0.042	0.103	0.070	0.051	0.616	0.304	0.363	0.078	0.191	0.169
	14	0.710	0.750	0.960	0.997	0.980	0.978	0.991	0.993	0.988	0.974
	15	0.571	0.658	0.642	0.275	0.351	0.537	0.782	0.623	0.781	0.626
	16	0.486	0.321	0.070	0.244	0.803	0.458	0.662	0.060	0.509	0.702
	17	0.885	0.555	0.462	0.376	0.756	0.319	0.163	0.225	0.193	0.157
	18	0.763	0.916	0.795	0.979	0.968	0.998	0.997	0.993	0.994	0.998
	19	0.997	0.990	0.901	0.791	0.992	0.796	0.820	0.719	0.704	0.620
2	20	0.795	0.435	0.154	0.089	0.743	0.019	0.152	0.187	0.034	0.052
	21	0.795	0.809	0.289	0.668	0.997	0.631	0.694	0.719	0.629	0.744
	22	0.066	0.041	0.289	0.560	0.459	0.749	0.782	0.719	0.796	0.644
	23	0.643	0.645	0.289	0.062	0.164	0.498	0.298	0.034	0.469	0.252
	24	0.371	0.475	0.795	0.994	0.459	0.966	0.944	0.935	0.958	0.920
	25	0.996	0.965	0.795	0.979	0.996	0.941	0.939	0.867	0.954	0.949
	26	0.817	0.893	0.795	0.915	0.585	0.968	0.645	0.935	0.959	0.974
	27	0.401	0.739	0.960	0.633	0.675	0.776	0.927	0.719	0.887	0.840
	28	0.939	0.980	0.795	0.967	0.814	0.958	0.990	0.963	0.935	0.962
	29	0.909	0.859	0.795	0.882	0.780	0.758	0.944	0.894	0.947	0.696
	30	0.040	0.103	0.289	0.216	0.026	0.304	0.594	0.046	0.391	0.425
	31	0.890	0.905	0.642	0.862	0.661	0.279	0.330	0.950	0.285	0.283
	32	0.266	0.286	0.154	0.011	0.136	0.004	0.008	0.124	0.003	0.006
	Range	0.967	0.948	0.917	0.987	0.971	0.994	0.989	0.980	0.992	0.992
	1	0.787	0.696	0.438	0.618	0.838	0.814	0.133	0.719	0.387	0.879
	2	0.984	0.945	0.636	0.953	0.838	0.803	0.541	0.762	0.588	0.184
	3	0.383	0.558	0.771	0.438	0.838	0.754	0.289	0.762	0.933	0.844
	4	0.038	0.139	0.374	0.128	0.360	0.409	0.500	0.719	0.420	0.022
	5	0.003	0.007	0.190	0.001	0.244	0.125	0.500	0.046	0.012	0.062
	6	0.972	0.938	0.815	0.971	0.977	0.980	0.711	0.985	0.952	0.932
	7	0.079	0.165	0.146	0.027	0.086	0.286	0.878	0.078	0.023	0.045
	8	0.977	0.975	0.986	0.981	0.999	0.962	0.929	0.935	0.973	0.989
	9	0.069	0.161	0.975	0.498	0.491	0.208	0.639	0.046	0.029	0.084
	10	0.676	0.425	0.028	0.290	0.151	0.232	0.239	0.046	0.355	0.229
	11	0.669	0.847	0.714	0.986	0.491	0.727	0.888	0.837	0.768	0.336
	12	0.396	0.431	0.079	0.390	0.044	0.315	0.078	0.623	0.555	0.585
	13	0.602	0.520	0.295	0.932	0.086	0.474	0.103	0.623	0.387	0.459
	14	0.894	0.897	0.280	0.547	0.623	0.814	0.922	0.990	0.838	0.522
	15	0.323	0.328	0.979	0.333	0.244	0.315	0.209	0.623	0.420	0.184
	16	0.424	0.387	0.314	0.163	0.001	0.458	0.500	0.225	0.265	0.803
3	17	0.853	0.656	0.112	0.785	0.623	0.345	0.013	0.572	0.387	0.111
	18	0.026	0.013	0.845	0.075	0.086	0.059	0.027	0.003	0.008	0.646
	19	0.076	0.027	0.318	0.269	0.021	0.392	0.027	0.124	0.189	0.336
	20	0.989	0.998	0.975	0.993	0.977	0.898	0.966	0.985	0.991	0.336
	21	0.840	0.968	0.958	0.835	0.742	0.779	0.999	0.972	0.793	0.522
	22	0.581	0.679	0.938	0.928	0.838	0.683	0.856	0.154	0.487	0.879
	23	0.007	0.002	0.547	0.002	0.151	0.038	0.021	0.025	0.023	0.336
	24	0.994	0.950	0.269	0.883	0.491	0.968	0.362	0.963	0.993	0.803
	25	0.991	0.972	0.740	0.944	0.838	0.936	0.639	0.985	0.858	0.879
	26	0.797	0.865	0.996	0.910	0.623	0.836	0.856	0.413	0.555	0.336
	Range	0.991	0.996	0.968	0.992	0.998	0.942	0.986	0.987	0.985	0.967
	1	0.539	0.515	0.250	0.125	0.433	0.367	0.357	0.178	0.957	0.641
	2	0.016	0.179	0.344	0.196	0.993	0.450	0.178	0.355	0.860	0.570
	3	0.891	0.762	0.368	0.981	0.726	0.414	0.936	0.658	0.383	0.247
	4	0.008	0.005	0.020	0.095	0.319	0.311	0.730	0.030	0.966	0.177
	5	0.691	0.701	0.996	0.913	0.319	0.992	0.740	0.894	0.480	0.937
	6	0.407	0.515	0.100	0.445	0.058	0.040	0.146	0.135	0.784	0.247
	7	0.080	0.076	0.032	0.369	0.486	0.007	0.432	0.013	0.480	0.707
	8	0.999	0.995	0.968	0.951	0.967	0.986	0.992	0.988	0.798	0.864
	9	0.985	0.978	0.716	0.999	0.929	0.819	0.997	0.869	0.597	0.999
	10	0.565	0.225	0.045	0.761	0.058	0.089	0.871	0.175	0.328	0.944
	11	0.080	0.043	0.194	0.044	0.798	0.333	0.013	0.185	0.558	0.161
	12	0.898	0.959	0.915	0.523	0.987	0.864	0.625	0.725	0.328	0.785
	13	0.433	0.413	0.442	0.095	0.942	0.212	0.051	0.364	0.402	0.210
	14	0.012	0.254	0.109	0.878	0.976	0.355	0.903	0.181	0.975	0.910
	15	0.446	0.334	0.909	0.471	0.643	0.767	0.809	0.778	0.798	0.210
	16	0.788	0.588	0.813	0.649	0.201	0.653	0.445	0.824	0.722	0.993
4	17	0.394	0.588	0.860	0.523	0.956	0.803	0.850	0.423	0.891	0.228
	18	0.433	0.515	0.135	0.321	0.539	0.378	0.625	0.331	0.076	0.546
	19	0.006	0.161	0.024	0.298	0.914	0.104	0.649	0.156	0.930	0.042
	20	0.201	0.023	0.025	0.106	0.201	0.014	0.012	0.017	0.260	0.097
	21	0.737	0.803	0.524	0.998	0.726	0.835	0.995	0.803	0.558	0.944
	22	0.778	0.124	0.164	0.432	0.008	0.178	0.730	0.114	0.187	0.069
	23	0.849	0.903	0.556	0.974	0.974	0.642	0.954	0.972	0.891	0.910
	24	0.251	0.029	0.051	0.406	0.539	0.290	0.154	0.085	0.441	0.177
	25	0.512	0.505	0.207	0.826	0.192	0.240	0.357	0.619	0.311	0.193
	26	0.617	0.570	0.660	0.740	0.962	0.870	0.761	0.892	0.997	0.570
	27	0.891	0.651	0.362	0.523	0.121	0.300	0.673	0.433	0.003	0.177
	28	0.446	0.542	0.226	0.497	0.857	0.300	0.980	0.580	0.987	0.685
	29	0.070	0.254	0.026	0.132	0.630	0.002	0.118	0.069	0.539	0.008
	30	0.655	0.191	0.149	0.178	0.459	0.063	0.214	0.240	0.017	0.133
	31	0.999	0.980	0.979	0.951	0.807	0.944	0.857	0.947	0.013	0.663
	32	0.472	0.505	0.581	0.685	0.999	0.697	0.871	0.703	0.916	0.728
	33	0.407	0.459	0.185	0.187	0.552	0.104	0.146	0.044	0.277	0.013
	Range	0.993	0.990	0.976	0.955	0.991	0.990	0.985	0.974	0.993	0.991

Condition no.	RHM no.	BD1	BD2	BD3	BD4	BD5	BD6	BD7	BD8	BD9	BD10
	1	0.795	0.938	0.965	0.253	0.982	0.999	0.682	0.802	0.955	0.864
	2	0.795	0.469	0.606	0.462	0.246	0.014	0.102	0.050	0.413	0.388
	3	0.901	0.972	0.890	0.772	0.894	0.965	0.341	0.967	0.903	0.667
	4	0.642	0.872	0.856	0.075	0.334	0.895	0.413	0.802	0.739	0.805
	5	0.642	0.825	0.918	0.740	0.834	0.691	0.204	0.824	0.684	0.717
	6	0.960	0.457	0.524	0.931	0.668	0.142	0.114	0.497	0.691	0.853
	7	0.070	0.457	0.491	0.947	0.845	0.990	0.846	0.779	0.492	0.909
	8	0.642	0.980	0.918	0.984	0.840	0.999	0.732	0.942	0.906	0.953
	9	0.154	0.412	0.134	0.012	0.487	0.001	0.054	0.112	0.531	0.352
	10	0.289	0.108	0.143	0.860	0.615	0.001	0.135	0.140	0.149	0.048
	11	0.642	0.989	0.912	0.836	0.422	0.995	0.682	0.802	0.998	0.170
	12	0.642	0.969	0.941	0.158	0.642	0.342	0.118	0.592	0.953	0.370
	13	0.901	0.972	0.905	0.987	0.973	0.999	0.996	0.967	0.985	0.993
	14	0.795	0.492	0.441	0.608	0.615	0.652	0.397	0.965	0.640	0.317
	15	0.642	0.515	0.361	0.047	0.651	0.008	0.282	0.080	0.281	0.937
	16	0.026	0.650	0.409	0.080	0.334	0.698	0.784	0.331	0.261	0.268
	17	0.642	0.910	0.606	0.028	0.524	0.713	0.319	0.486	0.698	0.684
	18	0.642	0.144	0.361	0.298	0.066	0.980	0.988	0.746	0.294	0.334
	19	0.795	0.315	0.590	0.634	0.334	0.441	0.865	0.381	0.625	0.084
	20	0.986	0.931	0.924	0.853	0.967	0.989	0.612	0.837	0.889	0.975
	21	0.026	0.025	0.050	0.143	0.185	0.002	0.160	0.030	0.044	0.864
	22	0.154	0.884	0.361	0.529	0.413	0.267	0.620	0.201	0.662	0.893
	23	0.795	0.884	0.905	0.242	0.890	0.989	0.802	0.592	0.959	0.099
	24	0.642	0.503	0.865	0.608	0.693	0.975	0.752	0.967	0.698	0.284
	25	0.642	0.284	0.638	0.951	0.840	0.769	0.513	0.755	0.764	0.763
	26	0.026	0.423	0.245	0.115	0.317	0.001	0.003	0.006	0.337	0.284
5	27	0.642	0.275	0.196	0.096	0.120	0.001	0.005	0.284	0.337	0.091
	28	0.289	0.617	0.574	0.960	0.810	0.999	0.987	0.710	0.436	0.982
	29	0.795	0.954	0.924	0.989	0.984	0.999	0.983	0.831	0.925	0.961
	30	0.901	0.942	0.912	0.966	0.953	0.999	0.950	0.983	0.993	0.937
	31	0.642	0.639	0.791	0.983	0.776	0.996	0.765	0.965	0.900	0.238
	32	0.642	0.671	0.574	0.977	0.890	0.999	0.983	0.959	0.810	0.334
	33	0.901	0.777	0.754	0.222	0.276	0.999	0.985	0.979	0.788	0.463
	34	0.795	0.561	0.258	0.193	0.198	0.913	0.496	0.779	0.389	0.717
	35	0.901	0.923	0.638	0.853	0.816	0.184	0.029	0.433	0.877	0.864
	36	0.960	0.935	0.825	0.695	0.377	0.800	0.282	0.956	0.930	0.076
	37	0.642	0.446	0.836	0.671	0.232	0.947	0.479	0.831	0.539	0.137
	38	0.795	0.802	0.814	0.963	0.167	0.458	0.254	0.720	0.916	0.028
	39	0.462	0.018	0.174	0.582	0.021	0.007	0.192	0.266	0.022	0.388
	40	0.795	0.650	0.727	0.943	0.996	0.999	0.886	0.810	0.745	0.893
	41	0.289	0.712	0.441	0.695	0.676	0.800	0.971	0.266	0.476	0.284
	42	0.154	0.050	0.125	0.384	0.066	0.001	0.118	0.165	0.413	0.048
	43	0.795	0.660	0.754	0.298	0.953	0.043	0.016	0.539	0.712	0.917
	44	0.795	0.606	0.606	0.659	0.651	0.999	0.996	0.976	0.397	0.931
	45	0.901	0.335	0.606	0.202	0.856	0.047	0.085	0.443	0.618	0.025
	46	0.154	0.247	0.185	0.621	0.053	0.011	0.241	0.240	0.044	0.048
	47	0.070	0.035	0.109	0.253	0.450	0.001	0.248	0.134	0.048	0.003
	48	0.462	0.357	0.727	0.051	0.276	0.184	0.373	0.755	0.248	0.058
	49	0.642	0.895	0.622	0.828	0.834	0.997	0.962	0.371	0.594	0.717
	50	0.795	0.702	0.606	0.242	0.039	0.246	0.651	0.391	0.420	0.032
	51	0.795	0.793	0.766	0.729	0.872	0.999	0.488	0.994	0.821	0.778
	52	0.795	0.895	0.905	0.071	0.982	0.882	0.198	0.592	0.855	0.557
	Range	0.960	0.971	0.915	0.977	0.975	0.999	0.994	0.987	0.976	0.990

Condition no.	RHM no.	BD1	BD2	BD3	BD4	BD5	BD6	BD7	BD8	BD9	BD10
	1	0.935	0.953	0.129	0.914	0.994	0.769	0.935	0.927	0.935	0.864
	2	0.302	0.738	0.515	0.885	0.331	0.710	0.468	0.279	0.468	0.715
	3	0.972	0.099	0.946	0.596	0.878	0.379	0.151	0.186	0.468	0.089
	4	0.967	0.776	0.544	0.048	0.357	0.956	0.284	0.195	0.498	0.803
	5	0.727	0.996	0.101	0.969	0.899	0.863	0.991	0.994	0.559	0.997
	6	0.034	0.084	0.005	0.083	0.021	0.113	0.274	0.377	0.111	0.089
	7	0.994	0.961	0.991	0.961	0.991	0.937	0.972	0.903	0.999	0.864
	8	0.015	0.221	0.058	0.334	0.070	0.094	0.246	0.508	0.001	0.472
	9	0.821	0.968	0.172	0.773	0.449	0.986	0.966	0.908	0.944	0.983
	10	0.489	0.849	0.905	0.552	0.960	0.659	0.866	0.854	0.980	0.812
	11	0.640	0.221	0.998	0.419	0.216	0.790	0.367	0.289	0.797	0.188
	12	0.627	0.794	0.500	0.680	0.992	0.365	0.617	0.604	0.925	0.793
	13	0.517	0.007	0.162	0.020	0.063	0.492	0.035	0.038	0.054	0.023
	14	0.148	0.696	0.095	0.756	0.750	0.591	0.894	0.918	0.588	0.556
	15	0.233	0.595	0.991	0.463	0.855	0.178	0.776	0.874	0.350	0.556
	16	0.302	0.606	0.014	0.354	0.167	0.434	0.468	0.533	0.901	0.715
	17	0.964	0.986	0.789	0.965	0.999	0.959	0.942	0.832	0.966	0.967
	18	0.086	0.863	0.846	0.961	0.819	0.152	0.872	0.913	0.245	0.905
	19	0.613	0.985	0.001	0.861	0.824	0.710	0.909	0.903	0.797	0.988
	20	0.969	0.498	0.994	0.660	0.695	0.492	0.583	0.569	0.618	0.570
	21	0.289	0.344	0.695	0.463	0.305	0.352	0.560	0.545	0.727	0.584
	22	0.892	0.987	0.863	0.995	0.988	0.941	0.957	0.927	0.994	0.985
	23	0.140	0.170	0.846	0.205	0.020	0.034	0.378	0.545	0.073	0.322
	24	0.691	0.618	0.413	0.914	0.992	0.506	0.660	0.735	0.944	0.514
	25	0.289	0.950	0.292	0.463	0.085	0.178	0.859	0.908	0.200	0.982
	26	0.739	0.378	0.572	0.334	0.586	0.659	0.084	0.084	0.468	0.598
6 (computer workstation)	27	0.392	0.239	0.244	0.190	0.185	0.911	0.131	0.059	0.818	0.083
	28	0.627	0.571	0.933	0.805	0.762	0.379	0.931	0.854	0.588	0.486
	29	0.991	0.652	0.172	0.294	0.955	0.605	0.549	0.581	0.901	0.639
	30	0.739	0.033	0.615	0.043	0.261	0.107	0.007	0.013	0.097	0.064
	31	0.339	0.882	0.067	0.994	0.629	0.088	0.988	0.982	0.618	0.840
	32	0.339	0.928	0.809	0.574	0.635	0.990	0.846	0.705	0.914	0.864
	33	0.066	0.099	0.050	0.175	0.091	0.492	0.119	0.269	0.004	0.160
	34	0.062	0.070	0.732	0.092	0.121	0.063	0.014	0.041	0.047	0.188
	Range	0.979	0.989	0.996	0.975	0.980	0.955	0.983	0.981	0.999	0.973

c) $n = 11$ (application to ergonomic design of a computer workstation in Chapter 6)

RHM no.	BD1	BD2	BD3	BD4	BD5	BD6	BD7	BD8	BD9	BD10	BD11
1	0.302	0.796	0.064	0.337	0.077	0.224	0.896	0.040	0.378	0.063	0.088
2	0.423	0.992	0.966	0.839	0.969	0.378	0.275	0.915	0.579	0.957	0.925
3	0.066	0.240	0.026	0.042	0.002	0.024	0.379	0.001	0.085	0.012	0.060
4	0.482	0.763	0.453	0.630	0.723	0.334	0.492	0.965	0.588	0.783	0.397
5	0.510	0.235	0.007	0.091	0.068	0.211	0.263	0.368	0.111	0.142	0.011
6	0.330	0.872	0.823	0.783	0.984	0.774	0.591	0.989	0.709	0.979	0.957
7	0.098	0.872	0.793	0.712	0.535	0.770	0.365	0.165	0.438	0.515	0.670
8	0.586	0.563	0.799	0.814	0.960	0.867	0.456	0.947	0.864	0.929	0.905
9	0.410	0.817	0.805	0.783	0.925	0.543	0.120	0.947	0.701	0.933	0.877
10	0.066	0.507	0.710	0.337	0.783	0.514	0.015	0.883	0.104	0.755	0.639
11	0.772	0.507	0.146	0.345	0.131	0.083	0.979	0.261	0.727	0.203	0.083
12	0.613	0.496	0.737	0.860	0.807	0.869	0.174	0.556	0.838	0.587	0.747
13	0.918	0.319	0.246	0.622	0.081	0.817	0.805	0.192	0.895	0.024	0.256
14	0.173	0.860	0.613	0.196	0.680	0.190	0.406	0.416	0.047	0.604	0.205
15	0.081	0.199	0.328	0.173	0.398	0.091	0.100	0.104	0.015	0.400	0.148
16	0.098	0.826	0.016	0.094	0.208	0.020	0.520	0.361	0.142	0.212	0.075
17	0.278	0.998	0.805	0.668	0.805	0.659	0.124	0.493	0.483	0.868	0.848
18	0.961	0.052	0.826	0.933	0.960	0.902	0.974	0.922	0.727	0.942	0.967
19	0.243	0.446	0.221	0.315	0.332	0.206	0.810	0.665	0.818	0.199	0.596
20	0.982	0.877	0.710	0.779	0.581	0.705	0.999	0.860	0.978	0.418	0.781
21	0.073	0.309	0.013	0.094	0.177	0.042	0.139	0.107	0.043	0.058	0.175
22	0.086	0.285	0.146	0.286	0.602	0.399	0.011	0.727	0.020	0.868	0.530
23	0.995	0.595	0.744	0.921	0.779	0.838	0.653	0.925	0.908	0.633	0.710
24	0.861	0.383	0.314	0.740	0.493	0.589	0.563	0.448	0.914	0.400	0.552
25	0.295	0.601	0.477	0.226	0.319	0.213	0.740	0.160	0.245	0.343	0.314
26	0.918	0.991	0.989	0.962	0.998	0.975	0.698	0.977	0.963	0.989	0.971
27	0.489	0.992	0.598	0.637	0.424	0.413	0.999	0.690	0.838	0.436	0.574
28	0.084	0.116	0.221	0.134	0.136	0.147	0.584	0.273	0.200	0.107	0.092
29	0.633	0.992	0.526	0.958	0.585	0.920	0.549	0.584	0.914	0.730	0.842
30	0.894	0.916	0.582	0.876	0.371	0.979	0.633	0.339	0.867	0.286	0.403
31	0.647	0.826	0.421	0.353	0.198	0.489	0.932	0.375	0.142	0.230	0.129
32	0.999	0.955	0.897	0.918	0.724	0.984	0.890	0.625	0.970	0.616	0.794
33	0.739	0.981	0.942	0.950	0.973	0.799	0.477	0.777	0.901	0.956	0.996
34	0.653	0.953	0.851	0.825	0.717	0.938	0.235	0.639	0.740	0.871	0.375
Range	0.933	0.946	0.982	0.920	0.996	0.965	0.988	0.989	0.963	0.977	0.985

d) $n = 15$

Condition no.	RHM no.	BD1	BD2	BD3	BD4	BD5	BD6	BD7	BD8	BD9	BD10	BD11	BD12	BD13	BD14	BD15
	1	0.471	0.319	0.732	0.162	0.347	0.430	0.287	0.747	0.182	0.275	0.131	0.618	0.233	0.765	0.878
	2	0.271	0.400	0.166	0.519	0.823	0.631	0.705	0.788	0.328	0.059	0.363	0.227	0.453	0.654	0.106
	3	0.997	0.969	0.960	0.958	0.921	0.954	0.966	0.992	0.949	0.980	0.975	0.841	0.953	0.797	0.829
	4	0.367	0.516	0.001	0.911	0.806	0.940	0.903	0.150	0.846	0.663	0.514	0.481	0.874	0.419	0.088
	5	0.997	0.974	0.030	0.999	0.996	0.998	0.999	0.971	0.997	0.879	0.514	0.911	0.970	0.897	0.863
	6	0.807	0.372	0.693	0.301	0.173	0.200	0.184	0.643	0.328	0.179	0.590	0.911	0.078	0.118	0.905
	7	0.156	0.089	0.960	0.003	0.006	0.002	0.005	0.284	0.028	0.266	0.293	0.618	0.072	0.570	0.448
	8	0.271	0.372	0.166	0.780	0.683	0.880	0.910	0.990	0.785	0.293	0.176	0.841	0.644	0.484	0.956
	9	0.679	0.222	0.145	0.259	0.497	0.345	0.337	0.041	0.064	0.284	0.663	0.742	0.485	0.377	0.006
	10	0.872	0.923	0.211	0.995	0.984	0.956	0.959	0.630	0.997	0.895	0.962	0.999	0.977	0.826	0.855
	11	0.920	0.987	0.486	0.974	0.977	0.982	0.987	0.967	0.996	0.999	0.962	0.980	0.983	0.998	0.953
	12	0.679	0.545	0.166	0.967	0.930	0.932	0.889	0.108	0.920	0.257	0.231	0.911	0.826	0.141	0.128
	13	0.997	0.969	0.127	0.951	0.990	0.978	0.983	0.914	0.895	0.850	0.943	0.136	0.934	0.840	0.698
	14	0.471	0.886	0.817	0.916	0.823	0.788	0.745	0.988	0.598	0.755	0.790	0.742	0.904	0.995	0.779
	15	0.418	0.293	0.152	0.361	0.497	0.588	0.571	0.368	0.476	0.497	0.231	0.074	0.004	0.244	0.917
	16	0.525	0.458	0.159	0.210	0.247	0.465	0.413	0.047	0.598	0.643	0.917	0.980	0.374	0.693	0.229
	17	0.271	0.163	0.991	0.065	0.043	0.050	0.090	0.284	0.054	0.123	0.029	0.227	0.057	0.023	0.378
	18	0.126	0.345	0.987	0.400	0.395	0.361	0.420	0.758	0.476	0.069	0.231	0.136	0.259	0.812	0.477
	19	0.981	0.820	0.055	0.870	0.980	0.912	0.930	0.251	0.931	0.956	0.590	0.481	0.826	0.279	0.128
	20	0.228	0.516	0.030	0.915	0.953	0.830	0.841	0.166	0.712	0.692	0.663	0.227	0.566	0.730	0.021
	21	0.807	0.820	0.006	0.638	0.759	0.703	0.625	0.592	0.598	0.831	0.437	0.227	0.957	0.505	0.067
	22	0.046	0.101	0.908	0.042	0.043	0.033	0.027	0.981	0.085	0.321	0.917	0.618	0.072	0.227	0.591
	23	0.061	0.163	0.375	0.191	0.383	0.571	0.579	0.080	0.274	0.186	0.018	0.136	0.233	0.279	0.810
	24	0.679	0.684	0.375	0.575	0.728	0.253	0.267	0.011	0.628	0.381	0.176	0.618	0.934	0.730	0.040
	25	0.679	0.089	0.220	0.061	0.103	0.053	0.041	0.058	0.046	0.201	0.231	0.136	0.246	0.052	0.577
1	26	0.953	0.942	0.264	0.890	0.977	0.893	0.889	0.864	0.880	0.999	0.790	0.481	0.975	0.956	0.953
	27	0.525	0.400	0.237	0.936	0.855	0.755	0.836	0.962	0.785	0.284	0.975	0.074	0.582	0.059	0.632
	28	0.061	0.163	0.312	0.108	0.300	0.225	0.217	0.898	0.127	0.117	0.066	0.006	0.048	0.484	0.198
	29	0.228	0.429	0.180	0.160	0.173	0.187	0.212	0.201	0.415	0.454	0.985	0.345	0.165	0.613	0.779
	30	0.679	0.089	0.475	0.403	0.347	0.361	0.344	0.407	0.182	0.475	0.131	0.481	0.731	0.570	0.970
	31	0.578	0.886	0.609	0.446	0.371	0.553	0.555	0.343	0.785	0.932	0.176	0.980	0.816	0.693	0.968
	32	0.768	0.400	0.995	0.367	0.092	0.170	0.149	0.987	0.538	0.720	0.044	0.227	0.374	0.419	0.993
	33	0.156	0.163	0.576	0.111	0.312	0.219	0.229	0.003	0.203	0.165	0.841	0.227	0.008	0.118	0.325
	34	0.726	0.602	0.888	0.856	0.574	0.491	0.594	0.726	0.895	0.050	0.437	0.481	0.437	0.613	0.491
	35	0.842	0.820	0.777	0.696	0.574	0.755	0.764	0.066	0.895	0.831	0.975	0.742	0.566	0.979	0.072
	36	0.898	0.974	0.683	0.996	0.983	0.993	0.994	0.981	0.931	0.763	0.663	0.841	0.904	0.994	0.959
	37	0.938	0.950	0.865	0.684	0.728	0.664	0.662	0.841	0.249	0.989	0.975	0.955	0.703	0.931	0.899
	38	0.953	0.969	0.683	0.980	0.967	0.987	0.982	0.964	0.974	0.971	0.991	0.997	0.660	0.865	0.659
	39	0.630	0.757	0.950	0.154	0.068	0.091	0.100	0.691	0.446	0.837	0.176	0.345	0.233	0.065	0.378
	40	0.920	0.820	0.032	0.978	0.997	0.988	0.992	0.987	0.974	0.692	0.985	0.136	0.469	0.748	0.892
	41	0.046	0.372	0.008	0.725	0.797	0.876	0.885	0.142	0.737	0.275	0.884	0.742	0.209	0.129	0.188
	42	0.965	0.963	0.323	0.820	0.797	0.964	0.933	0.472	0.920	0.810	0.363	0.980	0.757	0.997	0.477
	43	0.898	0.839	0.159	0.687	0.847	0.964	0.928	0.841	0.657	0.956	0.975	0.618	0.598	0.907	0.549
	44	0.920	0.800	0.004	0.988	0.991	0.994	0.992	0.108	0.974	0.454	0.975	0.136	0.826	0.931	0.113
	45	0.013	0.027	0.430	0.149	0.257	0.148	0.217	0.262	0.225	0.038	0.975	0.227	0.034	0.011	0.067
	46	0.317	0.345	0.801	0.361	0.510	0.703	0.719	0.999	0.225	0.592	0.790	0.345	0.176	0.244	0.975
	47	0.156	0.222	0.173	0.312	0.587	0.768	0.662	0.841	0.274	0.128	0.176	0.618	0.176	0.065	0.534
	48	0.768	0.574	0.971	0.120	0.068	0.034	0.057	0.183	0.386	0.331	0.094	0.074	0.437	0.181	0.275
	49	0.938	0.974	0.419	0.969	0.959	0.782	0.873	0.433	0.995	0.921	0.985	0.841	0.865	0.317	0.420
	50	0.156	0.319	0.831	0.272	0.300	0.438	0.389	0.041	0.301	0.146	0.018	0.074	0.048	0.419	0.032
	Range	0.984	0.960	0.993	0.997	0.991	0.996	0.994	0.996	0.969	0.962	0.972	0.993	0.979	0.986	0.988
	1	0.454	0.136	0.868	0.417	0.267	0.859	0.377	0.136	0.648	0.129	0.742	0.877	0.699	0.283	0.812
	2	0.388	0.345	0.248	0.441	0.287	0.669	0.652	0.739	0.648	0.118	0.151	0.334	0.872	0.799	0.592
	3	0.488	0.227	0.784	0.759	0.349	0.264	0.322	0.715	0.924	0.206	0.151	0.788	0.887	0.961	0.336
	4	0.435	0.841	0.784	0.042	0.181	0.669	0.342	0.101	0.924	0.267	0.742	0.763	0.139	0.929	0.141
	5	0.589	0.618	0.081	0.347	0.166	0.419	0.515	0.727	0.005	0.399	0.491	0.089	0.464	0.006	0.072
	6	0.320	0.911	0.313	0.992	0.248	0.806	0.377	0.083	0.523	0.912	0.360	0.419	0.796	0.414	0.440
	7	0.631	0.955	0.294	0.144	0.708	0.419	0.813	0.715	0.648	0.726	0.996	0.267	0.495	0.289	0.797
	8	0.202	0.841	0.170	0.086	0.067	0.419	0.183	0.598	0.942	0.714	0.623	0.113	0.196	0.761	0.080
	9	0.999	0.911	0.962	0.987	0.998	0.973	0.997	0.999	0.988	0.794	0.951	0.929	0.945	0.979	0.897
	10	0.882	0.481	0.323	0.953	0.957	0.264	0.933	0.831	0.693	0.902	0.838	0.199	0.434	0.707	0.377
	11	0.598	0.345	0.323	0.021	0.462	0.017	0.515	0.922	0.667	0.305	0.491	0.507	0.218	0.536	0.153
	12	0.986	0.481	0.914	0.999	0.845	0.504	0.977	0.998	0.979	0.980	0.623	0.940	0.953	0.988	0.897
	13	0.254	0.841	0.333	0.632	0.708	0.419	0.559	0.101	0.009	0.902	0.086	0.408	0.464	0.185	0.398
	14	0.988	0.742	0.985	0.991	0.998	0.504	0.933	0.927	0.487	0.896	0.491	0.988	0.953	0.452	0.979
	15	0.351	0.742	0.675	0.632	0.938	0.742	0.765	0.114	0.723	0.993	0.838	0.708	0.525	0.952	0.505
	16	0.989	0.618	0.995	0.999	0.994	0.934	0.998	0.979	0.995	0.999	0.951	0.991	0.960	0.999	0.924
	17	0.063	0.006	0.223	0.207	0.093	0.045	0.086	0.064	0.747	0.121	0.742	0.231	0.404	0.241	0.484
	18	0.730	0.618	0.323	0.609	0.248	0.669	0.349	0.906	0.641	0.406	0.151	0.199	0.108	0.498	0.181
	19	0.811	0.227	0.937	0.086	0.974	0.504	0.841	0.472	0.648	0.636	0.151	0.940	0.750	0.231	0.693
	20	0.231	0.481	0.215	0.347	0.248	0.264	0.478	0.543	0.362	0.889	0.086	0.130	0.464	0.958	0.613
	21	0.848	0.997	0.515	0.979	0.747	0.999	0.938	0.879	0.445	0.917	0.977	0.474	0.925	0.853	0.981
	22	0.984	0.980	0.767	0.894	0.945	0.934	0.964	0.962	0.979	0.656	0.951	0.718	0.375	0.864	0.570
	23	0.186	0.016	0.313	0.262	0.138	0.200	0.126	0.472	0.025	0.292	0.021	0.365	0.241	0.631	0.440
	24	0.671	0.618	0.493	0.370	0.578	0.859	0.588	0.793	0.279	0.267	0.244	0.507	0.053	0.649	0.840
	25	0.360	0.911	0.207	0.632	0.645	0.588	0.771	0.335	0.023	0.435	0.951	0.249	0.986	0.081	0.887
	26	0.551	0.911	0.644	0.719	0.894	0.419	0.427	0.652	0.972	0.879	0.623	0.474	0.726	0.952	0.398
	27	0.242	0.136	0.364	0.032	0.328	0.200	0.224	0.160	0.182	0.515	0.021	0.345	0.644	0.074	0.950
2	28	0.622	0.841	0.958	0.959	0.904	0.995	0.363	0.114	0.501	0.428	0.907	0.970	0.699	0.395	0.633
	29	0.329	0.074	0.822	0.032	0.708	0.102	0.309	0.188	0.990	0.358	0.151	0.833	0.464	0.841	0.261
	30	0.006	0.074	0.039	0.262	0.002	0.102	0.026	0.003	0.033	0.196	0.151	0.028	0.266	0.044	0.336
	31	0.798	0.345	0.364	0.857	0.978	0.145	0.748	0.872	0.487	0.364	0.623	0.430	0.887	0.745	0.916
	32	0.388	0.618	0.248	0.843	0.213	0.901	0.253	0.458	0.279	0.181	0.244	0.184	0.750	0.799	0.527
	33	0.125	0.980	0.066	0.028	0.213	0.339	0.193	0.348	0.396	0.222	0.907	0.044	0.495	0.305	0.797
	34	0.551	0.227	0.581	0.538	0.708	0.588	0.277	0.665	0.985	0.186	0.491	0.452	0.750	0.588	0.484
	35	0.406	0.345	0.374	0.001	0.213	0.504	0.303	0.529	0.910	0.385	0.623	0.397	0.027	0.960	0.080
	36	0.988	0.345	0.989	0.465	0.923	0.339	0.886	0.979	0.431	0.399	0.623	0.994	0.464	0.402	0.317
	37	0.026	0.227	0.099	0.262	0.060	0.264	0.011	0.348	0.621	0.449	0.021	0.169	0.045	0.613	0.006
	38	0.923	0.742	0.758	0.991	0.485	0.669	0.753	0.991	0.904	0.587	0.742	0.727	0.241	0.549	0.712
	39	0.654	0.742	0.613	0.740	0.485	0.957	0.493	0.416	0.244	0.789	0.838	0.659	0.991	0.063	0.797
	40	0.133	0.136	0.231	0.010	0.248	0.339	0.040	0.188	0.026	0.121	0.021	0.169	0.123	0.037	0.010
	41	0.968	0.841	0.775	0.915	0.971	0.669	0.998	0.959	0.551	0.714	0.838	0.541	0.925	0.498	0.965
	42	0.814	0.841	0.955	0.915	0.578	0.588	0.698	0.430	0.304	0.778	0.021	0.929	0.699	0.189	0.484
	43	0.507	0.911	0.385	0.777	0.914	0.669	0.874	0.486	0.135	0.726	0.244	0.518	0.464	0.346	0.693
	44	0.216	0.841	0.014	0.158	0.166	0.669	0.356	0.416	0.572	0.298	0.491	0.013	0.139	0.588	0.037
	45	0.324	0.742	0.428	0.538	0.032	0.934	0.130	0.691	0.735	0.587	0.742	0.376	0.139	0.853	0.261
	46	0.880	0.136	0.741	0.964	0.307	0.200	0.889	0.879	0.641	0.551	0.742	0.780	0.346	0.947	0.279
	47	0.925	0.036	0.694	0.953	0.967	0.145	0.990	0.941	0.586	0.942	0.044	0.595	0.953	0.918	0.945
	48	0.946	0.955	0.967	0.905	0.999	0.934	0.935	0.703	0.940	0.966	0.907	0.943	0.914	0.931	0.984
	49	0.532	0.742	0.849	0.812	0.181	0.742	0.356	0.557	0.641	0.515	0.491	0.913	0.157	0.988	0.153
	50	0.689	0.006	0.385	0.262	0.328	0.045	0.391	0.872	0.438	0.045	0.742	0.376	0.318	0.096	0.261
	51	0.146	0.841	0.602	0.586	0.267	0.901	0.219	0.007	0.424	0.318	0.491	0.485	0.953	0.221	0.748
	52	0.192	0.074	0.207	0.107	0.152	0.339	0.442	0.727	0.202	0.047	0.044	0.223	0.027	0.346	0.059
	53	0.927	0.036	0.694	0.894	0.983	0.419	0.968	0.840	0.143	0.629	0.491	0.617	0.855	0.198	0.673
	54	0.015	0.136	0.004	0.086	0.093	0.010	0.130	0.239	0.558	0.056	0.151	0.001	0.082	0.272	0.244
	55	0.794	0.345	0.304	0.207	0.349	0.200	0.617	0.691	0.028	0.052	0.244	0.345	0.139	0.096	0.693
	Range	0.993	0.991	0.991	0.999	0.998	0.990	0.986	0.996	0.990	0.955	0.975	0.993	0.964	0.993	0.977

Condition no.	RHM no.	BD1	BD2	BD3	BD4	BD5	BD6	BD7	BD8	BD9	BD10	BD11	BD12	BD13	BD14	BD15
	1	0.617	0.286	0.571	0.251	0.110	0.610	0.224	0.114	0.560	0.559	0.495	0.632	0.792	0.580	0.993
	2	0.361	0.552	0.017	0.667	0.784	0.695	0.969	0.755	0.923	0.059	0.699	0.048	0.692	0.040	0.116
	3	0.733	0.561	0.612	0.420	0.936	0.227	0.849	0.262	0.745	0.431	0.053	0.499	0.284	0.483	0.913
	4	0.361	0.033	0.207	0.251	0.718	0.137	0.604	0.002	0.282	0.050	0.176	0.193	0.264	0.078	0.016
	5	0.867	0.969	0.831	0.849	0.228	0.543	0.224	0.926	0.928	0.883	0.495	0.678	0.890	0.909	0.595
	6	0.997	0.984	0.937	0.938	0.999	0.923	0.999	0.996	0.987	0.976	0.971	0.987	0.974	0.973	0.977
	7	0.733	0.857	0.750	0.407	0.078	0.987	0.294	0.678	0.333	0.967	0.971	0.866	0.552	0.948	0.469
	8	0.828	0.906	0.136	0.499	0.381	0.951	0.840	0.915	0.402	0.848	0.991	0.814	0.734	0.887	0.990
	9	0.248	0.883	0.571	0.914	0.814	0.263	0.659	0.992	0.416	0.694	0.157	0.666	0.474	0.784	0.967
	10	0.982	0.714	0.831	0.841	0.950	0.543	0.880	0.622	0.937	0.431	0.434	0.289	0.366	0.454	0.289
	11	0.553	0.924	0.968	0.486	0.796	0.989	0.969	0.743	0.886	0.952	0.935	0.879	0.934	0.954	0.764
	12	0.302	0.963	0.160	0.959	0.902	0.322	0.901	0.705	0.942	0.451	0.434	0.355	0.655	0.469	0.406
	13	0.998	0.938	0.691	0.211	0.689	0.610	0.840	0.548	0.757	0.910	0.672	0.830	0.948	0.864	0.712
	14	0.617	0.539	0.078	0.135	0.062	0.632	0.320	0.563	0.402	0.559	0.495	0.355	0.474	0.693	0.346
	15	0.553	0.470	0.472	0.993	0.296	0.227	0.192	0.137	0.684	0.158	0.123	0.238	0.237	0.209	0.191
	16	0.784	0.112	0.793	0.211	0.357	0.895	0.173	0.022	0.347	0.588	0.953	0.797	0.699	0.617	0.851
	17	0.733	0.805	0.543	0.986	0.994	0.407	0.993	0.692	0.810	0.355	0.346	0.097	0.585	0.303	0.237
	18	0.068	0.207	0.055	0.552	0.521	0.227	0.865	0.341	0.697	0.099	0.318	0.238	0.445	0.152	0.346
	19	0.011	0.076	0.003	0.066	0.088	0.653	0.025	0.226	0.589	0.007	0.266	0.010	0.111	0.006	0.150
	20	0.924	0.619	0.218	0.964	0.865	0.872	0.632	0.767	0.745	0.228	0.914	0.169	0.192	0.189	0.191
	21	0.361	0.168	0.761	0.394	0.967	0.695	0.958	0.355	0.560	0.337	0.586	0.597	0.495	0.320	0.656
	22	0.007	0.020	0.048	0.044	0.003	0.125	0.003	0.226	0.048	0.056	0.023	0.238	0.049	0.084	0.532
	23	0.361	0.234	0.598	0.472	0.282	0.038	0.202	0.636	0.722	0.280	0.053	0.450	0.244	0.360	0.004
	24	0.200	0.165	0.218	0.024	0.513	0.588	0.146	0.341	0.295	0.284	0.615	0.573	0.089	0.246	0.191
	25	0.828	0.987	0.886	0.992	0.964	0.498	0.997	0.664	0.917	0.952	0.726	0.952	0.977	0.958	0.984
	26	0.553	0.722	0.444	0.512	0.513	0.282	0.711	0.593	0.847	0.485	0.157	0.177	0.851	0.536	0.088
	27	0.553	0.170	0.006	0.539	0.085	0.733	0.561	0.087	0.174	0.094	0.464	0.069	0.104	0.073	0.191
	28	0.302	0.306	0.297	0.864	0.381	0.895	0.416	0.457	0.174	0.686	0.887	0.830	0.153	0.689	0.469
3	29	0.784	0.963	0.114	0.273	0.814	0.803	0.934	0.692	0.757	0.817	0.644	0.797	0.860	0.836	0.851
	30	0.157	0.381	0.703	0.747	0.850	0.674	0.488	0.164	0.953	0.369	0.292	0.512	0.362	0.355	0.764
	31	0.121	0.314	0.585	0.903	0.666	0.038	0.711	0.065	0.416	0.214	0.032	0.133	0.302	0.179	0.810
	32	0.973	0.498	0.691	0.679	0.802	0.884	0.913	0.488	0.347	0.775	0.989	0.938	0.674	0.722	0.851
	33	0.899	0.360	0.932	0.526	0.571	0.914	0.645	0.327	0.546	0.942	0.966	0.982	0.744	0.856	0.851
	34	0.424	0.575	0.007	0.284	0.326	0.895	0.604	0.650	0.790	0.096	0.953	0.154	0.714	0.146	0.532
	35	0.553	0.993	0.803	0.526	0.941	0.653	0.924	0.972	0.757	0.988	0.774	0.979	0.965	0.978	0.997
	36	0.361	0.007	0.472	0.012	0.007	0.043	0.025	0.017	0.090	0.207	0.108	0.561	0.052	0.250	0.047
	37	0.988	0.958	0.639	0.592	0.990	0.733	0.907	0.488	0.966	0.783	0.774	0.845	0.956	0.769	0.191
	38	0.924	0.854	0.956	0.872	0.994	0.803	0.831	0.678	0.886	0.752	0.644	0.655	0.792	0.697	0.023
	39	0.899	0.119	0.703	0.319	0.048	0.179	0.051	0.457	0.069	0.559	0.108	0.710	0.067	0.714	0.116
	40	0.733	0.489	0.772	0.090	0.808	0.430	0.632	0.249	0.960	0.297	0.464	0.268	0.454	0.246	0.191
	41	0.617	0.543	0.335	0.512	0.304	0.632	0.173	0.874	0.347	0.505	0.644	0.310	0.063	0.402	0.088
	42	0.553	0.748	0.598	0.066	0.389	0.989	0.857	0.692	0.258	0.854	0.997	0.721	0.528	0.804	0.764
	43	0.677	0.944	0.144	0.985	0.970	0.833	0.998	0.840	0.855	0.500	0.774	0.597	0.924	0.589	0.885
	44	0.677	0.330	0.598	0.381	0.765	0.103	0.532	0.137	0.124	0.388	0.010	0.644	0.115	0.411	0.065
	45	0.617	0.854	0.985	0.420	0.689	0.951	0.759	0.718	0.295	0.997	0.925	0.992	0.764	0.990	0.712
	46	0.248	0.824	0.917	0.956	0.941	0.194	0.723	0.921	0.960	0.470	0.241	0.487	0.776	0.493	0.065
	47	0.121	0.221	0.297	0.035	0.019	0.407	0.246	0.137	0.041	0.146	0.292	0.177	0.109	0.186	0.764
	48	0.992	0.906	0.995	0.849	0.865	0.923	0.969	0.985	0.984	0.992	0.855	0.990	0.985	0.990	0.595
	49	0.248	0.054	0.038	0.041	0.007	0.227	0.173	0.488	0.060	0.173	0.196	0.289	0.511	0.186	0.289
	50	0.924	0.990	0.983	0.919	0.979	0.695	0.840	0.960	0.997	0.895	0.726	0.891	0.995	0.842	0.712
	51	0.961	0.827	0.968	0.798	0.894	0.475	0.947	0.238	0.444	0.870	0.525	0.976	0.731	0.923	0.935
	52	0.302	0.480	0.803	0.643	0.604	0.385	0.958	0.858	0.282	0.603	0.139	0.561	0.429	0.617	0.656
	53	0.899	0.786	0.783	0.778	0.778	0.847	0.360	0.992	0.973	0.764	0.935	0.891	0.910	0.791	0.656
	54	0.361	0.170	0.083	0.679	0.938	0.430	0.812	0.622	0.333	0.072	0.556	0.087	0.171	0.096	0.047
	55	0.828	0.986	0.727	0.472	0.984	0.923	0.939	0.993	0.906	0.948	0.991	0.926	0.972	0.920	0.953
	56	0.121	0.484	0.739	0.066	0.228	0.263	0.333	0.678	0.684	0.346	0.218	0.211	0.260	0.454	0.469
	57	0.553	0.729	0.458	0.971	0.711	0.566	0.919	0.262	0.658	0.564	0.495	0.366	0.274	0.589	0.088
	Range	0.991	0.986	0.992	0.980	0.997	0.951	0.996	0.994	0.956	0.989	0.986	0.982	0.945	0.984	0.993
	1	0.102	0.415	0.113	0.074	0.167	0.001	0.468	0.145	0.520	0.112	0.226	0.452	0.469	0.051	0.694
	2	0.308	0.785	0.188	0.228	0.588	0.713	0.856	0.790	0.597	0.948	0.764	0.565	0.346	0.533	0.832
	3	0.913	0.920	0.591	0.729	0.967	0.999	0.775	0.479	0.983	0.850	0.918	0.264	0.977	0.962	0.776
	4	0.514	0.274	0.885	0.869	0.238	0.023	0.179	0.051	0.720	0.117	0.198	0.988	0.712	0.574	0.156
	5	0.997	0.999	0.351	0.957	0.999	0.999	0.775	0.999	0.857	0.948	0.989	0.023	0.935	0.993	0.620
	6	0.683	0.476	0.434	0.846	0.858	0.999	0.727	0.988	0.123	0.779	0.943	0.565	0.810	0.825	0.541
	7	0.971	0.446	0.198	0.595	0.817	0.984	0.438	0.747	0.298	0.948	0.947	0.007	0.851	0.908	0.307
	8	0.840	0.920	0.945	0.921	0.908	0.999	0.999	0.996	0.767	0.996	0.999	0.732	0.967	0.970	0.957
	9	0.400	0.712	0.659	0.626	0.487	0.937	0.498	0.592	0.350	0.956	0.701	0.166	0.885	0.618	0.381
	10	0.883	0.712	0.047	0.587	0.893	0.220	0.529	0.367	0.134	0.550	0.277	0.005	0.116	0.825	0.024
	11	0.378	0.446	0.998	0.497	0.128	0.998	0.992	0.747	0.979	0.682	0.793	0.785	0.047	0.350	0.711
	12	0.349	0.908	0.534	0.657	0.921	0.999	0.991	0.647	0.752	0.997	0.982	0.375	0.595	0.603	0.620
	13	0.994	0.941	0.847	0.749	0.978	0.960	0.966	0.699	0.540	0.293	0.582	0.012	0.595	0.873	0.888
	14	0.308	0.538	0.506	0.056	0.742	0.014	0.054	0.647	0.878	0.050	0.207	0.044	0.150	0.291	0.239
	15	0.301	0.112	0.208	0.338	0.167	0.518	0.438	0.422	0.578	0.381	0.417	0.955	0.116	0.221	0.819
	16	0.209	0.301	0.160	0.400	0.059	0.001	0.160	0.089	0.081	0.020	0.287	0.531	0.595	0.286	0.209
	17	0.430	0.762	0.351	0.072	0.877	0.982	0.818	0.965	0.167	0.895	0.655	0.030	0.764	0.432	0.400
	18	0.514	0.301	0.605	0.538	0.355	0.999	0.901	0.790	0.959	0.996	0.990	0.343	0.237	0.554	0.400
	19	0.583	0.538	0.885	0.267	0.387	0.800	0.935	0.965	0.597	0.787	0.774	0.246	0.033	0.383	0.255
	20	0.998	0.992	0.094	0.792	0.943	0.342	0.245	0.314	0.041	0.592	0.532	0.004	0.656	0.958	0.325
	21	0.173	0.085	0.941	0.253	0.146	0.603	0.752	0.829	0.887	0.518	0.310	0.683	0.712	0.408	0.936
	22	0.886	0.895	0.999	0.774	0.858	0.999	0.998	0.647	0.994	0.917	0.764	0.464	0.764	0.794	0.897
	23	0.967	0.969	0.287	0.935	0.978	0.965	0.438	0.829	0.501	0.967	0.835	0.375	0.712	0.975	0.639
	24	0.683	0.785	0.757	0.216	0.858	0.999	0.953	0.829	0.114	0.988	0.923	0.007	0.656	0.508	0.065
	25	0.220	0.203	0.577	0.456	0.420	0.019	0.111	0.004	0.687	0.172	0.121	0.925	0.953	0.317	0.947
	26	0.940	0.949	0.992	0.977	0.588	0.999	0.935	0.863	0.913	0.932	0.995	0.750	0.532	0.969	0.973
	27	0.010	0.098	0.003	0.132	0.050	0.001	0.063	0.747	0.134	0.140	0.060	0.981	0.116	0.082	0.255
	28	0.423	0.249	0.094	0.489	0.621	0.195	0.818	0.699	0.250	0.539	0.455	0.576	0.289	0.656	0.168
	29	0.514	0.328	0.229	0.780	0.588	0.010	0.160	0.221	0.463	0.050	0.024	0.587	0.977	0.559	0.776
4	30	0.163	0.386	0.855	0.066	0.213	0.891	0.989	0.936	0.767	0.879	0.865	0.486	0.033	0.096	0.620
	31	0.730	0.992	0.970	0.967	0.817	0.999	0.991	0.790	0.846	0.994	0.995	0.955	0.851	0.916	0.711
	32	0.349	0.028	0.746	0.120	0.238	0.075	0.674	0.479	0.979	0.351	0.442	0.464	0.346	0.076	0.103
	33	0.315	0.846	0.829	0.664	0.793	0.999	0.438	0.965	0.981	0.817	0.667	0.877	0.764	0.656	0.480
	34	0.717	0.249	0.672	0.505	0.189	0.009	0.085	0.221	0.088	0.152	0.519	0.531	0.935	0.554	0.307
	35	0.030	0.249	0.941	0.432	0.189	0.092	0.408	0.265	0.019	0.201	0.087	0.975	0.656	0.147	0.639
	36	0.648	0.864	0.982	0.911	0.555	0.561	0.468	0.422	0.597	0.331	0.430	0.984	0.595	0.642	0.947
	37	0.922	0.657	0.152	0.820	0.817	0.003	0.142	0.020	0.927	0.123	0.164	0.273	0.289	0.801	0.541
	38	0.583	0.657	0.434	0.280	0.742	0.058	0.160	0.221	0.167	0.341	0.128	0.397	0.010	0.241	0.819
	39	0.371	0.225	0.577	0.416	0.294	0.001	0.004	0.051	0.974	0.042	0.128	0.475	0.595	0.286	0.480
	40	0.408	0.598	0.077	0.408	0.487	0.240	0.296	0.265	0.156	0.539	0.631	0.793	0.406	0.756	0.500
	41	0.858	0.274	0.113	0.473	0.588	0.001	0.085	0.265	0.387	0.112	0.073	0.090	0.851	0.326	0.195
	42	0.215	0.203	0.491	0.005	0.146	0.001	0.004	0.422	0.096	0.069	0.035	0.065	0.088	0.061	0.009
	43	0.018	0.005	0.263	0.005	0.004	0.001	0.296	0.089	0.010	0.201	0.033	0.741	0.088	0.004	0.002
	44	0.863	0.864	0.992	0.715	0.713	0.999	0.986	0.863	0.999	0.795	0.974	0.166	0.810	0.702	0.728
	45	0.772	0.657	0.054	0.416	0.653	0.146	0.142	0.592	0.081	0.850	0.902	0.166	0.191	0.574	0.381
	46	0.893	0.476	0.863	0.804	0.387	0.103	0.179	0.314	0.687	0.084	0.092	0.188	0.469	0.756	0.013
	47	0.871	0.657	0.962	0.626	0.713	0.628	0.701	0.699	0.767	0.401	0.198	0.049	0.088	0.618	0.906
	48	0.468	0.356	0.863	0.882	0.588	0.999	0.999	0.936	0.940	0.961	0.994	0.652	0.953	0.760	0.922
	49	0.942	0.969	0.746	0.679	0.982	0.999	0.935	0.982	0.669	0.980	0.947	0.011	0.712	0.744	0.325
	50	0.514	0.785	0.779	0.901	0.420	0.999	0.976	0.996	0.974	0.961	0.996	0.898	0.913	0.783	0.987
	51	0.018	0.074	0.722	0.023	0.015	0.010	0.350	0.089	0.887	0.351	0.344	0.903	0.088	0.004	0.027
	52	0.491	0.737	0.549	0.587	0.420	0.001	0.013	0.068	0.767	0.050	0.031	0.877	0.047	0.417	0.711
	53	0.742	0.864	0.240	0.893	0.993	0.940	0.245	0.592	0.463	0.874	0.865	0.598	0.977	0.798	0.480
	54	0.064	0.386	0.549	0.267	0.146	0.999	0.945	0.747	0.369	0.997	0.957	0.809	0.346	0.169	0.460
	55	0.982	0.598	0.899	0.984	0.908	0.999	0.960	0.994	0.992	0.956	0.998	0.354	0.993	0.983	0.878
	56	0.328	0.356	0.769	0.901	0.555	0.350	0.200	0.145	0.887	0.232	0.544	0.995	0.289	0.523	0.973
	57	0.453	0.657	0.899	0.465	0.653	0.054	0.701	0.367	0.597	0.179	0.344	0.464	0.150	0.393	0.034
	58	0.408	0.785	0.448	0.456	0.742	0.069	0.222	0.089	0.992	0.284	0.156	0.531	0.595	0.336	0.480
	Range	0.988	0.994	0.997	0.979	0.996	0.999	0.995	0.995	0.990	0.977	0.976	0.992	0.983	0.989	0.985

Condition no.	RHM no.	BD1	BD2	BD3	BD4	BD5	BD6	BD7	BD8	BD9	BD10	BD11	BD12	BD13	BD14	BD15
	1	0.366	0.362	0.064	0.054	0.137	0.850	0.899	0.152	0.047	0.408	0.408	0.621	0.275	0.118	0.168
	2	0.598	0.947	0.002	0.217	0.122	0.663	0.867	0.954	0.162	0.806	0.590	0.646	0.412	0.894	0.959
	3	0.707	0.736	0.183	0.641	0.287	0.737	0.361	0.469	0.730	0.497	0.800	0.733	0.791	0.355	0.319
	4	0.901	0.291	0.733	0.250	0.074	0.550	0.302	0.899	0.432	0.497	0.448	0.788	0.560	0.738	0.535
	5	0.839	0.992	0.170	0.244	0.750	0.755	0.997	0.914	0.574	0.987	0.312	0.807	0.967	0.938	0.944
	6	0.216	0.258	0.830	0.396	0.065	0.084	0.068	0.314	0.625	0.459	0.213	0.277	0.791	0.541	0.675
	7	0.312	0.575	0.520	0.741	0.137	0.201	0.424	0.225	0.196	0.660	0.146	0.111	0.701	0.138	0.108
	8	0.943	0.720	0.183	0.035	0.115	0.787	0.828	0.268	0.205	0.749	0.388	0.637	0.633	0.584	0.421
	9	0.540	0.922	0.011	0.362	0.287	0.779	0.961	0.891	0.244	0.769	0.770	0.847	0.791	0.714	0.820
	10	0.800	0.477	0.984	0.904	0.516	0.518	0.867	0.882	0.817	0.561	0.972	0.679	0.763	0.909	0.756
	11	0.924	0.935	0.778	0.025	0.189	0.433	0.361	0.808	0.419	0.956	0.330	0.621	0.979	0.918	0.942
	12	0.366	0.127	0.986	0.222	0.516	0.561	0.302	0.253	0.903	0.103	0.294	0.761	0.244	0.182	0.244
	13	0.481	0.879	0.014	0.955	0.945	0.293	0.677	0.853	0.445	0.916	0.686	0.357	0.929	0.909	0.969
	14	0.998	0.997	0.028	0.800	0.993	0.998	0.999	0.949	0.878	0.997	0.993	0.963	0.994	0.971	0.975
	15	0.598	0.982	0.001	0.764	0.976	0.904	0.992	0.962	0.661	0.926	0.721	0.831	0.733	0.859	0.934
	16	0.481	0.631	0.013	0.031	0.516	0.186	0.248	0.645	0.033	0.706	0.124	0.207	0.951	0.449	0.516
	17	0.262	0.021	0.667	0.878	0.927	0.284	0.488	0.064	0.968	0.068	0.408	0.524	0.143	0.054	0.050
	18	0.140	0.496	0.370	0.870	0.739	0.663	0.157	0.645	0.928	0.549	0.408	0.662	0.376	0.570	0.297
	19	0.839	0.972	0.099	0.187	0.324	0.956	0.982	0.808	0.224	0.980	0.408	0.807	0.967	0.864	0.840
	20	0.312	0.228	0.317	0.466	0.941	0.925	0.828	0.505	0.625	0.300	0.952	0.837	0.412	0.435	0.331
	21	0.958	0.969	0.317	0.950	0.972	0.999	0.995	0.820	0.885	0.977	0.667	0.981	0.951	0.842	0.820
	22	0.084	0.258	0.993	0.998	0.585	0.381	0.121	0.142	0.761	0.142	0.184	0.435	0.089	0.406	0.302
	23	0.707	0.613	0.425	0.417	0.350	0.965	0.248	0.725	0.369	0.648	0.349	0.944	0.597	0.556	0.446
	24	0.109	0.063	0.223	0.885	0.252	0.257	0.488	0.044	0.471	0.181	0.124	0.124	0.341	0.058	0.025
	25	0.423	0.720	0.006	0.009	0.004	0.107	0.361	0.212	0.047	0.749	0.184	0.043	0.882	0.250	0.325
5	26	0.707	0.594	0.884	0.473	0.739	0.663	0.488	0.831	0.790	0.759	0.800	0.725	0.929	0.464	0.291
	27	0.140	0.024	0.238	0.686	0.772	0.571	0.157	0.070	0.510	0.009	0.034	0.340	0.011	0.015	0.038
	28	0.970	0.980	0.701	0.929	0.998	0.913	0.982	0.999	0.994	0.988	0.912	0.990	0.996	0.997	0.997
	29	0.872	0.536	0.539	0.987	0.993	0.967	0.424	0.782	0.999	0.549	0.972	0.970	0.733	0.818	0.735
	30	0.481	0.594	0.253	0.994	0.974	0.737	0.867	0.541	0.891	0.636	0.468	0.868	0.733	0.663	0.640
	31	0.707	0.941	0.501	0.316	0.949	0.885	0.617	0.975	0.850	0.832	0.368	0.872	0.633	0.930	0.894
	32	0.481	0.965	0.444	0.355	0.189	0.040	0.617	0.954	0.432	0.900	0.610	0.177	0.763	0.909	0.911
	33	0.924	0.736	0.990	0.431	0.324	0.381	0.677	0.921	0.549	0.815	0.828	0.662	0.597	0.988	0.980
	34	0.481	0.496	0.999	0.855	0.666	0.963	0.302	0.541	0.850	0.695	0.904	0.961	0.840	0.750	0.573
	35	0.990	0.989	0.520	0.997	0.864	0.986	0.995	0.939	0.984	0.993	0.991	0.996	0.992	0.920	0.942
	36	0.872	0.796	0.853	0.256	0.417	0.284	0.733	0.808	0.357	0.806	0.349	0.819	0.668	0.680	0.785
	37	0.175	0.362	0.595	0.565	0.886	0.592	0.617	0.469	0.781	0.395	0.294	0.241	0.165	0.161	0.244
	38	0.540	0.720	0.425	0.919	0.893	0.331	0.961	0.842	0.878	0.561	0.667	0.671	0.341	0.536	0.709
	39	0.901	0.889	0.792	0.614	0.917	0.976	0.924	0.954	0.696	0.949	0.814	0.863	0.951	0.983	0.996
	40	0.872	0.767	0.990	0.820	0.985	0.994	0.992	0.820	0.908	0.728	0.686	0.961	0.763	0.833	0.771
	41	0.216	0.308	0.238	0.010	0.501	0.123	0.424	0.097	0.041	0.257	0.428	0.052	0.376	0.038	0.097
	42	0.756	0.796	0.028	0.473	0.927	0.961	0.899	0.628	0.536	0.916	0.912	0.825	0.990	0.498	0.535
	43	0.012	0.042	0.238	0.033	0.033	0.249	0.011	0.024	0.497	0.035	0.184	0.255	0.051	0.006	0.003
	44	0.084	0.308	0.048	0.674	0.084	0.028	0.424	0.083	0.013	0.190	0.198	0.008	0.075	0.113	0.121
	45	0.901	0.847	0.991	0.942	0.922	0.899	0.867	0.694	0.960	0.788	0.934	0.981	0.701	0.821	0.928
	46	0.756	0.991	0.048	0.403	0.363	0.755	0.924	0.998	0.276	0.989	0.428	0.807	0.992	0.994	0.997
	47	0.312	0.344	0.864	0.955	0.666	0.550	0.924	0.283	0.432	0.446	0.468	0.207	0.448	0.189	0.176
	48	0.839	0.957	0.048	0.544	0.404	0.623	0.553	0.949	0.790	0.759	0.875	0.662	0.448	0.902	0.938
	49	0.756	0.810	0.334	0.904	0.585	0.623	0.784	0.863	0.661	0.574	0.754	0.898	0.341	0.923	0.945
	50	0.998	0.736	0.733	0.764	0.727	0.980	0.973	0.979	0.740	0.806	0.985	0.994	0.882	0.933	0.916
	Range	0.986	0.976	0.999	0.989	0.994	0.971	0.989	0.974	0.987	0.988	0.959	0.988	0.985	0.991	0.994

e) $n = 20$

Condition no.	RHM no.	BD1	BD2	BD3	BD4	BD5	BD6	BD7	BD8	BD9	BD10	BD11	BD12	BD13	BD14	BD15	BD16	BD17	BD18	BD19	BD20
	1	0.350	0.997	0.322	0.905	0.038	0.187	0.311	0.342	0.434	0.244	0.403	0.416	0.326	0.460	0.531	0.123	0.278	0.814	0.183	0.549
	2	0.896	0.074	0.349	0.122	0.457	0.143	0.157	0.371	0.484	0.077	0.562	0.684	0.108	0.767	0.133	0.220	0.199	0.277	0.066	0.398
	3	0.971	0.841	0.867	0.905	0.979	0.916	0.383	0.359	0.769	0.747	0.839	0.992	0.869	0.990	0.170	0.999	0.855	0.997	0.758	0.826
	4	0.940	0.345	0.765	0.350	0.513	0.733	0.754	0.754	0.766	0.494	0.796	0.139	0.668	0.269	0.375	0.107	0.536	0.448	0.592	0.812
	5	0.878	0.227	0.398	0.580	0.219	0.465	0.688	0.449	0.094	0.244	0.233	0.488	0.613	0.310	0.819	0.014	0.717	0.198	0.368	0.765
	6	0.406	0.016	0.028	0.701	0.067	0.046	0.398	0.031	0.070	0.267	0.032	0.183	0.160	0.057	0.531	0.001	0.068	0.034	0.343	0.797
	7	0.350	0.841	0.964	0.765	0.381	0.993	0.209	0.980	0.627	0.473	0.966	0.531	0.972	0.224	0.875	0.970	0.949	0.529	0.356	0.527
	8	0.669	0.227	0.193	0.853	0.414	0.290	0.674	0.553	0.859	0.995	0.089	0.969	0.362	0.930	0.181	0.937	0.278	0.428	0.956	0.505
	9	0.767	0.742	0.996	0.961	0.568	0.997	0.325	0.983	0.824	0.723	0.995	0.671	0.999	0.534	0.857	0.999	0.996	0.686	0.394	0.693
	10	0.795	0.955	0.545	0.995	0.905	0.509	0.645	0.681	0.759	0.530	0.382	0.886	0.752	0.793	0.578	0.999	0.797	0.927	0.552	0.999
	11	0.934	0.742	0.537	0.400	0.684	0.353	0.715	0.659	0.799	0.855	0.531	0.722	0.308	0.925	0.102	0.999	0.408	0.648	0.959	0.924
	12	0.333	0.481	0.092	0.109	0.101	0.193	0.065	0.129	0.430	0.931	0.180	0.517	0.076	0.680	0.010	0.137	0.019	0.330	0.714	0.108
	13	0.704	0.980	0.776	0.821	0.435	0.830	0.899	0.777	0.957	0.815	0.796	0.906	0.720	0.680	0.996	0.999	0.778	0.840	0.486	0.730
	14	0.114	0.136	0.486	0.201	0.320	0.456	0.966	0.348	0.343	0.614	0.414	0.109	0.477	0.211	0.077	0.383	0.549	0.277	0.962	0.505
	15	0.781	0.618	0.938	0.837	0.993	0.912	0.912	0.878	0.940	0.994	0.930	0.996	0.889	0.994	0.797	0.999	0.900	0.972	0.833	0.916
	16	0.868	0.481	0.753	0.915	0.815	0.412	0.139	0.718	0.552	0.362	0.804	0.757	0.516	0.796	0.982	0.993	0.599	0.754	0.044	0.931
	17	0.105	0.955	0.711	0.803	0.992	0.571	0.985	0.697	0.606	0.228	0.675	0.546	0.685	0.644	0.959	0.985	0.778	0.800	0.778	0.693
	18	0.482	0.227	0.322	0.350	0.643	0.614	0.383	0.395	0.170	0.197	0.403	0.295	0.291	0.628	0.375	0.027	0.165	0.312	0.058	0.298
	19	0.369	0.742	0.631	0.060	0.468	0.456	0.811	0.553	0.201	0.764	0.615	0.722	0.736	0.477	0.563	0.829	0.574	0.610	0.643	0.613
	20	0.597	0.136	0.072	0.881	0.014	0.068	0.383	0.180	0.188	0.551	0.089	0.333	0.046	0.354	0.151	0.005	0.032	0.198	0.241	0.781
	21	0.846	0.345	0.841	0.915	0.822	0.680	0.949	0.868	0.983	0.820	0.839	0.933	0.767	0.945	0.966	0.999	0.728	0.686	0.714	0.991
	22	0.979	0.992	0.948	0.867	0.392	0.969	0.984	0.984	0.973	0.916	0.943	0.502	0.952	0.640	0.976	0.999	0.906	0.965	0.891	0.730
	23	0.067	0.481	0.537	0.150	0.203	0.703	0.177	0.443	0.092	0.007	0.509	0.079	0.668	0.028	0.202	0.001	0.323	0.027	0.041	0.227
	24	0.846	0.074	0.889	0.580	0.944	0.975	0.940	0.804	0.733	0.452	0.891	0.810	0.858	0.771	0.437	0.996	0.823	0.853	0.924	0.877
	25	0.235	0.345	0.717	0.971	0.128	0.447	0.460	0.461	0.835	0.800	0.730	0.957	0.767	0.872	0.531	0.982	0.728	0.885	0.758	0.907
	26	0.024	0.481	0.115	0.201	0.001	0.124	0.413	0.136	0.241	0.047	0.094	0.069	0.228	0.049	0.515	0.001	0.181	0.006	0.114	0.484
	27	0.315	0.136	0.370	0.016	0.524	0.447	0.851	0.412	0.355	0.785	0.562	0.459	0.275	0.464	0.484	0.013	0.227	0.509	0.945	0.003
	28	0.896	0.227	0.574	0.136	0.188	0.680	0.311	0.601	0.290	0.369	0.435	0.193	0.810	0.149	0.500	0.510	0.706	0.294	0.307	0.961
	29	0.669	0.742	0.581	0.654	0.524	0.482	0.766	0.865	0.682	0.974	0.562	0.768	0.457	0.834	0.578	0.812	0.599	0.213	0.956	0.059
	30	0.424	0.841	0.486	0.425	0.740	0.447	0.956	0.298	0.425	0.717	0.509	0.838	0.362	0.806	0.547	0.319	0.561	0.312	0.788	0.141
	31	0.443	0.136	0.652	0.281	0.491	0.841	0.198	0.786	0.123	0.047	0.541	0.307	0.796	0.146	0.710	0.628	0.900	0.864	0.096	0.261
	32	0.736	0.618	0.665	0.580	0.245	0.672	0.209	0.909	0.865	0.981	0.684	0.893	0.594	0.979	0.452	0.970	0.672	0.840	0.909	0.613
	33	0.809	0.742	0.962	0.971	0.923	0.703	0.877	0.824	0.968	0.997	0.949	0.992	0.957	0.986	0.484	0.999	0.953	0.972	0.999	0.956
	34	0.981	0.980	0.974	0.975	0.931	0.982	0.982	0.962	0.995	0.946	0.957	0.899	0.965	0.948	0.952	0.999	0.977	0.998	0.967	0.998
	35	0.167	0.227	0.077	0.881	0.468	0.154	0.877	0.114	0.606	0.907	0.147	0.603	0.076	0.326	0.437	0.319	0.109	0.590	0.985	0.419
	36	0.878	0.742	0.906	0.580	0.568	0.950	0.339	0.697	0.958	0.910	0.858	0.966	0.869	0.951	0.668	0.999	0.956	0.853	0.592	0.730
	37	0.220	0.345	0.679	0.060	0.807	0.761	0.569	0.479	0.452	0.967	0.594	0.983	0.685	0.903	0.015	0.940	0.612	0.428	0.982	0.317
	38	0.652	0.742	0.938	0.327	0.956	0.935	0.899	0.911	0.977	0.960	0.886	0.893	0.957	0.891	0.897	0.999	0.967	0.961	0.841	0.840
	39	0.193	0.841	0.122	0.304	0.236	0.544	0.523	0.400	0.294	0.667	0.103	0.124	0.308	0.122	0.237	0.001	0.323	0.072	0.885	0.052
	40	0.315	0.618	0.150	0.765	0.078	0.164	0.899	0.215	0.368	0.870	0.089	0.644	0.258	0.404	0.639	0.342	0.227	0.244	0.849	0.961
	41	0.687	0.992	0.742	0.803	0.480	0.857	0.842	0.921	0.773	0.382	0.730	0.360	0.889	0.284	0.984	0.190	0.855	0.828	0.273	0.549
	42	0.927	0.345	0.471	0.723	0.117	0.500	0.012	0.197	0.058	0.197	0.488	0.589	0.419	0.668	0.109	0.066	0.510	0.330	0.058	0.592
	43	0.193	0.742	0.219	0.014	0.281	0.404	0.043	0.412	0.135	0.025	0.250	0.214	0.186	0.262	0.303	0.001	0.312	0.011	0.058	0.195
	44	0.333	0.841	0.969	0.350	0.931	0.909	0.966	0.960	0.956	0.523	0.985	0.531	0.823	0.330	0.999	0.993	0.911	0.885	0.617	0.108
	45	0.959	0.227	0.961	0.350	0.910	0.919	0.569	0.836	0.994	0.976	0.957	0.953	0.879	0.951	0.563	0.999	0.916	0.993	0.726	0.840
	46	0.540	0.841	0.303	0.004	0.424	0.170	0.413	0.201	0.360	0.705	0.304	0.644	0.228	0.464	0.696	0.493	0.433	0.895	0.679	0.098
	47	0.822	0.481	0.926	0.451	0.815	0.943	0.554	0.812	0.674	0.824	0.869	0.444	0.869	0.334	0.214	0.995	0.961	0.840	0.938	0.549
1	48	0.019	0.481	0.336	0.183	0.111	0.124	0.491	0.143	0.075	0.403	0.202	0.295	0.477	0.065	0.056	0.002	0.371	0.171	0.617	0.298
	49	0.298	0.841	0.803	0.765	0.829	0.880	0.912	0.976	0.854	0.593	0.573	0.697	0.965	0.842	0.375	0.999	0.959	0.972	0.898	0.853
	50	0.193	0.742	0.813	0.925	0.350	0.912	0.930	0.943	0.812	0.790	0.730	0.847	0.965	0.652	0.654	0.869	0.889	0.969	0.898	0.961
	51	0.767	0.227	0.322	0.765	0.713	0.176	0.070	0.105	0.278	0.040	0.435	0.960	0.173	0.914	0.015	0.891	0.173	0.721	0.058	0.527
	52	0.736	0.481	0.933	0.905	0.971	0.893	0.444	0.768	0.933	0.950	0.832	0.979	0.969	0.962	0.531	0.999	0.977	0.667	0.864	0.956
	53	0.868	0.618	0.983	0.971	0.862	0.988	0.754	0.906	0.852	0.867	0.993	0.917	0.957	0.809	0.875	0.999	0.862	0.904	0.929	0.693
	54	0.501	0.618	0.906	0.281	0.850	0.852	0.107	0.624	0.310	0.297	0.930	0.473	0.823	0.767	0.170	0.985	0.869	0.895	0.127	0.440
	55	0.167	0.345	0.095	0.350	0.211	0.095	0.600	0.331	0.802	0.990	0.147	0.630	0.117	0.777	0.056	0.713	0.077	0.135	0.988	0.195
	56	0.005	0.481	0.054	0.765	0.096	0.164	0.100	0.045	0.009	0.029	0.026	0.074	0.291	0.047	0.133	0.001	0.121	0.610	0.021	0.462
	57	0.463	0.227	0.219	0.136	0.159	0.232	0.766	0.418	0.502	0.989	0.187	0.864	0.381	0.784	0.346	0.860	0.208	0.072	0.998	0.167
	58	0.144	0.742	0.060	0.529	0.310	0.068	0.016	0.143	0.211	0.037	0.038	0.603	0.108	0.636	0.026	0.002	0.135	0.104	0.002	0.227
	59	0.193	0.992	0.405	0.087	0.457	0.239	0.741	0.791	0.394	0.544	0.352	0.079	0.399	0.221	0.578	0.051	0.510	0.428	0.679	0.195
	60	0.887	0.999	0.871	0.087	0.941	0.680	0.832	0.659	0.929	0.910	0.918	0.810	0.736	0.887	0.500	0.999	0.587	0.952	0.924	0.317
	61	0.056	0.841	0.086	0.219	0.457	0.120	0.011	0.150	0.224	0.044	0.059	0.800	0.138	0.790	0.012	0.045	0.149	0.428	0.008	0.181
	62	0.193	0.227	0.798	0.060	0.807	0.801	0.036	0.786	0.502	0.233	0.573	0.722	0.947	0.477	0.289	0.968	0.906	0.629	0.085	0.730
	63	0.424	0.742	0.203	0.529	0.211	0.622	0.311	0.277	0.114	0.151	0.233	0.124	0.099	0.173	0.161	0.032	0.237	0.428	0.368	0.398
	64	0.180	0.742	0.363	0.503	0.856	0.260	0.523	0.108	0.908	0.769	0.477	0.963	0.291	0.853	0.724	0.923	0.335	0.912	0.630	0.748
	65	0.834	0.618	0.956	0.942	0.967	0.962	0.851	0.820	0.796	0.593	0.875	0.722	0.935	0.529	0.797	0.999	0.971	0.952	0.807	0.997
	66	0.990	0.841	0.923	0.998	0.910	0.718	0.969	0.636	0.922	0.790	0.954	0.871	0.835	0.941	0.786	0.999	0.823	0.965	0.833	0.916
	67	0.945	0.841	0.970	0.837	0.783	0.994	0.842	0.996	0.993	0.929	0.949	0.942	0.980	0.986	0.819	0.999	0.988	0.912	0.864	0.997
	68	0.974	0.911	0.832	0.905	0.919	0.761	0.615	0.491	0.992	0.997	0.918	0.999	0.685	0.993	0.437	0.999	0.561	0.946	0.986	0.938
	69	0.220	0.136	0.236	0.260	0.045	0.313	0.093	0.461	0.032	0.006	0.276	0.041	0.173	0.164	0.071	0.001	0.237	0.006	0.090	0.153
	70	0.959	0.742	0.356	0.122	0.783	0.253	0.741	0.359	0.917	0.641	0.435	0.973	0.275	0.984	0.044	0.998	0.173	0.686	0.526	0.153
	71	0.822	0.227	0.567	0.984	0.740	0.916	0.177	0.768	0.793	0.473	0.584	0.589	0.668	0.787	0.484	0.864	0.672	0.330	0.174	0.950
	72	0.520	0.992	0.665	0.529	0.992	0.631	0.960	0.583	0.976	0.992	0.730	0.946	0.613	0.916	0.468	0.997	0.549	0.800	0.997	0.613
	73	0.704	0.955	0.434	0.150	0.435	0.387	0.413	0.206	0.502	0.735	0.562	0.917	0.381	0.927	0.624	0.850	0.268	0.941	0.667	0.897
	74	0.950	0.911	0.290	0.765	0.546	0.465	0.949	0.371	0.740	0.729	0.403	0.722	0.275	0.858	0.594	0.968	0.289	0.912	0.974	0.961
	75	0.424	0.345	0.427	0.979	0.965	0.622	0.325	0.522	0.869	0.810	0.541	0.488	0.438	0.486	0.437	0.940	0.549	0.800	0.526	0.916
	76	0.067	0.841	0.933	0.678	0.931	0.836	0.043	0.965	0.318	0.197	0.952	0.546	0.879	0.442	0.452	0.578	0.797	0.864	0.108	0.505
	77	0.834	0.481	0.631	0.554	0.513	0.631	0.036	0.653	0.846	0.969	0.466	0.999	0.823	0.994	0.024	0.999	0.862	0.770	0.798	0.505
	78	0.927	0.136	0.183	0.630	0.843	0.034	0.645	0.185	0.649	0.222	0.241	0.722	0.127	0.845	0.202	0.441	0.103	0.294	0.273	0.484
	79	0.443	0.618	0.742	0.992	0.850	0.782	0.060	0.749	0.844	0.916	0.594	0.984	0.835	0.946	0.263	0.999	0.959	0.895	0.617	0.938
	80	0.959	0.841	0.959	0.451	0.783	0.962	0.554	0.974	0.993	0.863	0.978	0.893	0.941	0.962	0.724	0.999	0.911	0.875	0.747	0.965
	81	0.002	0.742	0.214	0.004	0.051	0.553	0.012	0.309	0.007	0.009	0.063	0.090	0.720	0.049	0.102	0.001	0.749	0.184	0.012	0.037
	82	0.193	0.841	0.964	0.785	0.633	0.975	0.585	0.935	0.623	0.131	0.973	0.224	0.965	0.291	0.331	0.408	0.934	0.171	0.319	0.633
	83	0.652	0.911	0.948	0.701	0.998	0.819	0.949	0.601	0.737	0.445	0.979	0.871	0.703	0.914	0.966	0.999	0.728	0.721	0.486	0.865
	84	0.634	0.742	0.515	0.821	0.997	0.345	0.892	0.461	0.849	0.558	0.625	0.969	0.186	0.931	0.578	0.999	0.420	0.989	0.758	0.877
	85	0.878	0.618	0.019	0.183	0.083	0.031	0.245	0.007	0.394	0.362	0.094	0.779	0.002	0.714	0.095	0.023	0.006	0.146	0.512	0.037
	86	0.045	0.980	0.617	0.997	0.856	0.622	0.688	0.547	0.364	0.355	0.675	0.131	0.536	0.196	0.774	0.184	0.636	0.349	0.512	0.748
	87	0.096	0.227	0.290	0.375	0.173	0.225	0.325	0.210	0.025	0.177	0.180	0.360	0.344	0.187	0.102	0.001	0.484	0.009	0.211	0.015
	88	0.559	0.227	0.652	0.477	0.480	0.412	0.283	0.670	0.698	0.627	0.562	0.430	0.258	0.334	0.668	0.458	0.574	0.840	0.343	0.462
	89	0.752	0.036	0.979	0.961	0.941	0.978	0.715	0.965	0.722	0.355	0.984	0.374	0.989	0.338	0.883	0.983	0.983	0.941	0.394	0.961
	90	0.501	0.618	0.253	0.654	0.045	0.639	0.789	0.354	0.722	0.621	0.276	0.069	0.291	0.096	0.974	0.037	0.268	0.408	0.579	0.812
	91	0.977	0.481	0.214	0.150	0.203	0.176	0.538	0.342	0.298	0.717	0.113	0.745	0.555	0.781	0.515	0.178	0.383	0.629	0.592	0.398
	92	0.350	0.036	0.193	0.853	0.371	0.232	0.139	0.219	0.170	0.008	0.108	0.156	0.419	0.092	0.052	0.006	0.459	0.448	0.006	0.336
	93	0.920	0.006	0.224	0.853	0.371	0.438	0.167	0.304	0.520	0.970	0.217	0.917	0.419	0.876	0.024	0.501	0.420	0.135	0.962	0.484
	94	0.105	0.481	0.164	0.087	0.300	0.148	0.645	0.298	0.138	0.537	0.103	0.937	0.344	0.855	0.133	0.201	0.278	0.570	0.933	0.153
	Range	0.988	0.993	0.977	0.994	0.997	0.966	0.975	0.989	0.989	0.991	0.968	0.958	0.997	0.966	0.989	0.999	0.990	0.991	0.997	0.997

Condition no.	RHM no.	BD1	BD2	BD3	BD4	BD5	BD6	BD7	BD8	BD9	BD10	BD11	BD12	BD13	BD14	BD15	BD16	BD17	BD18	BD19	BD20
	1	0.486	0.501	0.884	0.018	0.843	0.358	0.715	0.269	0.855	0.127	0.228	0.227	0.065	0.346	0.069	0.023	0.223	0.230	0.345	0.120
	2	0.645	0.615	0.901	0.768	0.962	0.874	0.615	0.968	0.368	0.657	0.748	0.905	0.849	0.595	0.730	0.995	0.633	0.955	0.740	0.845
	3	0.593	0.985	0.032	0.544	0.115	0.882	0.413	0.246	0.231	0.628	0.161	0.164	0.699	0.406	0.754	0.150	0.416	0.243	0.058	0.806
	4	0.795	0.995	0.961	0.972	0.959	0.979	0.832	0.989	0.913	0.827	0.900	0.847	0.932	0.469	0.916	0.871	0.948	0.981	0.988	0.993
	5	0.002	0.074	0.137	0.055	0.235	0.018	0.043	0.086	0.046	0.386	0.037	0.714	0.112	0.595	0.215	0.101	0.068	0.118	0.079	0.161
	6	0.972	0.520	0.717	0.631	0.962	0.891	0.960	0.934	0.905	0.415	0.728	0.498	0.498	0.656	0.537	0.566	0.925	0.916	0.871	0.699
	7	0.142	0.114	0.334	0.465	0.024	0.075	0.413	0.020	0.445	0.386	0.748	0.407	0.235	0.810	0.256	0.613	0.282	0.041	0.112	0.133
	8	0.109	0.927	0.842	0.111	0.115	0.769	0.233	0.006	0.030	0.162	0.021	0.407	0.348	0.346	0.507	0.332	0.047	0.006	0.345	0.344
	9	0.513	0.834	0.099	0.680	0.417	0.898	0.325	0.246	0.406	0.446	0.937	0.125	0.629	0.595	0.742	0.150	0.068	0.122	0.394	0.524
	10	0.298	0.955	0.253	0.275	0.097	0.850	0.368	0.120	0.051	0.274	0.062	0.521	0.122	0.469	0.124	0.741	0.223	0.155	0.033	0.220
	11	0.619	0.920	0.253	0.813	0.959	0.823	0.311	0.693	0.761	0.598	0.594	0.905	0.902	0.810	0.760	0.741	0.562	0.756	0.954	0.902
	12	0.761	0.934	0.937	0.159	0.277	0.940	0.368	0.076	0.525	0.144	0.803	0.588	0.022	0.237	0.034	0.051	0.047	0.074	0.673	0.034
	13	0.863	0.878	0.978	0.138	0.690	0.818	0.940	0.701	0.940	0.685	0.193	0.407	0.298	0.595	0.342	0.518	0.562	0.621	0.309	0.321
	14	0.424	0.315	0.406	0.695	0.878	0.484	0.754	0.840	0.866	0.908	0.920	0.923	0.456	0.469	0.484	0.423	0.948	0.794	0.458	0.678
	15	0.619	0.315	0.238	0.447	0.430	0.433	0.851	0.633	0.505	0.098	0.267	0.004	0.463	0.047	0.461	0.023	0.095	0.512	0.265	0.378
	16	0.914	0.999	0.501	0.841	0.783	0.998	0.868	0.624	0.729	0.785	0.570	0.923	0.596	0.885	0.507	0.423	0.562	0.605	0.761	0.760
	17	0.415	0.981	0.993	0.703	0.972	0.940	0.674	0.810	0.956	0.846	0.641	0.833	0.408	0.237	0.315	0.871	0.813	0.782	0.980	0.450
	18	0.567	0.927	0.993	0.553	0.918	0.932	0.167	0.552	0.746	0.785	0.996	0.803	0.323	0.532	0.328	0.779	0.813	0.521	0.998	0.414
	19	0.468	0.834	0.909	0.989	0.701	0.762	0.523	0.496	0.805	0.964	0.707	0.653	0.974	0.406	0.900	0.894	0.925	0.495	0.908	0.972
	20	0.801	0.687	0.649	0.246	0.819	0.424	0.702	0.740	0.545	0.074	0.400	0.872	0.115	0.532	0.060	0.779	0.130	0.729	0.333	0.024
	21	0.322	0.822	0.300	0.718	0.678	0.945	0.645	0.309	0.934	0.446	0.570	0.695	0.355	0.595	0.275	0.566	0.416	0.346	0.980	0.390
	22	0.917	0.369	0.931	0.830	0.701	0.342	0.966	0.948	0.641	0.880	0.161	0.695	0.886	0.656	0.967	0.976	0.633	0.934	0.536	0.822
	23	0.070	0.282	0.482	0.260	0.712	0.184	0.002	0.063	0.313	0.476	0.497	0.068	0.184	0.656	0.262	0.150	0.347	0.066	0.497	0.390
	24	0.813	0.669	0.733	0.919	0.982	0.570	0.892	0.955	0.956	0.895	0.288	0.980	0.981	0.595	0.975	0.987	0.994	0.972	0.523	0.958
	25	0.175	0.720	0.901	0.091	0.582	0.561	0.413	0.359	0.695	0.098	0.210	0.498	0.463	0.406	0.583	0.701	0.095	0.444	0.139	0.561
	26	0.239	0.206	0.058	0.527	0.115	0.350	0.270	0.086	0.202	0.446	0.376	0.244	0.596	0.595	0.677	0.150	0.925	0.058	0.432	0.426
	27	0.825	0.501	0.370	0.631	0.028	0.433	0.899	0.276	0.009	0.846	0.193	0.498	0.789	0.532	0.849	0.613	0.347	0.394	0.298	0.788
	28	0.004	0.114	0.444	0.622	0.287	0.095	0.005	0.440	0.063	0.386	0.147	0.068	0.449	0.532	0.704	0.213	0.347	0.300	0.054	0.438
	29	0.033	0.369	0.196	0.193	0.097	0.195	0.006	0.090	0.118	0.476	0.177	0.282	0.031	0.810	0.016	0.470	0.347	0.063	0.100	0.097
	30	0.725	0.767	0.853	0.997	0.897	0.860	0.325	0.769	0.946	0.949	0.850	0.872	0.984	0.977	0.974	0.423	0.977	0.800	0.685	0.995
	31	0.441	0.991	0.010	0.395	0.235	0.906	0.741	0.597	0.128	0.538	0.685	0.301	0.422	0.289	0.349	0.423	0.223	0.436	0.244	0.366
	32	0.992	0.992	0.993	0.978	0.957	0.999	0.956	0.973	0.982	0.920	0.996	0.999	0.936	0.967	0.922	0.915	0.895	0.975	0.993	0.966
	33	0.109	0.520	0.631	0.033	0.332	0.366	0.139	0.552	0.100	0.033	0.247	0.194	0.153	0.406	0.083	0.518	0.223	0.563	0.036	0.193
	34	0.702	0.235	0.317	0.794	0.442	0.128	0.924	0.633	0.896	0.864	0.889	0.322	0.938	0.346	0.904	0.518	0.948	0.707	0.561	0.972
	35	0.853	0.463	0.931	0.782	0.851	0.829	0.688	0.982	0.956	0.990	0.803	0.818	0.914	0.116	0.890	0.566	0.964	0.981	0.740	0.930
	36	0.825	0.235	0.025	0.647	0.277	0.240	0.429	0.659	0.387	0.712	0.177	0.301	0.763	0.346	0.930	0.871	0.347	0.613	0.254	0.760
	37	0.372	0.520	0.684	0.755	0.631	0.706	0.257	0.676	0.584	0.785	0.078	0.987	0.804	0.406	0.677	0.332	0.895	0.776	0.497	0.859
	38	0.033	0.250	0.853	0.862	0.643	0.220	0.075	0.377	0.855	0.568	0.497	0.872	0.818	0.764	0.723	0.180	0.633	0.300	0.600	0.770
	39	0.781	0.019	0.317	0.055	0.181	0.072	0.728	0.709	0.010	0.249	0.247	0.364	0.032	0.346	0.030	0.081	0.347	0.588	0.178	0.034
	40	0.450	0.920	0.520	0.926	0.667	0.818	0.868	0.468	0.761	0.957	0.570	0.966	0.789	0.656	0.811	0.998	0.948	0.546	0.850	0.907
	41	0.415	0.559	0.818	0.929	0.810	0.860	0.944	0.776	0.505	0.864	0.785	0.498	0.911	0.406	0.863	0.249	0.925	0.812	0.834	0.938
	42	0.914	0.406	0.520	0.975	0.835	0.527	0.918	0.816	0.791	0.988	0.331	0.543	0.914	0.712	0.963	0.150	0.925	0.776	0.908	0.926
	43	0.186	0.463	0.805	0.225	0.754	0.184	0.075	0.351	0.406	0.386	0.594	0.674	0.070	0.191	0.173	0.779	0.223	0.419	0.696	0.073
	44	0.807	0.220	0.406	0.253	0.493	0.501	0.832	0.468	0.877	0.112	0.767	0.521	0.166	0.469	0.113	0.332	0.948	0.495	0.673	0.140
	45	0.023	0.809	0.901	0.246	0.298	0.433	0.100	0.027	0.313	0.356	0.069	0.301	0.175	0.237	0.149	0.064	0.095	0.031	0.066	0.310
	46	0.137	0.167	0.300	0.782	0.073	0.157	0.177	0.167	0.622	0.762	0.108	0.847	0.869	0.851	0.760	0.376	0.813	0.160	0.432	0.731
	47	0.977	0.887	0.701	0.819	0.923	0.898	0.969	0.822	0.978	0.657	0.929	0.803	0.975	0.289	0.958	0.741	0.948	0.886	0.809	0.963
	48	0.433	0.809	0.980	0.404	0.256	0.812	0.209	0.404	0.150	0.162	0.785	0.674	0.699	0.656	0.826	0.124	0.282	0.436	0.587	0.751
	49	0.983	0.959	0.717	0.919	0.908	0.984	0.569	0.867	0.831	0.999	0.944	0.674	0.849	0.810	0.886	0.871	0.997	0.845	0.885	0.891
2	50	0.781	0.443	0.953	0.819	0.430	0.652	0.491	0.404	0.928	0.476	0.521	0.452	0.415	0.595	0.529	0.332	0.172	0.378	0.790	0.689
	51	0.380	0.991	0.864	0.871	0.851	0.997	0.245	0.845	0.695	0.598	0.944	0.714	0.886	0.346	0.805	0.871	0.813	0.894	0.944	0.970
	52	0.999	0.887	0.792	0.954	0.843	0.923	0.997	0.991	0.956	0.949	0.877	0.498	0.893	0.532	0.935	0.741	0.994	0.991	0.963	0.976
	53	0.890	0.669	0.818	0.527	0.310	0.570	0.741	0.928	0.139	0.356	0.546	0.733	0.491	0.469	0.641	0.566	0.489	0.909	0.406	0.211
	54	0.807	0.940	0.444	0.058	0.156	0.818	0.789	0.045	0.603	0.144	0.078	0.787	0.137	0.764	0.163	0.915	0.282	0.077	0.276	0.065
	55	0.686	0.193	0.778	0.313	0.245	0.146	0.167	0.505	0.091	0.112	0.011	0.385	0.184	0.532	0.232	0.566	0.172	0.538	0.254	0.120
	56	0.397	0.767	0.999	0.801	0.965	0.742	0.429	0.834	0.426	0.785	0.472	0.695	0.789	0.656	0.821	0.932	0.699	0.886	0.936	0.788
	57	0.441	0.167	0.183	0.370	0.287	0.208	0.325	0.134	0.296	0.301	0.097	0.342	0.443	0.469	0.514	0.470	0.095	0.081	0.561	0.103
	58	0.877	0.887	0.999	0.747	0.913	0.749	0.930	0.790	0.791	0.908	0.641	0.674	0.649	0.346	0.748	0.813	0.633	0.800	0.857	0.426
	59	0.920	0.999	0.137	0.066	0.172	0.983	0.940	0.368	0.505	0.144	0.937	0.164	0.070	0.469	0.067	0.213	0.282	0.330	0.600	0.073
	60	0.042	0.540	0.733	0.954	0.851	0.561	0.100	0.588	0.791	0.762	0.993	0.905	0.886	0.656	0.875	0.332	0.633	0.677	0.649	0.845
	61	0.890	0.767	0.147	0.622	0.235	0.869	0.989	0.404	0.641	0.957	0.900	0.714	0.699	0.712	0.723	0.124	0.858	0.487	0.497	0.760
	62	0.999	0.350	0.284	0.447	0.245	0.311	0.999	0.676	0.202	0.446	0.448	0.521	0.681	0.469	0.717	0.518	0.282	0.721	0.406	0.536
	63	0.079	0.045	0.018	0.500	0.544	0.037	0.198	0.334	0.057	0.249	0.228	0.194	0.596	0.656	0.522	0.518	0.416	0.224	0.309	0.741
	64	0.953	0.896	0.893	0.999	0.723	0.926	0.832	0.861	0.877	0.997	0.950	0.632	0.976	0.935	0.989	0.871	0.991	0.829	0.990	0.988
	65	0.468	0.167	0.792	0.940	0.266	0.375	0.715	0.218	0.805	0.920	0.288	0.733	0.890	0.953	0.886	0.915	0.416	0.250	0.612	0.912
	66	0.914	0.333	0.317	0.909	0.793	0.668	0.966	0.977	0.622	0.895	0.889	0.210	0.879	0.532	0.795	0.150	0.895	0.973	0.781	0.945
	67	0.059	0.767	0.444	0.148	0.701	0.335	0.060	0.351	0.776	0.538	0.004	0.385	0.235	0.191	0.232	0.249	0.347	0.411	0.106	0.133
	68	0.941	0.615	0.406	0.836	0.532	0.891	0.630	0.894	0.331	0.685	0.962	0.884	0.950	0.595	0.875	0.741	0.895	0.829	0.978	0.963
	69	0.653	0.934	0.557	0.353	0.430	0.940	0.715	0.422	0.083	0.598	0.850	0.342	0.723	0.469	0.826	0.894	0.416	0.453	0.809	0.438
	70	0.010	0.003	0.284	0.134	0.519	0.003	0.107	0.041	0.069	0.064	0.210	0.068	0.074	0.346	0.067	0.039	0.068	0.043	0.170	0.032
	71	0.147	0.015	0.425	0.138	0.380	0.029	0.569	0.386	0.603	0.144	0.028	0.179	0.042	0.346	0.092	0.009	0.172	0.346	0.074	0.012
	72	0.012	0.180	0.853	0.111	0.356	0.201	0.021	0.204	0.128	0.085	0.087	0.884	0.067	0.116	0.105	0.566	0.416	0.243	0.095	0.087
	73	0.986	0.350	0.805	0.297	0.121	0.260	0.992	0.755	0.505	0.182	0.288	0.244	0.224	0.346	0.128	0.332	0.633	0.714	0.357	0.078
	74	0.611	0.999	0.501	0.353	0.594	0.998	0.507	0.468	0.603	0.628	0.288	0.818	0.280	0.406	0.328	0.423	0.562	0.504	0.205	0.258
	75	0.958	0.704	0.969	0.801	0.974	0.628	0.728	0.934	0.905	0.908	0.210	0.994	0.809	0.885	0.871	0.894	0.925	0.957	0.536	0.885
	76	0.199	0.250	0.842	0.253	0.235	0.304	0.476	0.134	0.262	0.301	0.002	0.521	0.274	0.150	0.315	0.081	0.489	0.105	0.254	0.220
	77	0.205	0.298	0.501	0.973	0.344	0.475	0.257	0.261	0.313	0.446	0.641	0.914	0.988	0.712	0.971	0.915	0.562	0.354	0.574	0.979
	78	0.267	0.333	0.842	0.871	0.544	0.319	0.311	0.276	0.076	0.737	0.078	0.322	0.908	0.469	0.961	0.289	0.223	0.155	0.357	0.930
	79	0.941	0.350	0.733	0.655	0.142	0.433	0.940	0.232	0.426	0.356	0.193	0.752	0.836	0.885	0.816	0.566	0.347	0.278	0.809	0.917
	80	0.175	0.992	0.576	0.124	0.417	0.916	0.131	0.359	0.202	0.785	0.078	0.084	0.323	0.289	0.408	0.213	0.223	0.250	0.084	0.289
	81	0.886	0.999	0.982	0.421	0.975	0.999	0.270	0.810	0.921	0.628	0.956	0.770	0.602	0.532	0.690	0.932	0.562	0.812	0.994	0.573
	82	0.836	0.913	0.969	0.912	0.997	0.988	0.339	0.881	0.982	0.356	0.981	0.993	0.845	0.712	0.821	0.982	0.925	0.913	0.993	0.885
	83	0.960	0.913	0.613	0.819	0.986	0.989	0.918	0.967	0.928	0.762	0.785	0.895	0.980	0.289	0.959	0.932	0.813	0.982	0.932	0.983
	84	0.842	0.266	0.884	0.801	0.810	0.578	0.801	0.890	0.641	0.985	0.247	0.818	0.622	0.532	0.491	0.982	0.977	0.873	0.878	0.585
	85	0.011	0.282	0.388	0.111	0.310	0.128	0.001	0.006	0.030	0.098	0.002	0.137	0.149	0.237	0.256	0.081	0.068	0.007	0.224	0.087
	86	0.944	0.857	0.733	0.929	0.936	0.728	0.778	0.615	0.928	0.685	0.147	0.818	0.911	0.532	0.784	0.376	0.699	0.721	0.897	0.879
	87	0.477	0.540	0.196	0.703	0.455	0.450	0.892	0.624	0.505	0.328	0.641	0.752	0.865	0.764	0.717	0.990	0.699	0.677	0.878	0.806
	88	0.949	0.927	0.805	0.747	0.891	0.976	0.368	0.840	0.831	0.920	0.663	0.498	0.498	0.289	0.627	0.779	0.985	0.818	0.923	0.770
	89	0.996	0.540	0.117	0.313	0.519	0.788	0.892	0.615	0.791	0.737	0.819	0.632	0.443	0.712	0.415	0.566	0.858	0.512	0.708	0.512
	90	0.987	0.991	0.931	0.807	0.989	0.992	0.940	0.978	0.999	0.657	0.999	0.714	0.649	0.469	0.641	0.376	0.858	0.971	0.999	0.741
	91	0.415	0.559	0.238	0.465	0.908	0.475	0.060	0.740	0.746	0.064	0.819	0.632	0.286	0.406	0.244	0.915	0.813	0.749	0.673	0.355
	92	0.346	0.045	0.792	0.036	0.103	0.103	0.600	0.334	0.030	0.301	0.037	0.038	0.184	0.116	0.226	0.007	0.282	0.257	0.234	0.289
	93	0.070	0.081	0.649	0.337	0.092	0.103	0.270	0.179	0.013	0.112	0.685	0.054	0.141	0.237	0.116	0.124	0.020	0.205	0.118	0.114
	94	0.702	0.482	0.884	0.313	0.678	0.668	0.659	0.845	0.761	0.598	0.448	0.610	0.484	0.289	0.364	0.932	0.416	0.898	0.963	0.585
	95	0.424	0.369	0.170	0.562	0.918	0.675	0.674	0.940	0.713	0.827	0.570	0.905	0.876	0.116	0.778	0.958	0.699	0.951	0.471	0.873
	96	0.306	0.964	0.961	0.148	0.872	0.906	0.177	0.246	0.564	0.144	0.850	0.543	0.106	0.764	0.198	0.289	0.223	0.199	0.954	0.193
	97	0.004	0.002	0.268	0.553	0.043	0.007	0.012	0.041	0.076	0.657	0.048	0.043	0.470	0.712	0.627	0.101	0.347	0.024	0.058	0.426
	98	0.338	0.520	0.108	0.200	0.053	0.274	0.715	0.086	0.091	0.415	0.247	0.061	0.065	0.191	0.102	0.001	0.068	0.058	0.146	0.133
	Range	0.997	0.998	0.990	0.981	0.972	0.997	0.999	0.985	0.990	0.965	0.998	0.995	0.966	0.930	0.973	0.997	0.976	0.985	0.966	0.983

Condition no.	RHM no.	BD1	BD2	BD3	BD4	BD5	BD6	BD7	BD8	BD9	BD10	BD11	BD12	BD13	BD14	BD15	BD16	BD17	BD18	BD19	BD20
	1	0.903	0.977	0.985	0.187	0.623	0.975	0.992	0.975	0.999	0.963	0.988	0.764	0.989	0.994	0.984	0.994	0.999	0.996	0.980	0.592
	2	0.969	0.907	0.996	0.100	0.822	0.991	0.883	0.957	0.727	0.461	0.999	0.810	0.799	0.294	0.985	0.999	0.977	0.351	0.989	0.066
	3	0.909	0.951	0.990	0.519	0.868	0.984	0.945	0.983	0.491	0.782	0.973	0.902	0.633	0.618	0.981	0.951	0.955	0.950	0.981	0.565
	4	0.121	0.044	0.211	0.150	0.062	0.338	0.016	0.287	0.042	0.111	0.189	0.033	0.071	0.040	0.185	0.105	0.004	0.008	0.136	0.090
	5	0.691	0.996	0.997	0.480	0.723	0.998	0.993	0.992	0.984	0.924	0.999	0.643	0.965	0.913	0.996	0.997	0.959	0.894	0.994	0.319
	6	0.273	0.907	0.046	0.957	0.184	0.093	0.287	0.441	0.574	0.671	0.355	0.754	0.703	0.518	0.025	0.307	0.482	0.554	0.100	0.319
	7	0.967	0.999	0.984	0.245	0.980	0.957	0.957	0.978	0.950	0.819	0.817	0.908	0.950	0.961	0.993	0.840	0.992	0.990	0.984	0.891
	8	0.108	0.086	0.316	0.798	0.592	0.264	0.213	0.458	0.361	0.316	0.146	0.321	0.166	0.913	0.321	0.143	0.316	0.475	0.288	0.997
	9	0.788	0.838	0.172	0.038	0.385	0.141	0.230	0.425	0.109	0.171	0.555	0.380	0.106	0.445	0.230	0.376	0.217	0.554	0.238	0.022
	10	0.080	0.491	0.273	0.402	0.073	0.306	0.601	0.175	0.727	0.621	0.420	0.033	0.664	0.532	0.160	0.275	0.482	0.136	0.185	0.001
	11	0.778	0.838	0.836	0.015	0.125	0.775	0.126	0.752	0.330	0.285	0.420	0.256	0.203	0.192	0.677	0.560	0.300	0.661	0.647	0.015
	12	0.085	0.151	0.749	0.969	0.131	0.642	0.688	0.765	0.574	0.533	0.838	0.519	0.300	0.747	0.473	0.882	0.910	0.982	0.613	0.825
	13	0.368	0.151	0.553	0.754	0.918	0.525	0.485	0.331	0.300	0.177	0.213	0.655	0.043	0.618	0.537	0.341	0.286	0.506	0.547	0.909
	14	0.898	0.360	0.906	0.948	0.962	0.921	0.894	0.903	0.874	0.971	0.742	0.986	0.987	0.575	0.961	0.763	0.879	0.730	0.957	0.991
	15	0.135	0.838	0.865	0.480	0.240	0.753	0.845	0.863	0.392	0.177	0.653	0.189	0.211	0.518	0.864	0.633	0.465	0.675	0.816	0.747
	16	0.703	0.360	0.985	0.311	0.385	0.989	0.230	0.854	0.698	0.637	0.960	0.544	0.799	0.102	0.931	0.929	0.465	0.097	0.935	0.166
	17	0.788	0.977	0.217	0.634	0.343	0.247	0.267	0.491	0.361	0.391	0.238	0.810	0.643	0.068	0.090	0.275	0.380	0.145	0.120	0.066
	18	0.714	0.151	0.150	0.187	0.109	0.112	0.328	0.047	0.754	0.559	0.213	0.594	0.557	0.711	0.055	0.143	0.499	0.703	0.105	0.058
	19	0.985	0.742	0.524	0.597	0.976	0.588	0.883	0.711	0.930	0.987	0.684	0.989	0.938	0.998	0.716	0.523	0.935	0.994	0.718	0.929
	20	0.630	0.977	0.900	0.688	0.515	0.955	0.747	0.889	0.941	0.788	0.908	0.607	0.965	0.802	0.826	0.817	0.946	0.824	0.931	0.592
	21	0.331	0.244	0.609	0.999	0.675	0.742	0.166	0.458	0.163	0.365	0.238	0.965	0.253	0.095	0.505	0.341	0.129	0.078	0.647	0.945
	22	0.010	0.151	0.040	0.754	0.085	0.084	0.138	0.136	0.491	0.248	0.420	0.033	0.457	0.672	0.098	0.244	0.300	0.844	0.049	0.816
	23	0.841	0.244	0.940	0.688	0.926	0.838	0.858	0.929	0.958	0.983	0.960	0.865	0.956	0.873	0.901	0.951	0.879	0.862	0.871	0.273
	24	0.035	0.742	0.304	0.973	0.364	0.247	0.093	0.524	0.245	0.171	0.387	0.380	0.101	0.078	0.240	0.244	0.482	0.585	0.219	0.841
	25	0.192	0.491	0.273	0.994	0.655	0.189	0.728	0.441	0.377	0.506	0.621	0.712	0.300	0.857	0.338	0.597	0.713	0.631	0.304	0.691
	26	0.816	0.951	0.869	0.871	0.767	0.843	0.152	0.934	0.712	0.863	0.324	0.865	0.843	0.235	0.758	0.307	0.465	0.601	0.832	0.486
	27	0.127	0.838	0.102	0.076	0.104	0.076	0.393	0.247	0.196	0.207	0.189	0.024	0.579	0.320	0.164	0.412	0.138	0.136	0.129	0.114
	28	0.472	0.491	0.005	0.539	0.266	0.011	0.439	0.127	0.441	0.357	0.355	0.506	0.360	0.547	0.007	0.486	0.331	0.792	0.014	0.296
	29	0.758	0.742	0.297	0.047	0.581	0.426	0.555	0.621	0.622	0.718	0.817	0.594	0.799	0.723	0.380	0.840	0.667	0.780	0.283	0.201
	30	0.015	0.021	0.682	0.957	0.526	0.694	0.416	0.331	0.541	0.559	0.324	0.256	0.320	0.575	0.648	0.307	0.271	0.554	0.630	0.679
	31	0.135	0.623	0.403	0.688	0.449	0.511	0.439	0.491	0.286	0.149	0.621	0.216	0.211	0.604	0.648	0.275	0.430	0.601	0.510	0.747
	32	0.885	0.360	0.915	0.109	0.885	0.806	0.765	0.790	0.825	0.910	0.973	0.643	0.931	0.659	0.904	0.960	0.851	0.689	0.903	0.924
3	33	0.262	0.623	0.948	0.969	0.843	0.916	0.213	0.725	0.524	0.391	0.960	0.819	0.330	0.333	0.890	0.967	0.447	0.506	0.871	0.985
	34	0.807	0.360	0.531	0.460	0.713	0.712	0.967	0.854	0.882	0.941	0.487	0.774	0.856	0.939	0.518	0.597	0.499	0.756	0.601	0.605
	35	0.592	0.044	0.926	0.174	0.294	0.904	0.416	0.667	0.590	0.408	0.653	0.356	0.502	0.068	0.901	0.448	0.347	0.049	0.895	0.262
	36	0.016	0.360	0.285	0.616	0.081	0.214	0.230	0.024	0.163	0.188	0.189	0.028	0.330	0.138	0.344	0.123	0.286	0.218	0.342	0.592
	37	0.166	0.086	0.021	0.057	0.248	0.030	0.002	0.018	0.069	0.103	0.002	0.028	0.078	0.012	0.026	0.002	0.008	0.003	0.014	0.006
	38	0.807	0.623	0.935	0.215	0.713	0.811	0.623	0.982	0.377	0.488	0.684	0.607	0.350	0.735	0.849	0.633	0.667	0.902	0.858	0.579
	39	0.307	0.907	0.900	0.402	0.385	0.916	0.799	0.813	0.856	0.702	0.793	0.181	0.862	0.360	0.867	0.448	0.769	0.730	0.881	0.241
	40	0.872	0.623	0.538	0.539	0.849	0.497	0.831	0.273	0.779	0.595	0.653	0.810	0.722	0.547	0.467	0.560	0.830	0.351	0.664	0.643
	41	0.284	0.491	0.574	0.022	0.143	0.706	0.623	0.524	0.541	0.374	0.621	0.021	0.546	0.849	0.618	0.448	0.286	0.427	0.571	0.015
	42	0.919	0.951	0.869	0.616	0.967	0.938	0.957	0.801	0.945	0.981	0.621	0.943	0.965	0.980	0.939	0.882	0.917	0.980	0.946	0.977
	43	0.929	0.990	0.955	0.881	0.986	0.960	0.967	0.991	0.987	0.997	0.988	0.977	0.914	0.991	0.922	0.992	0.983	0.973	0.937	0.768
	44	0.864	0.491	0.719	0.027	0.602	0.718	0.831	0.441	0.924	0.863	0.742	0.480	0.856	0.840	0.688	0.862	0.941	0.780	0.697	0.778
	45	0.459	0.838	0.883	0.860	0.799	0.964	0.962	0.939	0.958	0.978	0.988	0.744	0.891	0.999	0.917	0.973	0.974	0.942	0.946	0.942
	46	0.142	0.838	0.233	0.722	0.163	0.137	0.032	0.331	0.361	0.241	0.387	0.164	0.173	0.202	0.276	0.341	0.286	0.127	0.193	0.499
	47	0.472	0.003	0.177	0.027	0.665	0.102	0.462	0.362	0.117	0.149	0.095	0.121	0.101	0.032	0.255	0.123	0.217	0.041	0.133	0.102
	48	0.816	0.742	0.701	0.421	0.895	0.675	0.728	0.621	0.727	0.687	0.588	0.802	0.807	0.993	0.748	0.560	0.950	0.958	0.786	0.985
	49	0.420	0.491	0.031	0.383	0.257	0.016	0.138	0.111	0.046	0.055	0.059	0.368	0.211	0.084	0.064	0.022	0.243	0.184	0.032	0.262
	50	0.343	0.742	0.546	0.558	0.248	0.581	0.667	0.652	0.941	0.782	0.793	0.310	0.985	0.831	0.386	0.862	0.840	0.743	0.485	0.262
	51	0.924	0.999	0.656	0.860	0.930	0.843	0.923	0.765	0.984	0.973	0.858	0.982	0.905	0.934	0.732	0.899	0.981	0.946	0.865	0.891
	52	0.986	0.491	0.989	0.047	0.985	0.995	0.998	0.957	0.945	0.872	0.997	0.872	0.927	0.934	0.993	0.995	0.981	0.908	0.991	0.319
	53	0.150	0.360	0.383	0.577	0.333	0.258	0.371	0.287	0.541	0.248	0.877	0.181	0.117	0.958	0.492	0.915	0.683	0.970	0.430	0.605
	54	0.102	0.742	0.595	0.849	0.016	0.532	0.166	0.247	0.143	0.103	0.294	0.405	0.153	0.604	0.442	0.341	0.465	0.743	0.491	0.319
	55	0.788	0.623	0.958	0.597	0.922	0.929	0.938	0.777	0.918	0.807	0.877	0.851	0.740	0.632	0.967	0.915	0.969	0.585	0.898	0.758
	56	0.989	0.742	0.538	0.174	0.955	0.753	0.393	0.844	0.712	0.687	0.817	0.957	0.923	0.711	0.642	0.817	0.667	0.646	0.618	0.150
	57	0.041	0.907	0.067	0.969	0.156	0.066	0.485	0.221	0.153	0.149	0.042	0.266	0.173	0.474	0.112	0.089	0.271	0.195	0.103	0.938
	58	0.768	0.491	0.304	0.754	0.829	0.090	0.645	0.409	0.574	0.533	0.521	0.819	0.684	0.888	0.429	0.560	0.551	0.937	0.383	0.969
	59	0.381	0.742	0.707	0.812	0.131	0.662	0.601	0.441	0.143	0.154	0.621	0.678	0.320	0.474	0.612	0.523	0.243	0.631	0.687	0.307
	60	0.737	0.742	0.978	0.277	0.417	0.957	0.728	0.896	0.912	0.702	0.817	0.557	0.896	0.831	0.951	0.791	0.807	0.661	0.887	0.526
	61	0.816	0.742	0.273	0.100	0.675	0.166	0.393	0.175	0.727	0.533	0.167	0.493	0.457	0.604	0.266	0.143	0.192	0.942	0.257	0.726
	62	0.952	0.977	0.912	0.923	0.822	0.938	0.957	0.989	0.924	0.894	0.967	0.991	0.783	0.972	0.860	0.951	0.896	0.814	0.906	0.841
	63	0.251	0.742	0.087	0.260	0.047	0.060	0.509	0.047	0.081	0.084	0.095	0.164	0.117	0.123	0.098	0.042	0.286	0.661	0.097	0.368
	64	0.703	0.244	0.062	0.012	0.073	0.036	0.196	0.145	0.143	0.052	0.355	0.115	0.101	0.388	0.075	0.376	0.180	0.322	0.029	0.038
	65	0.486	0.491	0.102	0.402	0.504	0.115	0.196	0.287	0.590	0.188	0.059	0.532	0.253	0.532	0.131	0.143	0.064	0.661	0.133	0.630
	Range	0.980	0.996	0.992	0.988	0.970	0.987	0.996	0.974	0.957	0.945	0.998	0.970	0.946	0.987	0.989	0.997	0.996	0.993	0.980	0.996

Condition no.	RHM no.	BD1	BD2	BD3	BD4	BD5	BD6	BD7	BD8	BD9	BD10	BD11	BD12	BD13	BD14	BD15	BD16	BD17	BD18	BD19	BD20
	1	0.193	0.820	0.437	0.132	0.611	0.881	0.275	0.702	0.063	0.696	0.300	0.101	0.288	0.612	0.346	0.173	0.017	0.424	0.126	0.030
	2	0.384	0.459	0.943	0.072	0.660	0.634	0.929	0.930	0.713	0.728	0.381	0.658	0.581	0.394	0.837	0.873	0.956	0.092	0.644	0.996
	3	0.695	0.593	0.176	0.935	0.940	0.558	0.969	0.949	0.855	0.940	0.799	0.701	0.992	0.885	0.750	0.873	0.891	0.501	0.996	0.837
	4	0.671	0.686	0.363	0.030	0.542	0.923	0.024	0.778	0.128	0.454	0.643	0.289	0.012	0.510	0.404	0.770	0.878	0.603	0.019	0.002
	5	0.193	0.551	0.066	0.028	0.568	0.995	0.138	0.093	0.162	0.102	0.140	0.017	0.079	0.406	0.023	0.123	0.119	0.004	0.140	0.002
	6	0.035	0.187	0.790	0.120	0.538	0.022	0.344	0.615	0.188	0.195	0.091	0.249	0.264	0.458	0.157	0.416	0.305	0.173	0.366	0.005
	7	0.875	0.431	0.943	0.603	0.696	0.916	0.796	0.953	0.622	0.875	0.836	0.213	0.859	0.458	0.872	0.791	0.914	0.860	0.845	0.999
	8	0.275	0.972	0.884	0.955	0.863	0.671	0.869	0.851	0.406	0.817	0.381	0.779	0.946	0.561	0.644	0.802	0.736	0.570	0.912	0.999
	9	0.026	0.116	0.131	0.287	0.455	0.722	0.051	0.075	0.046	0.309	0.028	0.081	0.062	0.561	0.139	0.004	0.024	0.391	0.034	0.001
	10	0.968	0.593	0.094	0.432	0.947	0.441	0.668	0.953	0.216	0.976	0.985	0.566	0.405	0.897	0.375	0.812	0.797	0.510	0.475	0.987
	11	0.158	0.018	0.437	0.037	0.156	0.003	0.326	0.122	0.109	0.178	0.253	0.613	0.129	0.162	0.053	0.547	0.431	0.713	0.140	0.008
	12	0.184	0.273	0.514	0.141	0.761	0.084	0.457	0.851	0.296	0.320	0.330	0.470	0.230	0.549	0.346	0.698	0.199	0.208	0.185	0.122
	13	0.595	0.942	0.231	0.166	0.615	0.634	0.308	0.383	0.855	0.462	0.300	0.101	0.220	0.761	0.094	0.913	0.666	0.527	0.202	0.060
	14	0.167	0.946	0.884	0.729	0.956	0.923	0.935	0.969	0.956	0.888	0.253	0.987	0.938	0.954	0.872	0.972	0.864	0.940	0.930	0.975
	15	0.232	0.052	0.094	0.338	0.178	0.162	0.108	0.107	0.027	0.158	0.513	0.332	0.288	0.154	0.038	0.258	0.537	0.041	0.414	0.022
	16	0.298	0.895	0.437	0.792	0.156	0.499	0.091	0.093	0.564	0.298	0.310	0.180	0.325	0.154	0.196	0.374	0.260	0.878	0.278	0.001
	17	0.184	0.173	0.514	0.216	0.069	0.245	0.457	0.569	0.331	0.544	0.166	0.423	0.736	0.044	0.292	0.051	0.218	0.227	0.644	0.853
	18	0.212	0.973	0.590	0.820	0.889	0.999	0.344	0.270	0.791	0.250	0.203	0.518	0.742	0.891	0.318	0.095	0.199	0.742	0.644	0.046
	19	0.960	0.950	0.663	0.762	0.983	0.722	0.496	0.924	0.641	0.966	0.973	0.987	0.574	0.960	0.901	0.989	0.999	0.660	0.731	0.999
	20	0.940	0.641	0.962	0.990	0.508	0.245	0.995	0.789	0.695	0.823	0.880	0.843	0.999	0.369	0.935	0.994	0.996	0.706	0.999	0.949
	21	0.423	0.349	0.231	0.247	0.127	0.798	0.720	0.006	0.445	0.033	0.203	0.518	0.288	0.265	0.241	0.037	0.049	0.095	0.524	0.001
	22	0.740	0.824	0.514	0.416	0.729	0.499	0.810	0.953	0.139	0.794	0.633	0.779	0.712	0.612	0.774	0.747	0.878	0.375	0.548	0.999
	23	0.888	0.285	0.995	0.701	0.284	0.346	0.941	0.257	0.175	0.585	0.896	0.976	0.913	0.298	0.644	0.474	0.218	0.327	0.866	0.915
	24	0.991	0.641	0.991	0.984	0.917	0.908	0.999	0.994	0.934	0.934	0.975	0.990	0.999	0.903	0.996	0.873	0.833	0.987	0.999	0.999
	25	0.954	0.593	0.975	0.610	0.529	0.480	0.935	0.994	0.831	0.855	0.967	0.999	0.811	0.458	0.994	0.954	0.815	0.967	0.907	0.999
	26	0.423	0.466	0.590	0.841	0.251	0.769	0.961	0.297	0.465	0.707	0.568	0.813	0.770	0.178	0.796	0.781	0.903	0.311	0.934	0.915
	27	0.051	0.127	0.590	0.274	0.175	0.798	0.438	0.491	0.695	0.429	0.083	0.741	0.371	0.044	0.346	0.445	0.590	0.260	0.390	0.979
	28	0.232	0.870	0.231	0.749	0.934	0.923	0.326	0.906	0.695	0.961	0.513	0.741	0.539	0.790	0.774	0.518	0.260	0.208	0.524	0.997
	29	0.264	0.139	0.975	0.554	0.116	0.311	0.650	0.131	0.331	0.146	0.067	0.470	0.910	0.066	0.796	0.108	0.164	0.051	0.912	0.046
	30	0.659	0.239	0.884	0.072	0.350	0.187	0.555	0.368	0.313	0.119	0.281	0.566	0.656	0.287	0.434	0.029	0.017	0.510	0.524	0.016
	31	0.608	0.936	0.293	0.210	0.870	0.995	0.127	0.257	0.660	0.165	0.310	0.213	0.129	0.865	0.139	0.084	0.057	0.162	0.268	0.022
	32	0.503	0.867	0.998	0.820	0.784	0.383	0.823	0.585	0.545	0.295	0.350	0.946	0.919	0.834	0.914	0.698	0.690	0.769	0.891	0.451
	33	0.906	0.785	0.437	0.234	0.464	0.754	0.275	0.167	0.505	0.148	0.524	0.023	0.447	0.637	0.006	0.123	0.218	0.433	0.475	0.003
	34	0.762	0.999	0.790	0.976	0.966	0.997	0.782	0.949	0.831	0.812	0.862	0.968	0.855	0.865	0.872	0.888	0.949	0.675	0.873	0.999
	35	0.999	0.977	0.437	0.672	0.988	0.558	0.631	0.999	0.761	0.996	0.999	0.701	0.511	0.995	0.837	0.929	0.967	0.994	0.536	0.999
	36	0.762	0.764	0.590	0.921	0.598	0.597	0.978	0.912	0.956	0.862	0.693	0.779	0.926	0.333	0.901	0.964	0.997	0.812	0.866	0.999
	37	0.410	0.466	0.917	0.715	0.870	0.812	0.957	0.832	0.641	0.748	0.350	0.976	0.946	0.649	0.586	0.857	0.666	0.675	0.976	0.998
	38	0.729	0.888	0.231	0.497	0.963	0.957	0.243	0.899	0.426	0.366	0.513	0.741	0.345	0.972	0.434	0.880	0.956	0.636	0.289	0.183
	39	0.999	0.445	0.590	0.860	0.889	0.688	0.823	0.960	0.584	0.950	0.999	0.982	0.955	0.842	0.925	0.802	0.903	0.916	0.942	0.999
	40	0.047	0.957	0.790	0.338	0.477	0.993	0.243	0.233	0.246	0.346	0.060	0.039	0.204	0.649	0.061	0.307	0.736	0.075	0.278	0.046
	41	0.232	0.919	0.884	0.309	0.707	0.969	0.613	0.460	0.622	0.195	0.101	0.701	0.447	0.696	0.495	0.561	0.962	0.586	0.666	0.022
	42	0.951	0.955	0.985	0.774	0.777	0.616	0.982	0.930	0.622	0.528	0.874	0.518	0.913	0.708	0.495	0.547	0.690	0.991	0.934	0.654
	43	0.973	0.998	0.917	0.908	0.968	0.825	0.998	0.994	0.729	0.958	0.958	0.915	0.992	0.923	0.994	0.967	0.987	0.829	0.993	0.999
	44	0.476	0.466	0.590	0.323	0.379	0.784	0.835	0.960	0.545	0.585	0.601	0.996	0.796	0.187	0.901	0.459	0.305	0.416	0.731	0.996
	45	0.860	0.362	0.962	0.408	0.858	0.038	0.685	0.778	0.262	0.601	0.874	0.101	0.518	0.781	0.139	0.901	0.757	0.775	0.632	0.060
4	46	0.989	0.979	0.663	0.977	0.992	0.754	0.906	0.974	0.993	0.988	0.999	0.946	0.924	0.998	0.796	0.978	0.972	0.949	0.926	0.999
	47	0.021	0.222	0.917	0.804	0.258	0.139	0.767	0.187	0.505	0.401	0.020	0.968	0.656	0.406	0.945	0.802	0.924	0.274	0.731	0.821
	48	0.940	0.431	0.293	0.715	0.408	0.916	0.965	0.569	0.678	0.560	0.874	0.332	0.962	0.471	0.817	0.791	0.616	0.882	0.961	0.995
	49	0.371	0.717	0.514	0.156	0.781	0.616	0.555	0.460	0.128	0.389	0.203	0.376	0.214	0.625	0.071	0.138	0.084	0.954	0.202	0.201
	50	0.423	0.424	0.590	0.786	0.310	0.653	0.994	0.028	0.584	0.264	0.227	0.701	0.994	0.345	0.644	0.173	0.431	0.072	0.998	0.077
	51	0.947	0.885	0.231	0.634	0.560	0.837	0.308	0.187	0.279	0.454	0.896	0.566	0.185	0.817	0.615	0.459	0.590	0.942	0.438	0.030
	52	0.462	0.674	0.293	0.440	0.585	0.187	0.477	0.868	0.713	0.699	0.622	0.249	0.185	0.510	0.837	0.894	0.777	0.450	0.462	0.999
	53	0.729	0.959	0.176	0.489	0.560	0.849	0.685	0.257	0.934	0.401	0.310	0.613	0.669	0.730	0.644	0.759	0.690	0.424	0.779	0.040
	54	0.503	0.654	0.884	0.400	0.481	0.916	0.935	0.688	0.505	0.678	0.590	0.289	0.885	0.345	0.945	0.346	0.260	0.603	0.699	0.999
	55	0.792	0.473	0.985	0.694	0.952	0.441	0.613	0.966	0.844	0.957	0.850	0.982	0.504	0.984	0.925	0.934	0.757	0.968	0.731	0.995
	56	0.966	0.924	0.437	0.993	0.960	0.990	0.835	0.979	0.887	0.978	0.953	0.779	0.901	0.944	0.991	0.924	0.849	0.971	0.885	0.999
	57	0.175	0.011	0.590	0.432	0.434	0.015	0.685	0.270	0.465	0.173	0.117	0.039	0.775	0.333	0.157	0.192	0.119	0.818	0.779	0.016
	58	0.321	0.164	0.590	0.831	0.184	0.174	0.858	0.055	0.678	0.580	0.590	0.566	0.972	0.162	0.061	0.059	0.404	0.069	0.961	0.580
	59	0.222	0.187	0.176	0.302	0.577	0.024	0.796	0.754	0.368	0.696	0.300	0.566	0.615	0.458	0.586	0.791	0.238	0.162	0.644	0.993
	60	0.943	0.473	0.590	0.204	0.774	0.150	0.594	0.778	0.729	0.948	0.880	0.871	0.230	0.790	0.837	0.685	0.590	0.769	0.185	0.971
	61	0.595	0.077	0.663	0.701	0.767	0.187	0.108	0.615	0.564	0.260	0.457	0.332	0.371	0.850	0.218	0.333	0.329	0.850	0.211	0.166
	62	0.222	0.244	0.176	0.120	0.284	0.688	0.051	0.065	0.017	0.187	0.300	0.150	0.162	0.095	0.241	0.051	0.106	0.282	0.169	0.001
	63	0.115	0.250	0.001	0.019	0.082	0.634	0.012	0.055	0.387	0.077	0.096	0.002	0.007	0.254	0.007	0.078	0.008	0.220	0.010	0.001
	64	0.751	0.349	0.514	0.749	0.269	0.017	0.782	0.953	0.641	0.757	0.874	0.124	0.748	0.321	0.644	0.939	0.903	0.869	0.689	0.999
	65	0.740	0.070	0.176	0.137	0.644	0.038	0.326	0.270	0.188	0.192	0.568	0.064	0.141	0.809	0.045	0.445	0.181	0.806	0.248	0.001
	66	0.016	0.735	0.514	0.914	0.042	0.383	0.399	0.023	0.262	0.139	0.051	0.518	0.615	0.125	0.644	0.360	0.305	0.025	0.524	0.014
	67	0.529	0.375	0.131	0.514	0.262	0.441	0.906	0.554	0.188	0.362	0.513	0.658	0.497	0.146	0.346	0.346	0.777	0.416	0.689	0.853
	68	0.671	0.948	0.962	0.804	0.948	0.201	0.810	0.990	0.713	0.932	0.862	0.518	0.815	0.944	0.726	0.711	0.815	0.898	0.699	0.999
	69	0.947	0.987	0.730	0.914	0.999	0.849	0.536	0.998	0.928	0.992	0.985	0.968	0.730	0.999	0.996	0.993	0.967	0.997	0.751	0.999
	70	0.608	0.904	0.514	0.424	0.893	0.860	0.613	0.995	0.296	0.503	0.381	0.566	0.700	0.923	0.615	0.711	0.690	0.636	0.731	0.098
	71	0.462	0.661	0.975	0.749	0.949	0.825	0.399	0.645	0.844	0.540	0.253	0.249	0.482	0.972	0.434	0.723	0.797	0.840	0.585	0.004
	72	0.994	0.913	0.437	0.768	0.928	0.597	0.957	0.999	0.564	0.981	0.994	0.995	0.904	0.948	0.999	0.929	0.933	0.960	0.830	0.999
	73	0.836	0.764	0.790	0.497	0.668	0.539	0.982	0.940	0.928	0.636	0.731	0.180	0.966	0.661	0.434	0.913	0.757	0.510	0.845	0.989
	74	0.978	0.187	0.995	0.914	0.590	0.109	0.988	0.766	0.805	0.882	0.975	0.423	0.999	0.600	0.901	0.632	0.849	0.586	0.992	0.999
	75	0.926	0.800	0.730	0.804	0.983	0.519	0.823	0.956	0.485	0.983	0.934	0.813	0.919	0.983	0.434	0.943	0.815	0.949	0.917	0.999
	76	0.242	0.349	0.590	0.918	0.310	0.162	0.961	0.754	0.584	0.707	0.524	0.741	0.910	0.254	0.218	0.812	0.590	0.493	0.751	0.853
	77	0.683	0.473	0.514	0.804	0.224	0.558	0.972	0.507	0.968	0.478	0.381	0.518	0.993	0.244	0.404	0.735	0.891	0.424	0.982	0.989
	78	0.232	0.063	0.018	0.369	0.116	0.070	0.399	0.081	0.019	0.198	0.403	0.124	0.312	0.066	0.495	0.258	0.537	0.536	0.248	0.053
	79	0.646	0.045	0.094	0.176	0.656	0.006	0.199	0.491	0.505	0.204	0.535	0.470	0.230	0.708	0.292	0.173	0.218	0.906	0.248	0.136
	80	0.931	0.863	0.176	0.836	0.754	0.277	0.685	0.754	0.713	0.738	0.807	0.779	0.560	0.612	0.586	0.561	0.564	0.909	0.512	0.999
	81	0.695	0.878	0.176	0.408	0.903	0.311	0.536	0.974	0.968	0.890	0.611	0.894	0.742	0.923	0.945	0.947	0.956	0.668	0.770	0.881
	82	0.634	0.962	0.437	0.456	0.975	0.930	0.362	0.953	0.485	0.931	0.713	0.871	0.518	0.985	0.495	0.659	0.815	0.947	0.258	0.723
	83	0.772	0.135	0.514	0.037	0.224	0.738	0.149	0.615	0.175	0.767	0.749	0.518	0.145	0.162	0.556	0.374	0.537	0.416	0.103	0.853
	84	0.922	0.285	0.514	0.331	0.318	0.162	0.631	0.949	0.776	0.860	0.967	0.741	0.595	0.298	0.817	0.307	0.218	0.253	0.366	0.853
	85	0.253	0.212	0.066	0.032	0.815	0.346	0.160	0.383	0.465	0.295	0.513	0.332	0.010	0.817	0.318	0.192	0.057	0.375	0.032	0.068
	86	0.999	0.752	0.841	0.546	0.934	0.022	0.810	0.988	0.978	0.993	0.999	0.968	0.662	0.878	0.953	0.982	0.979	0.961	0.822	0.999
	87	0.242	0.916	0.884	0.901	0.425	0.936	0.160	0.444	0.445	0.213	0.350	0.213	0.282	0.708	0.123	0.445	0.457	0.891	0.278	0.183
	88	0.867	0.459	0.131	0.064	0.870	0.754	0.042	0.715	0.231	0.576	0.862	0.566	0.036	0.928	0.971	0.202	0.084	0.855	0.042	0.327
	89	0.906	0.881	0.437	0.937	0.996	0.653	0.879	0.999	0.934	0.998	0.967	0.871	0.712	0.990	0.699	0.939	0.962	0.960	0.806	0.995
	90	0.881	0.473	0.590	0.132	0.354	0.558	0.889	0.754	0.387	0.696	0.910	0.566	0.581	0.369	0.750	0.831	0.641	0.391	0.666	0.999
	Range	0.984	0.988	0.997	0.974	0.958	0.996	0.988	0.994	0.976	0.965	0.980	0.997	0.993	0.956	0.994	0.990	0.990	0.993	0.989	0.999

Condition no.	RHM no.	BD1	BD2	BD3	BD4	BD5	BD6	BD7	BD8	BD9	BD10	BD11	BD12	BD13	BD14	BD15	BD16	BD17	BD18	BD19	BD20
	1	0.536	0.927	0.321	0.586	0.087	0.284	0.588	0.763	0.408	0.041	0.196	0.416	0.070	0.426	0.871	0.190	0.264	0.051	0.548	0.341
	2	0.799	0.829	0.568	0.843	0.400	0.812	0.733	0.953	0.509	0.764	0.625	0.832	0.383	0.612	0.887	0.224	0.806	0.566	0.858	0.935
	3	0.265	0.067	0.887	0.699	0.999	0.784	0.752	0.334	0.550	0.675	0.740	0.278	0.851	0.710	0.506	0.795	0.028	0.376	0.121	0.362
	4	0.484	0.911	0.298	0.003	0.060	0.167	0.301	0.501	0.024	0.241	0.214	0.416	0.615	0.107	0.366	0.131	0.010	0.613	0.300	0.396
	5	0.205	0.506	0.044	0.740	0.001	0.201	0.282	0.406	0.059	0.574	0.205	0.520	0.822	0.041	0.104	0.096	0.419	0.289	0.789	0.383
	6	0.406	0.113	0.950	0.538	0.997	0.538	0.695	0.425	0.686	0.992	0.445	0.516	0.339	0.853	0.280	0.992	0.901	0.779	0.287	0.534
	7	0.484	0.769	0.555	0.243	0.077	0.588	0.125	0.406	0.146	0.358	0.333	0.434	0.081	0.332	0.926	0.513	0.005	0.518	0.442	0.449
	8	0.321	0.077	0.809	0.719	0.995	0.772	0.770	0.334	0.840	0.944	0.612	0.252	0.009	0.819	0.538	0.883	0.419	0.976	0.121	0.166
	9	0.214	0.312	0.383	0.347	0.068	0.239	0.342	0.388	0.448	0.511	0.309	0.282	0.043	0.234	0.184	0.304	0.010	0.518	0.070	0.150
	10	0.999	0.998	0.993	0.987	0.999	0.999	0.956	0.909	0.991	0.851	0.999	0.995	0.999	0.994	0.997	0.995	0.588	0.843	0.866	0.995
	11	0.357	0.263	0.658	0.973	0.867	0.357	0.430	0.982	0.349	0.662	0.510	0.557	0.585	0.819	0.538	0.905	0.504	0.518	0.563	0.471
	12	0.649	0.299	0.760	0.959	0.984	0.416	0.714	0.818	0.786	0.364	0.740	0.841	0.209	0.761	0.427	0.940	0.995	0.779	0.755	0.893
	13	0.510	0.106	0.835	0.987	0.723	0.608	0.974	0.763	0.388	0.595	0.510	0.271	0.177	0.629	0.381	0.812	0.806	0.332	0.622	0.267
	14	0.799	0.251	0.670	0.699	0.260	0.441	0.610	0.684	0.738	0.957	0.625	0.592	0.245	0.662	0.646	0.304	0.901	0.470	0.840	0.583
	15	0.761	0.769	0.286	0.441	0.201	0.289	0.301	0.539	0.146	0.180	0.406	0.769	0.615	0.241	0.661	0.370	0.010	0.150	0.957	0.789
	16	0.523	0.198	0.051	0.007	0.006	0.161	0.884	0.853	0.031	0.102	0.095	0.083	0.021	0.111	0.049	0.107	0.069	0.566	0.413	0.060
	17	0.471	0.477	0.396	0.513	0.503	0.632	0.364	0.701	0.895	0.960	0.419	0.520	0.413	0.277	0.887	0.370	0.669	0.332	0.164	0.552
	18	0.458	0.968	0.232	0.207	0.260	0.267	0.385	0.048	0.550	0.371	0.214	0.421	0.801	0.285	0.887	0.609	0.339	0.813	0.692	0.570
	19	0.954	0.672	0.739	0.998	0.999	0.974	0.452	0.986	0.983	0.934	0.913	0.970	0.944	0.913	0.926	0.870	0.742	0.894	0.994	0.964
	20	0.923	0.605	0.905	0.979	0.999	0.985	0.407	0.978	0.895	0.649	0.995	0.919	0.491	0.984	0.689	0.719	0.806	0.871	0.730	0.873
	21	0.369	0.722	0.950	0.947	0.949	0.772	0.884	0.223	0.509	0.999	0.625	0.809	0.339	0.868	0.990	0.953	0.669	0.843	0.563	0.848
	22	0.988	0.959	0.916	0.999	0.999	0.958	0.966	0.999	0.989	0.985	0.986	0.998	0.754	0.961	0.968	0.964	0.859	0.990	0.998	0.999
	23	0.948	0.892	0.990	0.987	0.999	0.986	0.985	0.957	0.875	0.904	0.992	0.748	0.960	0.980	0.958	0.973	0.669	0.995	0.593	0.766
	24	0.074	0.251	0.232	0.086	0.003	0.045	0.282	0.028	0.171	0.162	0.058	0.051	0.081	0.201	0.646	0.144	0.010	0.813	0.061	0.081
	25	0.214	0.287	0.943	0.190	0.991	0.632	0.610	0.667	0.550	0.982	0.600	0.883	0.554	0.837	0.490	0.940	0.504	0.470	0.678	0.826
	26	0.891	0.863	0.965	0.987	0.999	0.891	0.733	0.961	0.864	0.999	0.834	0.994	0.963	0.970	0.942	0.991	0.973	0.958	0.718	0.994
	27	0.132	0.577	0.193	0.131	0.035	0.118	0.282	0.792	0.260	0.371	0.154	0.493	0.899	0.188	0.780	0.207	0.010	0.030	0.636	0.547
	28	0.685	0.911	0.016	0.021	0.002	0.111	0.610	0.284	0.031	0.133	0.125	0.117	0.093	0.068	0.154	0.037	0.264	0.009	0.137	0.127
	29	0.214	0.188	0.739	0.054	0.979	0.194	0.914	0.209	0.213	0.412	0.333	0.326	0.491	0.357	0.218	0.812	0.859	0.894	0.341	0.358
	30	0.871	0.577	0.887	0.947	0.999	0.948	0.322	0.370	0.972	0.475	0.981	0.976	0.940	0.927	0.661	0.759	0.859	0.289	0.593	0.983
	31	0.637	0.378	0.818	0.976	0.971	0.719	0.966	0.701	0.946	0.489	0.708	0.710	0.131	0.775	0.768	0.973	0.200	0.423	0.903	0.719
	32	0.510	0.491	0.358	0.304	0.002	0.512	0.452	0.300	0.034	0.012	0.510	0.170	0.018	0.340	0.506	0.118	0.742	0.289	0.503	0.152
	33	0.549	0.975	0.489	0.262	0.022	0.502	0.588	0.388	0.368	0.199	0.523	0.326	0.956	0.348	0.932	0.347	0.045	0.180	0.017	0.454
	34	0.041	0.229	0.212	0.002	0.003	0.255	0.610	0.053	0.059	0.175	0.321	0.168	0.413	0.120	0.053	0.262	0.028	0.813	0.035	0.238
	35	0.661	0.106	0.771	0.870	0.999	0.832	0.674	0.763	0.590	0.351	0.944	0.434	0.100	0.740	0.112	0.538	0.339	0.871	0.503	0.507
	36	0.885	0.646	0.383	0.465	0.022	0.909	0.322	0.931	0.171	0.162	0.549	0.552	0.047	0.654	0.412	0.190	0.200	0.376	0.650	0.556
	37	0.719	0.790	0.859	0.632	0.999	0.748	0.818	0.223	0.904	0.888	0.932	0.690	0.615	0.951	0.780	0.777	0.991	0.932	0.821	0.668
	38	0.761	0.905	0.383	0.174	0.150	0.865	0.895	0.874	0.171	0.770	0.751	0.543	0.851	0.621	0.538	0.417	0.339	0.843	0.137	0.507
	39	0.968	0.965	0.999	0.996	0.999	0.987	0.923	0.613	0.853	0.959	0.981	0.984	0.554	0.997	0.998	0.997	0.934	0.982	0.996	0.982
	40	0.484	0.263	0.555	0.759	0.975	0.289	0.385	0.117	0.428	0.815	0.510	0.636	0.912	0.702	0.616	0.632	0.901	0.064	0.355	0.696
	41	0.673	0.698	0.987	0.719	0.999	0.670	0.632	0.117	0.754	0.332	0.708	0.912	0.892	0.863	0.894	0.915	0.419	0.566	0.472	0.930
	42	0.963	0.932	0.939	0.997	0.999	0.845	0.653	0.980	0.946	0.656	0.885	0.912	0.984	0.847	0.853	0.915	0.806	0.976	0.936	0.932
	43	0.574	0.996	0.462	0.417	0.327	0.768	0.714	0.444	0.770	0.489	0.333	0.930	0.899	0.348	0.988	0.393	0.145	0.658	0.692	0.917
	44	0.957	0.448	0.658	0.999	0.989	0.959	0.914	0.901	0.996	0.622	0.980	0.818	0.615	0.902	0.887	0.759	0.934	0.741	0.705	0.843
	45	0.850	0.965	0.781	0.740	0.984	0.784	0.938	0.463	0.754	0.482	0.944	0.552	0.139	0.782	0.853	0.857	0.859	0.843	0.518	0.516
	46	0.066	0.810	0.129	0.008	0.003	0.208	0.244	0.595	0.244	0.020	0.321	0.085	0.177	0.065	0.280	0.118	0.145	0.332	0.032	0.081
5	47	0.891	0.991	0.620	0.586	0.477	0.944	0.244	0.909	0.468	0.532	0.850	0.961	0.245	0.868	0.950	0.417	0.419	0.180	0.889	0.964
	48	0.549	0.338	0.489	0.465	0.723	0.276	0.566	0.253	0.828	0.946	0.673	0.841	0.645	0.662	0.475	0.947	0.339	0.423	0.840	0.861
	49	0.799	0.563	0.670	0.441	0.975	0.812	0.301	0.924	0.828	0.895	0.944	0.890	0.476	0.621	0.932	0.699	0.742	0.566	0.941	0.938
	50	0.132	0.312	0.031	0.003	0.001	0.005	0.125	0.909	0.294	0.076	0.051	0.148	0.507	0.074	0.015	0.158	0.069	0.023	0.129	0.160
	51	0.345	0.128	0.489	0.719	0.701	0.416	0.714	0.334	0.927	0.968	0.536	0.872	0.715	0.695	0.675	0.812	0.995	0.566	0.730	0.882
	52	0.012	0.208	0.103	0.054	0.001	0.126	0.210	0.005	0.011	0.027	0.106	0.045	0.460	0.050	0.038	0.283	0.102	0.289	0.081	0.019
	53	0.948	0.577	0.358	0.262	0.955	0.930	0.588	0.901	0.721	0.012	0.857	0.759	0.715	0.612	0.336	0.441	0.339	0.150	0.678	0.738
	54	0.523	0.178	0.859	0.905	0.999	0.932	0.733	0.268	0.941	0.859	0.826	0.619	0.860	0.920	0.661	0.812	0.504	0.124	0.044	0.578
	55	0.966	0.973	0.818	0.795	0.982	0.693	0.787	0.924	0.853	0.962	0.751	0.989	0.688	0.894	0.994	0.924	0.419	0.213	0.996	0.993
	56	0.432	0.722	0.243	0.370	0.010	0.338	0.263	0.425	0.114	0.730	0.276	0.722	0.100	0.227	0.661	0.262	0.859	0.566	0.327	0.748
	57	0.781	0.911	0.489	0.699	0.035	0.482	0.125	0.137	0.072	0.171	0.445	0.351	0.413	0.365	0.950	0.107	0.339	0.039	0.563	0.321
	58	0.730	0.563	0.103	0.417	0.002	0.201	0.610	0.137	0.065	0.230	0.095	0.019	0.002	0.120	0.459	0.158	0.339	0.518	0.183	0.016
	59	0.205	0.120	0.800	0.562	0.239	0.426	0.364	0.238	0.171	0.622	0.406	0.470	0.444	0.837	0.294	0.609	0.069	0.051	0.262	0.521
	60	0.790	0.463	0.946	0.812	0.999	0.865	0.872	0.463	0.875	0.838	0.918	0.947	0.115	0.983	0.862	0.843	0.419	0.982	0.767	0.942
	61	0.781	0.734	0.790	0.905	0.998	0.900	0.733	0.520	0.972	0.979	0.923	0.530	0.413	0.920	0.756	0.759	0.419	0.968	0.164	0.647
	62	0.587	0.448	0.717	0.857	0.991	0.431	0.961	0.975	0.509	0.319	0.673	0.360	0.081	0.788	0.522	0.828	0.973	0.871	0.800	0.454
	63	0.084	0.169	0.122	0.118	0.053	0.497	0.342	0.099	0.114	0.005	0.196	0.094	0.339	0.277	0.067	0.224	0.742	0.180	0.048	0.125
	64	0.333	0.591	0.435	0.068	0.201	0.289	0.194	0.147	0.114	0.020	0.309	0.783	0.980	0.308	0.490	0.441	0.102	0.023	0.533	0.748
	65	0.154	0.922	0.184	0.001	0.068	0.376	0.301	0.025	0.294	0.736	0.254	0.326	0.429	0.220	0.522	0.190	0.504	0.871	0.274	0.329
	66	0.817	0.632	0.310	0.032	0.098	0.665	0.385	0.864	0.213	0.938	0.612	0.290	0.460	0.332	0.490	0.224	0.504	0.701	0.488	0.235
	67	0.224	0.710	0.062	0.001	0.002	0.197	0.430	0.238	0.408	0.433	0.084	0.170	0.659	0.149	0.127	0.054	0.806	0.124	0.056	0.199
	68	0.510	0.113	0.062	0.032	0.010	0.057	0.022	0.667	0.087	0.153	0.062	0.034	0.019	0.160	0.018	0.061	0.742	0.124	0.154	0.032
	69	0.345	0.188	0.670	0.655	0.999	0.441	0.931	0.159	0.895	0.885	0.394	0.381	0.221	0.733	0.689	0.655	0.742	0.289	0.355	0.366
	70	0.966	0.855	0.383	0.347	0.016	0.343	0.114	0.909	0.277	0.153	0.625	0.390	0.353	0.220	0.443	0.207	0.102	0.051	0.650	0.440
	71	0.244	0.198	0.809	0.870	0.993	0.548	0.543	0.924	0.912	0.898	0.381	0.623	0.413	0.595	0.570	0.924	0.973	0.289	0.636	0.561
	72	0.321	0.100	0.950	0.586	0.999	0.476	0.566	0.238	0.989	0.615	0.510	0.796	0.100	0.847	0.646	0.857	0.859	0.470	0.874	0.730
	73	0.406	0.152	0.739	0.190	0.966	0.357	0.770	0.317	0.976	0.204	0.523	0.502	0.741	0.718	0.743	0.905	0.419	0.249	0.164	0.556
	74	0.523	0.240	0.136	0.207	0.002	0.381	0.029	0.901	0.021	0.137	0.276	0.322	0.100	0.248	0.022	0.077	0.339	0.213	0.215	0.267
	75	0.809	0.996	0.232	0.001	0.053	0.476	0.150	0.961	0.529	0.319	0.458	0.552	0.715	0.248	0.459	0.118	0.504	0.213	0.730	0.547
	76	0.992	0.810	0.212	0.857	0.375	0.967	0.543	0.961	0.754	0.171	0.954	0.852	0.177	0.559	0.184	0.144	0.339	0.289	0.976	0.829
	77	0.708	0.420	0.184	0.465	0.109	0.608	0.956	0.539	0.800	0.270	0.574	0.368	0.538	0.270	0.174	0.465	0.588	0.566	0.821	0.405
	78	0.276	0.434	0.930	0.699	0.955	0.776	0.210	0.317	0.885	0.885	0.781	0.956	0.966	0.890	0.792	0.964	0.806	0.150	0.949	0.967
	79	0.445	0.240	0.818	0.993	0.997	0.693	0.847	0.853	0.895	0.447	0.661	0.470	0.554	0.847	0.522	0.609	0.669	0.993	0.874	0.507
	80	0.394	0.672	0.358	0.940	0.260	0.487	0.210	0.117	0.529	0.093	0.224	0.241	0.702	0.308	0.717	0.347	0.588	0.613	0.164	0.392
	81	0.074	0.351	0.422	0.061	0.014	0.190	0.475	0.032	0.408	0.214	0.205	0.511	0.081	0.292	0.506	0.370	0.102	0.101	0.800	0.414
	82	0.944	0.810	0.873	0.964	0.999	0.919	0.833	0.991	0.800	0.847	0.908	0.653	0.476	0.775	0.961	0.812	0.742	0.894	0.457	0.748
	83	0.023	0.240	0.076	0.347	0.007	0.140	0.475	0.006	0.228	0.312	0.178	0.034	0.339	0.091	0.022	0.118	0.028	0.081	0.002	0.052
	84	0.790	0.911	0.275	0.991	0.046	0.679	0.695	0.253	0.388	0.669	0.287	0.355	0.187	0.292	0.689	0.513	0.806	0.470	0.730	0.317
	85	0.761	0.927	0.620	0.417	0.068	0.661	0.194	0.137	0.828	0.230	0.345	0.386	0.157	0.399	0.475	0.586	0.669	0.180	0.457	0.366
	86	0.913	0.325	0.910	0.999	0.999	0.968	0.985	0.942	0.895	0.843	0.960	0.844	0.060	0.982	0.601	0.915	0.742	0.946	0.974	0.745
	87	0.908	0.420	0.222	0.795	0.010	0.903	0.430	0.842	0.610	0.102	0.649	0.306	0.087	0.207	0.164	0.096	0.145	0.249	0.398	0.238
	88	0.918	0.863	0.930	0.999	0.966	0.719	0.847	0.942	0.786	0.700	0.685	0.714	0.157	0.953	0.768	0.843	0.669	0.658	0.903	0.676
	89	0.897	0.959	0.212	0.304	0.529	0.868	0.452	0.853	0.468	0.426	0.685	0.898	0.960	0.733	0.490	0.086	0.859	0.289	0.488	0.926
	90	0.265	0.019	0.555	0.562	0.785	0.426	0.543	0.170	0.885	0.270	0.471	0.018	0.538	0.417	0.145	0.370	0.669	0.376	0.012	0.013
	91	0.708	0.198	0.880	0.777	0.915	0.896	0.833	0.370	0.648	0.475	0.948	0.706	0.985	0.754	0.661	0.843	0.984	0.946	0.383	0.711
	92	0.857	0.863	0.939	0.777	0.999	0.723	0.543	0.170	0.770	0.615	0.834	0.815	0.413	0.733	0.946	0.953	0.504	0.871	0.622	0.748
	93	0.214	0.325	0.887	0.982	0.999	0.744	0.905	0.053	0.770	0.931	0.536	0.412	0.139	0.782	0.968	0.857	0.264	0.894	0.692	0.354
	Range	0.987	0.979	0.983	0.999	0.999	0.994	0.963	0.994	0.985	0.994	0.948	0.980	0.997	0.956	0.983	0.960	0.990	0.986	0.996	0.986

A.2. Distributed methods

Method	RHM no.	BD1	BD2	BD3	BD4	BD5	BD6	BD7	BD8	BD9	BD10
	1	0.202	0.008	0.656	0.054	0.171	0.275	0.023	0.033	0.179	0.006
	2	0.314	0.122	0.399	0.054	0.111	0.619	0.040	0.033	0.179	0.160
	3	0.653	0.186	0.572	0.102	0.371	0.820	0.067	0.033	0.727	0.160
	4	0.054	0.104	0.358	0.205	0.075	0.088	0.203	0.366	0.007	0.160
	5	0.233	0.155	0.529	0.314	0.298	0.229	0.284	0.366	0.179	0.160
	6	0.352	0.595	0.280	0.314	0.206	0.563	0.367	0.366	0.179	0.690
	7	0.559	0.230	0.695	0.463	0.642	0.449	0.378	0.366	0.727	0.160
	8	0.691	0.686	0.442	0.463	0.529	0.780	0.468	0.366	0.727	0.690
Grid	9	0.921	0.776	0.615	0.596	0.838	0.917	0.560	0.366	0.980	0.690
	10	0.164	0.195	0.669	0.756	0.558	0.034	0.731	0.880	0.179	0.160
	11	0.266	0.641	0.413	0.756	0.449	0.188	0.801	0.880	0.179	0.690
	12	0.461	0.269	0.799	0.848	0.855	0.113	0.809	0.880	0.727	0.160
	13	0.600	0.738	0.572	0.848	0.778	0.392	0.866	0.880	0.727	0.690
	14	0.727	0.971	0.318	0.848	0.689	0.735	0.909	0.880	0.727	0.978
	15	0.871	0.811	0.732	0.914	0.952	0.633	0.914	0.880	0.980	0.690
	16	0.935	0.984	0.485	0.914	0.917	0.892	0.945	0.880	0.980	0.978
	17	0.640	0.978	0.456	0.984	0.882	0.338	0.994	0.996	0.727	0.978
	Range	0.882	0.975	0.519	0.930	0.877	0.882	0.971	0.963	0.972	0.973
	1	0.140	0.748	0.089	0.700	0.238	0.198	0.785	0.847	0.200	0.822
	2	0.703	0.559	0.280	0.314	0.406	0.829	0.356	0.269	0.646	0.556
	3	0.132	0.134	0.399	0.222	0.171	0.135	0.195	0.279	0.126	0.160
	4	0.314	0.355	0.744	0.618	0.558	0.188	0.538	0.628	0.350	0.348
	5	0.898	0.413	0.642	0.239	0.635	0.932	0.228	0.122	0.818	0.361
	6	0.627	0.686	0.778	0.805	0.789	0.463	0.776	0.792	0.674	0.652
	7	0.703	0.776	0.500	0.719	0.682	0.698	0.740	0.694	0.727	0.761
Cluster	8	0.233	0.378	0.181	0.294	0.185	0.338	0.335	0.377	0.222	0.443
	9	0.586	0.819	0.058	0.485	0.305	0.800	0.628	0.545	0.559	0.856
	10	0.750	0.437	0.911	0.618	0.824	0.591	0.526	0.496	0.752	0.361
	11	0.278	0.675	0.471	0.790	0.529	0.208	0.801	0.861	0.350	0.690
	12	0.951	0.924	0.809	0.895	0.948	0.922	0.900	0.832	0.952	0.886
	13	0.447	0.070	0.720	0.123	0.344	0.420	0.075	0.075	0.350	0.064
	14	0.475	0.212	0.471	0.175	0.311	0.549	0.165	0.148	0.408	0.218
	15	0.640	0.968	0.305	0.944	0.756	0.646	0.968	0.965	0.727	0.970
	Range	0.819	0.898	0.853	0.821	0.777	0.797	0.893	0.890	0.827	0.906
	1	0.715	0.279	0.744	0.508	0.767	0.577	0.411	0.354	0.887	0.178
	2	0.830	0.919	0.558	0.914	0.893	0.672	0.927	0.903	0.935	0.893
	3	0.517	0.870	0.471	0.914	0.738	0.312	0.938	0.958	0.528	0.872
	4	0.600	0.785	0.413	0.680	0.586	0.591	0.721	0.705	0.588	0.803
	5	0.406	0.079	0.572	0.102	0.267	0.535	0.064	0.056	0.378	0.068
	6	0.475	0.641	0.572	0.821	0.708	0.275	0.839	0.880	0.559	0.612
	7	0.339	0.249	0.587	0.485	0.471	0.252	0.457	0.533	0.350	0.218
	8	0.792	0.819	0.428	0.530	0.615	0.863	0.560	0.424	0.818	0.822
Optimization	9	0.266	0.522	0.331	0.441	0.244	0.352	0.491	0.557	0.126	0.612
	10	0.278	0.128	0.544	0.239	0.286	0.300	0.203	0.249	0.222	0.128
	11	0.419	0.249	0.428	0.135	0.216	0.633	0.114	0.099	0.322	0.273
	12	0.406	0.498	0.344	0.275	0.244	0.591	0.304	0.289	0.245	0.570
	13	0.703	0.571	0.629	0.680	0.762	0.563	0.649	0.616	0.838	0.486
	14	0.782	0.961	0.385	0.861	0.767	0.746	0.909	0.874	0.818	0.967
	15	0.289	0.390	0.544	0.639	0.493	0.178	0.649	0.755	0.270	0.388
	16	0.792	0.390	0.615	0.275	0.608	0.847	0.220	0.122	0.887	0.322
	17	0.503	0.425	0.456	0.334	0.378	0.605	0.314	0.289	0.468	0.443
	Range	0.564	0.882	0.413	0.812	0.676	0.685	0.875	0.902	0.810	0.899

Appendix B. MATLAB codes for RHMs generation

B.1. Square Method

```
N_Variables=10; N_Repetition=5;
for iteration=1: N_Repetition
    clear L N mn sd s F RC X;
    switch iteration
        case 1:
            X=textread('C:\DB\Var10\Var10_R1_Learning.txt');
        case 2
            X=textread('C:\DB\Var10\Var10_R2_Learning.txt');
        case 3
            X=textread('C:\DB\Var10\Var10_R3_Learning.txt');
        case 4
            X=textread('C:\DB\Var10\Var10_R4_Learning.txt');
        case 5
            X=textread('C:\DB\Var10\Var10_R5_Learning.txt');
    end
    [L CP SDV C]=factpc(X); [m n]=size(C);
    % Factor loading adjustment by communality
    for i=1:m
        C(i)=1/C(i);
    end
    [dummy N]=size(L);
    for i=1:N
        L(:,i)=diag(L(:,i)*C');
    end
    for j=1:N_Variables
        mn(j)=mean(X(:,j)); sd(j)=std(X(:,j));
    end
    % Factor scores using Bittner constant (1.2208)
    switch N
        case 1
            s=[1.2208; -1.2208; 0];
        case 2
            s=[ 1.2208   1.2208
                1.2208  -1.2208
               -1.2208   1.2208
               -1.2208  -1.2208
                0        0];
        case 3
            s=[1.2208   1.2208   1.2208
               1.2208   1.2208  -1.2208
               1.2208  -1.2208   1.2208
              -1.2208   1.2208   1.2208
               1.2208  -1.2208  -1.2208
              -1.2208  -1.2208   1.2208
              -1.2208   1.2208  -1.2208
              -1.2208  -1.2208  -1.2208
               0        0        0];
        case 4
            s=[1.2208   1.2208   1.2208   1.2208
               1.2208   1.2208   1.2208  -1.2208
               1.2208   1.2208  -1.2208   1.2208
               1.2208  -1.2208   1.2208   1.2208
              -1.2208   1.2208   1.2208   1.2208
              -1.2208  -1.2208   1.2208   1.2208
              -1.2208   1.2208  -1.2208   1.2208
              -1.2208   1.2208   1.2208  -1.2208
               1.2208  -1.2208  -1.2208   1.2208
               1.2208  -1.2208   1.2208  -1.2208
               1.2208   1.2208  -1.2208  -1.2208
              -1.2208  -1.2208  -1.2208   1.2208
              -1.2208  -1.2208   1.2208  -1.2208
               1.2208  -1.2208  -1.2208  -1.2208
              -1.2208  -1.2208  -1.2208  -1.2208
               0        0        0        0];
        case 5
            s=[1.2208   1.2208   1.2208   1.2208   1.2208
               1.2208   1.2208   1.2208   1.2208  -1.2208
               1.2208   1.2208   1.2208  -1.2208   1.2208
               1.2208   1.2208  -1.2208   1.2208   1.2208
               1.2208  -1.2208   1.2208   1.2208   1.2208
              -1.2208   1.2208   1.2208   1.2208   1.2208
-1.2208 -1.2208   1.2208   1.2208   1.2208
              -1.2208   1.2208  -1.2208   1.2208   1.2208
              -1.2208   1.2208   1.2208  -1.2208   1.2208
              -1.2208   1.2208   1.2208   1.2208  -1.2208
               1.2208  -1.2208  -1.2208   1.2208   1.2208
               1.2208  -1.2208   1.2208  -1.2208   1.2208
               1.2208  -1.2208   1.2208   1.2208  -1.2208
               1.2208   1.2208  -1.2208  -1.2208   1.2208
               1.2208   1.2208  -1.2208   1.2208  -1.2208
               1.2208   1.2208   1.2208  -1.2208  -1.2208
              -1.2208  -1.2208  -1.2208   1.2208   1.2208
              -1.2208  -1.2208   1.2208  -1.2208   1.2208
              -1.2208  -1.2208   1.2208   1.2208  -1.2208
               1.2208  -1.2208  -1.2208  -1.2208   1.2208
               1.2208  -1.2208  -1.2208   1.2208  -1.2208
               1.2208   1.2208  -1.2208  -1.2208  -1.2208
              -1.2208  -1.2208  -1.2208  -1.2208   1.2208
               1.2208  -1.2208  -1.2208  -1.2208  -1.2208
              -1.2208  -1.2208  -1.2208  -1.2208  -1.2208
               0        0        0        0        0];
    end
    F=L*s'; [N2 dummy]=size(s);
    for j=1:N2
        RC(j,1:N_Variables)=mn+diag(F(:,j)*sd)';
    end
    switch iteration
        case 1
            X=textread('C:\DB\Var10\Var10_R1_Testing.txt');
        case 2
            X=textread('C:\DB\Var10\Var10_R2_Testing.txt');
        case 3
            X=textread('C:\DB\Var10\Var10_R3_Testing.txt');
        case 4
            X=textread('C:\DB\Var10\Var10_R4_Testing.txt');
        case 5
            X=textread('C:\DB\Var10\Var10_R5_Testing.txt');
     end
    i=1; i2=2; i3=3; i4=4; i5=5;i6=6;i7=7;i8=8;i9=9;i10=10; ck=0;
    [m n]=size(X);
    for i=1:N_Variables
        y_max(i)=max(RC(:,i));    y_min(i)=min(RC(:,i));
    end
    for k=1:m
        if y_max(i)>=X(k,i) && y_min(i)<=X(k,i)
          if y_max(i2)>=X(k,i2) && y_min(i2)<=X(k,i2)
            if y_max(i3)>=X(k,i3) && y_min(i3)<=X(k,i3)
              if y_max(i4)>=X(k,i4) && y_min(i4)<=X(k,i4)
                if y_max(i5)>=X(k,i5) && y_min(i5)<=X(k,i5)
                  if y_max(i6)>=X(k,i6) && y_min(i6)<=X(k,i6)
                    if y_max(i7)>=X(k,i7) && y_min(i7)<=X(k,i7)
                     if y_max(i8)>=X(k,i8) && y_min(i8)<=X(k,i8)
                       if y_max(i9)>=X(k,i9) && y_min(i9)<=X(k,i9)
                         if y_max(i10)>=X(k,i10) &&
y_min(i10)<=X(k,i10)
                           ck=ck+1;
                         end
                       end
                     end
                    end
                  end
                end
              end
            end
          end
        end
    end
    disp(sprintf('Iteration: %3.0f, # of factors: %3.0f (Explained = %3.0f, SD
= %3.2f), # of RHM: %3.0f, Accommodation percentage: %3.2f \n', iteration,
N, CP(1), SDV, N2, ck/m));
end
```

B.2. Rectangular Method

```
N_Variables=10;N_Repetition=5;
for iteration=1:N_Repetition
    clear L N mn sd s F RC X;
    switch iteration
        case 1
            X=textread('C:\DB\Var10\Var10_R1_Learning.txt');
        case 2
            X=textread('C:\DB\Var10\Var10_R2_Learning.txt');
        case 3
            X=textread('C:\DB\Var10\Var10_R3_Learning.txt');
        case 4
            X=textread('C:\DB\Var10\Var10_R4_Learning.txt');
        case 5
            X=textread('C:\DB\Var10\Var10_R5_Learning.txt');
    end
    [L CP SDV Variance]=factpc(X); [dummy N]=size(L);
    for j=1:N_Variables
        mn(j)=mean(X(:,j)); sd(j)=std(X(:,j));
    end
    options = optimset('Display', 'off');
    % Factor scores of Rectangular method
    x0=0; w=[];
    switch N
        case 1
            y=[]; y=norminv(0.05,0,1); s=[y;-y;0];
        case 2
            w=[1/sqrt(Variance(1)) 1/sqrt(Variance(2))];
            x = fzero(@myfun2,x0,options,w);
            y=[]; y=abs(norminv(w*x/2,0,1));
            s=[y(1)   y(2)
              -y(1)   y(2)
               y(1) -y(2)
              -y(1) -y(2)
               0       0];
        case 3
            w=[1/sqrt(Variance(1)) 1/sqrt(Variance(2)) 1/sqrt(Variance(3))];
            x = fzero(@myfun3,x0,options,w);
            y=[]; y=abs(norminv(w*x/2,0,1));
            s=[y(1)   y(2)   y(3)
              -y(1)   y(2)   y(3)
               y(1) -y(2)   y(3)
               y(1)   y(2) -y(3)
              -y(1) -y(2)   y(3)
              -y(1)   y(2) -y(3)
               y(1) -y(2) -y(3)
              -y(1) -y(2) -y(3)
               0      0      0];
        case 4
            w=[1/sqrt(Variance(1))  1/sqrt(Variance(2))  1/sqrt(Variance(3))
1/sqrt(Variance(4))];
            x = fzero(@myfun4,x0,options,w);
            y=[]; y=abs(norminv(w*x/2,0,1));
            s=[y(1)   y(2)   y(3)   y(4)
              -y(1)   y(2)   y(3)   y(4)
               y(1) -y(2)   y(3)   y(4)
               y(1)   y(2) -y(3)   y(4)
               y(1)   y(2)   y(3) -y(4)
              -y(1) -y(2)   y(3)   y(4)
              -y(1)   y(2) -y(3)   y(4)
              -y(1)   y(2)   y(3) -y(4)
               y(1) -y(2) -y(3)   y(4)
               y(1) -y(2)   y(3) -y(4)
               y(1)   y(2) -y(3) -y(4)
              -y(1) -y(2) -y(3)   y(4)
              -y(1)   y(2) -y(3) -y(4)
               y(1) -y(2) -y(3) -y(4)
               0      0      0       0];
        case 5
            w=[1/sqrt(Variance(1))  1/sqrt(Variance(2))  1/sqrt(Variance(3))
1/sqrt(Variance(4)) 1/sqrt(Variance(5))];
            x = fzero(@myfun5,x0,options,w);
            y=[]; y=abs(norminv(w*x/2,0,1));
            s=[y(1)   y(2)   y(3)   y(4)   y(5)
               y(1)   y(2)   y(3)   y(4) -y(5)
               y(1)   y(2)   y(3)  -y(4)   y(5)
               y(1)   y(2)  -y(3)   y(4)   y(5)
               y(1)  -y(2)   y(3)   y(4)   y(5)
              -y(1)   y(2)   y(3)   y(4)   y(5)
              -y(1)  -y(2)   y(3)   y(4)   y(5)
              -y(1)   y(2)  -y(3)   y(4)   y(5)
              -y(1)   y(2)   y(3)  -y(4)   y(5)
              -y(1)   y(2)   y(3)   y(4) -y(5)
               y(1)  -y(2)  -y(3)   y(4)   y(5)
               y(1)  -y(2)   y(3)  -y(4)   y(5)
               y(1)  -y(2)   y(3)   y(4) -y(5)
               y(1)   y(2)  -y(3)  -y(4)   y(5)
               y(1)   y(2)  -y(3)   y(4) -y(5)
               y(1)   y(2)   y(3)  -y(4) -y(5)
              -y(1)  -y(2)  -y(3)   y(4)   y(5)
              -y(1)  -y(2)   y(3)  -y(4)   y(5)
              -y(1)  -y(2)   y(3)   y(4) -y(5)
               y(1)  -y(2)  -y(3)  -y(4)   y(5)
               y(1)  -y(2)  -y(3)   y(4) -y(5)
               y(1)   y(2)  -y(3)  -y(4) -y(5)
              -y(1)  -y(2)  -y(3)  -y(4)   y(5)
               y(1)  -y(2)  -y(3)  -y(4) -y(5)
              -y(1)  -y(2)  -y(3)  -y(4) -y(5)
               0       0       0       0       0];
    end
    F=L*s'; [N2 dummy]=size(s);
    for j=1:N2
        RC(j,1:N_Variables)=mn+diag(F(:,j)*sd)';
    end
    switch iteration
        case 1
            X=textread('C:\DB\Var10\Var10_R1_Testing.txt');
        case 2
            X=textread('C:\DB\Var10\Var10_R2_Testing.txt');
        case 3
            X=textread('C:\DB\Var10\Var10_R3_Testing.txt');
        case 4
            X=textread('C:\DB\Var10\Var10_R4_Testing.txt');
        case 5
            X=textread('C:\DB\Var10\Var10_R5_Testing.txt');
     end
    i=1; i2=2; i3=3; i4=4; i5=5;i6=6;i7=7;i8=8;i9=9;i10=10; ck=0;
    [m n]=size(X);
    for i=1:N_Variables
        y_max(i)=max(RC(:,i)); y_min(i)=min(RC(:,i));
    end
    for k=1:m
        if y_max(i)>=X(k,i) && y_min(i)<=X(k,i)
          if y_max(i2)>=X(k,i2) && y_min(i2)<=X(k,i2)
            if y_max(i3)>=X(k,i3) && y_min(i3)<=X(k,i3)
              if y_max(i4)>=X(k,i4) && y_min(i4)<=X(k,i4)
                if y_max(i5)>=X(k,i5) && y_min(i5)<=X(k,i5)
                  if y_max(i6)>=X(k,i6) && y_min(i6)<=X(k,i6)
                    if y_max(i7)>=X(k,i7) && y_min(i7)<=X(k,i7)
                      if y_max(i8)>=X(k,i8) && y_min(i8)<=X(k,i8)
                        if y_max(i9)>=X(k,i9) && y_min(i9)<=X(k,i9)
                          if y_max(i10)>=X(k,i10) &&
y_min(i10)<=X(k,i10)
                            ck=ck+1;
                          end
                        end
                      end
                    end
                  end
                end
              end
            end
          end
        end
    end
    disp(sprintf('Iteration: %3.0f, # of factors: %3.0f (Explained = %3.0f, SD
= %3.2f), # of RHM: %3.0f, Accommodation percentage: %3.2f \n', iteration,
N, CP(1), SDV, N2, ck/m));
end

function F = myfun2(x,w)
F = w(1)*x+w(2)*x-w(1)*x*w(2)*x-0.1;
```

B.3. Circular Method

```
N_Variables=10; N_Repetition=5;
for iteration=1:N_Repetition
    clear L N mn sd s F RC X elimatrix;
    switch iteration
        case 1
            X=textread('C:\DB\Var10\Var10_R1_Learning.txt');
        case 2
            X=textread('C:\DB\Var10\Var10_R2_Learning.txt');
        case 3
            X=textread('C:\DB\Var10\Var10_R3_Learning.txt');
        case 4
            X=textread('C:\DB\Var10\Var10_R4_Learning.txt');
        case 5
            X=textread('C:\DB\Var10\Var10_R5_Learning.txt');
    end
    V=corrcoef(X);
    [L, latent, explained] = pcacov(V);
    la=latent>1; f= cumsum(explained) < 80;
    NofFactor=max(sum(la), sum(f)+1); CP=sum(explained(1:NofFactor));
    L=L(:,1:NofFactor); [dummy N]=size(L);
    for j=1:N_Variables
        mn(j)=mean(X(:,j));
        sd(j)=std(X(:,j));
    end
    % Factor scores in Circular method
    switch N
        case 1
            y=funcircle(X,L);
            s=[y; -y; 0];
        case 2
            y=funcircle(X,L);
            s=[y              0
               cosd(45)*y    sind(45)*y
               0              y
              -cosd(45)*y    sind(45)*y
              -y              0
              -cosd(45)*y -sind(45)*y
               0             -y
               cosd(45)*y -sind(45)*y
               0              0];
        case 3
            y=funcircle(X,L);
            s=[y              0              0
               cosd(45)*y    sind(45)*y     0
               0              y              0
              -cosd(45)*y    sind(45)*y     0
              -y              0              0
              -cosd(45)*y -sind(45)*y       0
               0             -y              0
               cosd(45)*y -sind(45)*y       0
               y              0              0
               cosd(45)*y     0              sind(45)*y
               0              0              y
              -cosd(45)*y     0              sind(45)*y
              -y              0              0
              -cosd(45)*y     0             -sind(45)*y
               0              0             -y
               cosd(45)*y     0             -sind(45)*y
               0              y              0
               0              cosd(45)*y    sind(45)*y
               0              0              y
               0             -cosd(45)*y    sind(45)*y
               0             -y              0
               0             -cosd(45)*y -sind(45)*y
               0              0             -y
               0              cosd(45)*y -sind(45)*y
               0              0              0];
           [sk dummy]=size(s); eli=0;
           for ik=1:sk-1
               for ik2=ik+1:sk
                   if s(ik,:)==s(ik2,:)
                       eli=eli+1; elimatrix(eli)=ik2;
                   end
               end
           end
           s(elimatrix,:)=[];
```

```
                    for ik2=ik+1:sk
                        if s(ik,:)==s(ik2,:)
                            eli=eli+1; elimatrix(eli)=ik2;
                        end
                    end
                end
                s(elimatrix,:)=[];
    end
    F=L*s'; [N2 dummy]=size(s);
    for j=1:N2
        RC(j,1:N_Variables)=mn+diag(F(:,j)*sd)';
    end
    switch iteration
        case 1
            X=textread('C:\DB\Var10\Var10_R1_Testing.txt');
        case 2
            X=textread('C:\DB\Var10\Var10_R2_Testing.txt');
        case 3
            X=textread('C:\DB\Var10\Var10_R3_Testing.txt');
        case 4
            X=textread('C:\DB\Var10\Var10_R4_Testing.txt');
        case 5
            X=textread('C:\DB\Var10\Var10_R5_Testing.txt');
     end
    i=1; i2=2; i3=3; i4=4; i5=5;i6=6;i7=7;i8=8;i9=9;i10=10; ck=0;
    [m n]=size(X);
    for i=1:N_Variables
        y_max(i)=max(RC(:,i));
        y_min(i)=min(RC(:,i));
    end
    for k=1:m
        if y_max(i)>=X(k,i) && y_min(i)<=X(k,i)
          if y_max(i2)>=X(k,i2) && y_min(i2)<=X(k,i2)
            if y_max(i3)>=X(k,i3) && y_min(i3)<=X(k,i3)
              if y_max(i4)>=X(k,i4) && y_min(i4)<=X(k,i4)
                if y_max(i5)>=X(k,i5) && y_min(i5)<=X(k,i5)
                  if y_max(i6)>=X(k,i6) && y_min(i6)<=X(k,i6)
                    if y_max(i7)>=X(k,i7) && y_min(i7)<=X(k,i7)
                      if y_max(i8)>=X(k,i8) && y_min(i8)<=X(k,i8)
                        if y_max(i9)>=X(k,i9) && y_min(i9)<=X(k,i9)
                          if y_max(i10)>=X(k,i10) &&
y_min(i10)<=X(k,i10)
                            ck=ck+1;
                          end
                        end
                      end
                    end
                  end
                end
              end
            end
          end
        end
    end
    disp(sprintf('Iteration: %3.0f, # of factors: %3.0f (Explained = %3.0f), #
of RHM: %3.0f, Accommodation percentage: %3.2f \n', iteration, N, CP, N2,
ck/m));
end

function F = funcircle(X, L)
[m n]=size(X);[o p]=size(L);
for i=1:n
    X(:,i)=(X(:,i)-mean(X(:,i)))/std(X(:,i));
end
X=X*pinv(L)';cc=0;
switch p
    case 1
        for j=1:0.01:10
            cc=0;
            for i=1:m
                if sqrt(X(i,1)^2)<=j
                    cc=cc+1;
                end
            end
            if cc/m>=0.9
                F=j;
```

```
case 4
    y=funcircle(X,L);
    s=[y            0              0              0
       cosd(45)*y   sind(45)*y     0              0
       0            y              0              0
       -cosd(45)*y  sind(45)*y     0              0
       -y           0              0              0
       -cosd(45)*y -sind(45)*y     0              0
       0            -y             0              0
       cosd(45)*y -sind(45)*y      0              0
       y            0              0              0
       cosd(45)*y   0              sind(45)*y     0
       0            y              0              0
       -cosd(45)*y  0              sind(45)*y     0
       -y           0              0              0
       -cosd(45)*y  0              -sind(45)*y    0
       0            0              -y             0
       cosd(45)*y   0              -sind(45)*y    0
       y            0              0              0
       cosd(45)*y   0              0              sind(45)*y
       0            y              0              0
       -cosd(45)*y  0              0              sind(45)*y
       -y           0              0              0
       -cosd(45)*y  0              0              -sind(45)*y
       0            0              -y             0
       cosd(45)*y   0              0              -sind(45)*y
       0            y              0              0
       0            cosd(45)*y     sind(45)*y     0
       0            0              y              0
       0            -cosd(45)*y    sind(45)*y     0
       0            -y             0              0
       0            -cosd(45)*y -sind(45)*y       0
       0            0              -y             0
       0            cosd(45)*y -sind(45)*y        0
       0            y              0              0
       0            cosd(45)*y     0              sind(45)*y
       0            0              0              y
       0            -cosd(45)*y    0              sind(45)*y
       0            -y             0              0
       0            -cosd(45)*y    0              -sind(45)*y
       0            0              0              -y
       0            cosd(45)*y     0              -sind(45)*y
       0            0              y              0
       0            0              cosd(45)*y     sind(45)*y
       0            0              0              y
       0            0              -cosd(45)*y    sind(45)*y
       0            0              -y             0
       0            0              -cosd(45)*y -sind(45)*y
       0            0              0              -y
       0            0              cosd(45)*y -sind(45)*y
       0            0              0              0];
       [sk dummy]=size(s);
       eli=0;
       for ik=1:sk-1
```

```
                break
            end
        end
    case 2
        for j=1:0.01:10
            cc=0;
            for i=1:m
                if sqrt(X(i,1)^2+X(i,2)^2)<=j
                    cc=cc+1;
                end
            end
            if cc/m>=0.9
                F=j;
                break
            end
        end
    case 3
        for j=1:0.01:10
            cc=0;
            for i=1:m
                if sqrt(X(i,1)^2+X(i,2)^2+X(i,3)^2)<=j
                    cc=cc+1;
                end
            end
            if cc/m>=0.9
                F=j;
                break
            end
        end
    case 4
        for j=1:0.01:10
            cc=0;
            for i=1:m
                if sqrt(X(i,1)^2+X(i,2)^2+X(i,3)^2+X(i,4)^2)<=j
                    cc=cc+1;
                end
            end
            if cc/m>=0.9
                F=j;
                break
            end
        end
    case 5
        for j=1:0.01:10
            cc=0;
            for i=1:m
                if sqrt(X(i,1)^2+X(i,2)^2+X(i,3)^2+X(i,4)^2+X(i,5)^2)<=j
                    cc=cc+1;
                end
            end
            if cc/m>=0.9
                F=j;
                break
            end
        end
end
```

B.4. BZ Method

```
N_Variables=10; N_Repetition=5;
for iteration=1:N_Repetition
    clear L N mn sd s F RC RC_z X;
    switch iteration
        case 1
            X=textread('C:\DB\Var10\Var10_R1_Learning.txt');
        case 2
            X=textread('C:\DB\Var10\Var10_R2_Learning.txt');
        case 3
            X=textread('C:\DB\Var10\Var10_R3_Learning.txt');
        case 4
            X=textread('C:\DB\Var10\Var10_R4_Learning.txt');
        case 5
            X=textread('C:\DB\Var10\Var10_R5_Learning.txt');
    end
    % Initial Chi-squared value
    ChiU = chi2inv(0.91,N_Variables); ChiL = chi2inv(0.89,N_Variables);
    [m n]=size(X); z=zeros(m,n);
    for j=1:n
      sd=std(X(:,j)); mn=mean(X(:,j)); y=(X(:,j)-ones(m,1)*mn)/sd; z(:,j)=y;
    end
    Verification=0;
    while Verification==0
        covz=cov(z); selected=0;anth=zeros(m,n);ik1=0;ik2=0;
        for i=1:m
            k=z(i,:)*inv(covz)*z(i,:)';
            if k<=ChiU && k>=ChiL
                selected=selected+1;
                anth(selected,:)=X(i,:);
                distance(selected)=k;
            end
            if k<=ChiL
                ik1=ik1+1;
            end
            if k<=ChiU
                ik2=ik2+1;
            end
        end
        if (ik1/m>=0.889 & ik1/m<=0.891) & (ik2/m<=0.911 & ik2/m>=0.909)
            Verification=1;
        end
        % Chi-square value adjustment
        if ik1/m<0.89
            ChiL=ChiL+0.01;
        else
            ChiL=ChiL-0.01;
        end
        if ik2/m>0.91
            ChiU=ChiU-0.01;
        else
            ChiU=ChiU+0.01;
        end
    end
    disp(sprintf('Boundary Zone = %3.3f ~ %3.3f',ik1/m, ik2/m))
    anth(selected+1:m,:)=[]; RC=anth;
    [m1 n]=size(RC); acco=zeros(1,60);
    for cl=2:m1
        [IDX,R_temp]=kmeans(RC,cl); oj=0;
        for i=1:cl
            ss=0; num_ss=0;
            for j=1:selected
                if IDX(j)==i
                    oj=oj+1;
                    if ss<=distance(j)
                        ss=distance(j); num_ss=j;
                    end
                end
            end
            RC_z(cl,i,:)=RC(num_ss,:);
        end
        i=1; i2=2; i3=3; i4=4; i5=5;i6=6;i7=7;i8=8;i9=9;i10=10; ck=0;
        [m n]=size(X);
        for i=1:N_Variables
            y_max(i)=max(RC_z(cl,:,i));
            y_min(i)=min(RC_z(cl,:,i));
        end
        for k=1:m
         if y_max(i)>=X(k,i) && y_min(i)<=X(k,i)
          if y_max(i2)>=X(k,i2) && y_min(i2)<=X(k,i2)
           if y_max(i3)>=X(k,i3) && y_min(i3)<=X(k,i3)
            if y_max(i4)>=X(k,i4) && y_min(i4)<=X(k,i4)
             if y_max(i5)>=X(k,i5) && y_min(i5)<=X(k,i5)
              if y_max(i6)>=X(k,i6) && y_min(i6)<=X(k,i6)
               if y_max(i7)>=X(k,i7) && y_min(i7)<=X(k,i7)
                if y_max(i8)>=X(k,i8) && y_min(i8)<=X(k,i8)
                 if y_max(i9)>=X(k,i9) && y_min(i9)<=X(k,i9)
                  if y_max(i10)>=X(k,i10) && y_min(i10)<=X(k,i10)
                    ck=ck+1;
                  end
                 end
                end
               end
              end
             end
            end
           end
          end
         end
        end
        acco(cl)=ck/m;
    end
    a1=find(acco>=0.9); a1=a1(1);
    for k1=1:a1
        for k2=1:N_Variables
            RC_k(k1,k2)=RC_z(a1,k1,k2);
        end
    end
    RC=RC_k;
    switch iteration
        case 1
            X=textread('C:\DB\Var10\Var10_R1_Testing.txt');
        case 2
            X=textread('C:\DB\Var10\Var10_R2_Testing.txt');
        case 3
            X=textread('C:\DB\Var10\Var10_R3_Testing.txt');
        case 4
            X=textread('C:\DB\Var10\Var10_R4_Testing.txt');
        case 5
            X=textread('C:\DB\Var10\Var10_R5_Testing.txt');
    end
    [m n]=size(X);
    for i=1:N_Variables
        y_max(i)=max(RC(:,i)); y_min(i)=min(RC(:,i));
    end
    i=1; i2=2; i3=3; i4=4; i5=5;i6=6;i7=7;i8=8;i9=9;i10=10; ck=0;
    for k=1:m
        if y_max(i)>=X(k,i) && y_min(i)<=X(k,i)
          if y_max(i2)>=X(k,i2) && y_min(i2)<=X(k,i2)
            if y_max(i3)>=X(k,i3) && y_min(i3)<=X(k,i3)
              if y_max(i4)>=X(k,i4) && y_min(i4)<=X(k,i4)
                if y_max(i5)>=X(k,i5) && y_min(i5)<=X(k,i5)
                 if y_max(i6)>=X(k,i6) && y_min(i6)<=X(k,i6)
                  if y_max(i7)>=X(k,i7) && y_min(i7)<=X(k,i7)
                   if y_max(i8)>=X(k,i8) && y_min(i8)<=X(k,i8)
                    if y_max(i9)>=X(k,i9) && y_min(i9)<=X(k,i9)
                     if y_max(i10)>=X(k,i10) && y_min(i10)<=X(k,i10)
                       ck=ck+1;
                     end
                    end
                   end
                  end
                 end
                end
              end
            end
          end
        end
    end
    disp(sprintf('Iteration: %3.0f, # of RHM: %3.0f, Accommodation percentage: %3.2f \n', iteration, a1, acco(a1)));
end
```

Appendix C. Visual Basic code for anthropometric simulation

Form1.frm

```
Dim sXX As Single, sYY As Single, sZZ As Single
Private FPS As Long
Private all_stop As Boolean
Private cube As Object3D
Private Sub Check1_Click()
    If Check1.Value = 1 Then
        Me.Height = 9165
        Else
        Me.Height = 2295
    End If
End Sub
Private Sub Command1_Click()
    MsgBox HSX.Value
End Sub
Private Sub Command2_Click()
    KF = Val(Text4)
    TableHeight = 70
    SeatHeight = 40
    Call LoadObject(cube)
    HSX_Change
    Command1_Click
End Sub

Private Sub ComStart_Click()
    LoadAnthropometry
    Text1 = Time
    PosturePrecision = txtParameter(0)
    DesignPrecision = txtParameter(1)
    Tolerance = txtParameter(2)
    For i = 1 To RHM_Number
        NumberofAlternative = 0: NthRHM = i
        For TableHeight = 50 To 85 Step DesignPrecision
            For SeatHeight = 25 To 65 Step DesignPrecision
                Text3 = Int(((TableHeight - 50) * (SeatHeight - 30)) / ((80
                    - 50) * (60 - 30)) * 100)
                txtSimulation(0) = TableHeight
                txtSimulation(1) = SeatHeight
                For KF = 70 To 110 Step PosturePrecision
                    For HF = 0 To 0 Step PosturePrecision
                        SRP = (LL(i, 8) + LL(i, 10)) * Sin(KF / 180 *
                            3.14) + LL(i, 7) * Sin(HF / 180 * 3.14) +
                            2.5
                        SRP = SRP - LL(i, 11) * Cos(HF / 180 * 3.14)
                        Clearance = SeatHeight + RHM(i, 6)
                        Text8 = Int(Clearance)
                        If SRP >= SeatHeight - Tolerance And SRP <=
                        SeatHeight + Tolerance And Clearance <=
                        TableHeight Then
                            NewRun = 0
                            Loss_Temp = 100000
                            For SF = 0 To 25 Step PosturePrecision
                             For SA = 0 To 25 Step PosturePrecision
                              For EF = 70 To 135 Step PosturePrecision
                                HandLocation = SRP + LL(i, 5) - LL(i,
                                2) * Cos(SF / 180 * 3.14) * Cos(SA /
                                180 * 3.14) - LL(i, 3) * Cos(EF / 180 *
                                3.14)
                                 If HandLocation >= TableHeight -
                                Tolerance And HandLocation <=
                                TableHeight + Tolerance Then
                                 If Loss_Temp > Abs(KF - 90) +
                                Abs(HF - 0) + Abs(SF - 0) + Abs(SA -
                                0) + Abs(EF - 90) Then
                                 If NewRun = 0 Then
                                      NumberofAlternative =
                                      NumberofAlternative + 1
                                      NewRun = 1
                                 End If

                                        Loss(NumberofAlternative, 1)
                                        = TableHeight
```

```
Call ScaleObject(15, 15, 15, temp)
  sXX = HSX.Value * 3.141592654 / 180
  sYY = HSY.Value * 3.141592654 / 180
  sZZ = HSZ.Value * 3.141592654 / 180
  Call RotateObject(sXX, sYY, sZZ, temp)
  Call TranslateObject(0, 0, 50, temp)
  Call ProjectObject(temp, Picture1)
  Call DisplayObject(temp, Picture1)
End Sub
Private Sub HSY_Change()
  HSX_Change
End Sub
Private Sub HSZ_Change()
  HSX_Change
End Sub
Private Sub Option1_Click()
    If Option1.Value = True Then
        HSX.Value = 200
        HSY.Value = 319
        HSZ.Value = 70
    End If
End Sub
Private Sub Option2_Click()
    If Option2.Value = True Then
        HSX.Value = 263
        HSY.Value = 0
        HSZ.Value = 0
    End If
End Sub
Private Sub Option3_Click()
    If Option3.Value = True Then
        HSX.Value = 182
        HSY.Value = 0
        HSZ.Value = 0
    End If
End Sub
Public Sub LoadAnthropometry()
    If Combo1.ListIndex = 0 Then
        RHM_Number = 3
        Open App.Path & "\RHM_Percentile.txt" For Input As #1
            For i = 1 To RHM_Number
                For j = 1 To 11
                    Input #1, RHM(i, j)
                    RHM(i, j) = RHM(i, j) / 10
                Next
            Next
        Close #1
        For i = 1 To RHM_Number
            LL(i, 1) = RHM(i, 9) * 0.77
            LL(i, 2) = RHM(i, 10) * 0.16
            LL(i, 3) = RHM(i, 10) * 0.16
            LL(i, 5) = RHM(i, 1) * 0.91
            LL(i, 6) = RHM(i, 4) * 0.49
            LL(i, 7) = RHM(i, 5) * 0.89
            LL(i, 8) = RHM(i, 7) * 0.9
            LL(i, 9) = RHM(i, 8) * 0.75
            LL(i, 10) = RHM(i, 7) * 0.2
            LL(i, 11) = RHM(i, 6) * 0.5
            LL(i, 12) = RHM(i, 5) * 0.22
        Next
    End If
    If Combo1.ListIndex = 1 Then
        RHM_Number = 9
        Open App.Path & "\RHM_Square.txt" For Input As #1
            For i = 1 To RHM_Number
                For j = 1 To 11
                    Input #1, RHM(i, j)
                    RHM(i, j) = RHM(i, j) / 10
                Next
            Next
        Close #1
        For i = 1 To RHM_Number
```

```
Loss(NumberofAlternative, 2) = SeatHeight

Loss(NumberofAlternative, 3) = Abs(KF - 90) + Abs(HF - 0) + Abs(SF - 0) + Abs(SA - 0) + Abs(EF - 90)

Loss(NumberofAlternative, 4) = KF

Loss(NumberofAlternative, 5) = HF

Loss(NumberofAlternative, 6) = SF

Loss(NumberofAlternative, 7) = SA

Loss(NumberofAlternative, 8) = EF

Loss(NumberofAlternative, 9) = (LL(i, 8) * Sin(KF / 180 * 3.14)) / 0.9 + 2.5 + (RHM(i, 12) - 43) * Sin(HF / 180 * 3.14)
Loss_Temp = Abs(KF - 90) + Abs(HF - 0) + Abs(SF - 0) + Abs(SA - 0) + Abs(EF - 90)
    If Check1.Value = 1 Then
        txtSimulation(4) = Int(Loss_Temp)
        Text5(2) = KF
        Text6 = Int(SRP)
        Text7 = Int(HandLocation)
        Call LoadObject(cube)
        HSX_Change
        Form1.Show 1
    End If
    End If
    End If
    Next
    Next
    Next
    End If
    Next
    Next
    Next
    Next
    If Combo1.ListIndex = 0 Then
        Open App.Path & "\Result_Percentile" & i & ".csv" For Output As #1
        ElseIf Combo1.ListIndex = 1 Then
        Open App.Path & "\Result_Square" & i & ".csv" For Output As #1
        ElseIf Combo1.ListIndex = 2 Then
        Open App.Path & "\Result_Circular" & i & ".csv" For Output As #1
        ElseIf Combo1.ListIndex = 3 Then
        Open App.Path & "\Result_Rectangular" & i & ".csv" For Output As #1
        ElseIf Combo1.ListIndex = 4 Then
        Open App.Path & "\Result_Boundary" & i & ".csv" For Output As #1
    End If
        For j = 1 To NumberofAlternative
            Print #1, Loss(j, 1) & "," & Loss(j, 2) & "," & Loss(j, 3) & "," & Loss(j, 4) & "," & Loss(j, 5) & "," & Loss(j, 6) & "," & Loss(j, 7) & "," & Loss(j, 8) & "," & Loss(j, 9)
        Next
    Close #1
  Next
  Text2 = Time
End Sub

Private Sub Form_Load()
```

```
            LL(i, 1) = RHM(i, 9) * 0.77
            LL(i, 2) = RHM(i, 10) * 0.16
            LL(i, 3) = RHM(i, 10) * 0.16
            LL(i, 5) = RHM(i, 1) * 0.91
            LL(i, 6) = RHM(i, 4) * 0.49
            LL(i, 7) = RHM(i, 5) * 0.89
            LL(i, 8) = RHM(i, 7) * 0.9
            LL(i, 9) = RHM(i, 8) * 0.75
            LL(i, 10) = RHM(i, 7) * 0.2
            LL(i, 11) = RHM(i, 6) * 0.5
            LL(i, 12) = RHM(i, 5) * 0.22
        Next
End If
If Combo1.ListIndex = 2 Then
        RHM_Number = 19
        Open App.Path & "\RHM_Circular.txt" For Input As #1
            For i = 1 To RHM_Number
                For j = 1 To 11
                    Input #1, RHM(i, j)
                    RHM(i, j) = RHM(i, j) / 10
                Next
            Next
        Close #1
        For i = 1 To RHM_Number
            LL(i, 1) = RHM(i, 9) * 0.77
            LL(i, 2) = RHM(i, 10) * 0.16
            LL(i, 3) = RHM(i, 10) * 0.16
            LL(i, 5) = RHM(i, 1) * 0.91
            LL(i, 6) = RHM(i, 4) * 0.49
            LL(i, 7) = RHM(i, 5) * 0.89
            LL(i, 8) = RHM(i, 7) * 0.9
            LL(i, 9) = RHM(i, 8) * 0.75
            LL(i, 10) = RHM(i, 7) * 0.2
            LL(i, 11) = RHM(i, 6) * 0.5
            LL(i, 12) = RHM(i, 5) * 0.22
        Next
End If
If Combo1.ListIndex = 3 Then
        RHM_Number = 9
        Open App.Path & "\RHM_Rectangular.txt" For Input As #1
            For i = 1 To RHM_Number
                For j = 1 To 11
                    Input #1, RHM(i, j)
                    RHM(i, j) = RHM(i, j) / 10
                Next
            Next
        Close #1
        For i = 1 To RHM_Number
            LL(i, 1) = RHM(i, 9) * 0.77
            LL(i, 2) = RHM(i, 10) * 0.16
            LL(i, 3) = RHM(i, 10) * 0.16
            LL(i, 5) = RHM(i, 1) * 0.91
            LL(i, 6) = RHM(i, 4) * 0.49
            LL(i, 7) = RHM(i, 5) * 0.89
            LL(i, 8) = RHM(i, 7) * 0.9
            LL(i, 9) = RHM(i, 8) * 0.75
            LL(i, 10) = RHM(i, 7) * 0.2
            LL(i, 11) = RHM(i, 6) * 0.5
            LL(i, 12) = RHM(i, 5) * 0.22
        Next
End If
If Combo1.ListIndex = 4 Then
        RHM_Number = 34
        Open App.Path & "\RHM_Boundary.txt" For Input As #1
            For i = 1 To RHM_Number
                For j = 1 To 13
                    Input #1, RHM(i, j)
                    RHM(i, j) = RHM(i, j) / 10
                Next
            Next
        Close #1
        For i = 1 To RHM_Number
            LL(i, 1) = RHM(i, 9) * 0.77
            LL(i, 2) = RHM(i, 10) * 0.16
            LL(i, 3) = RHM(i, 10) * 0.16
            LL(i, 5) = RHM(i, 1) * 0.91
            LL(i, 6) = RHM(i, 4) * 0.49
            LL(i, 7) = RHM(i, 5) * 0.89
            LL(i, 8) = RHM(i, 7) * 0.9
```

```
    'Initialize
    HF = -10: KF = 90: SA = 0: SF = 0: EF = 90: TableHeight = 55:
SeatHeight = 40: ArmrestHeight = 50: ArmrestClearance = 40: NthRHM = 1
    RHM_Number = 3
    Open App.Path & "\RHM_Percentile.txt" For Input As #1
        For i = 1 To RHM_Number
            For j = 1 To 11
                Input #1, RHM(i, j)
                RHM(i, j) = RHM(i, j) / 10
            Next
        Next
    Close #1
    For i = 1 To RHM_Number
        LL(i, 1) = RHM(i, 9) * 0.77
        LL(i, 2) = RHM(i, 10) * 0.16
        LL(i, 3) = RHM(i, 10) * 0.16
        LL(i, 4) = RHM(i, 11)
        LL(i, 5) = RHM(i, 1) * 0.91
        LL(i, 6) = RHM(i, 4) * 0.49
        LL(i, 7) = RHM(i, 5) * 0.69
        LL(i, 8) = RHM(i, 7) * 0.72
        LL(i, 9) = RHM(i, 8) * 0.4
        LL(i, 10) = RHM(i, 7) * 0.157576
        LL(i, 11) = RHM(i, 6) * 0.5
        LL(i, 12) = RHM(i, 5) * 0.22
    Next
    Call LoadObject(cube)
    HSX_Change
    Combo1.AddItem "Percentile"
    Combo1.AddItem "Square"
    Combo1.AddItem "Circular"
    Combo1.AddItem "Rectangular"
    Combo1.AddItem "Boundary zone"
    Combo1.ListIndex = 0
End Sub

Private Sub Form_Unload(Cancel As Integer)
  all_stop = True
End Sub

Private Sub HSX_Change()
 Dim temp As Object3D
 Dim ang As Single
 temp = cube
 Picture1.Cls
```

```
                LL(i, 9) = RHM(i, 8) * 0.75
                LL(i, 10) = RHM(i, 7) * 0.2
                LL(i, 11) = RHM(i, 6) * 0.5
                LL(i, 12) = RHM(i, 5) * 0.22
            Next
        End If
End Sub
Public Sub User()
    RHM_Number = 1000
    Open App.Path & "\CW_Testing.txt" For Input As #1
        For i = 1 To RHM_Number
            For j = 1 To 11
                Input #1, RHM(i, j)
                RHM(i, j) = RHM(i, j) / 10
            Next
        Next
    Close #1
    For i = 1 To RHM_Number
        LL(i, 1) = RHM(i, 9) * 0.77     'Shoulder pivot width
        LL(i, 2) = RHM(i, 10) * 0.16    'Humeral link
        LL(i, 3) = RHM(i, 10) * 0.16    'Forearm link
        LL(i, 4) = RHM(i, 11)           'Hand link
        LL(i, 5) = RHM(i, 1) * 0.91     'Trunk link
        LL(i, 6) = RHM(i, 4) * 0.49     'Hip pivot width
        LL(i, 7) = RHM(i, 5) * 0.89     'Femoral link
        LL(i, 8) = RHM(i, 7) * 0.9      'Shank link
        LL(i, 9) = RHM(i, 8) * 0.75     'Ankle-to-toe link
        LL(i, 10) = RHM(i, 7) * 0.2     'Ankle-to-floor link
        LL(i, 11) = RHM(i, 6) * 0.5     'SRP-to-HP vertical link
        LL(i, 12) = RHM(i, 5) * 0.28    'SRP-to-HP horizontal link
    Next
End Sub
```

Module1.bas

```
Public RHM(10000, 20), LL(10000, 30), Loss(1000000, 10), HF, KF, SF,
SA, EF, TableHeight, SeatHeight, ArmrestHeight, ArmrestClearance,
NthRHM, RHM_Number
Public Declare Sub Sleep Lib "kernel32" (ByVal dwMilliseconds As Long)
Public Declare Function SleepEx Lib "kernel32" (ByVal dwMilliseconds As
Long, ByVal bAlertable As Long) As Long
Public Declare Sub GetSystemTime Lib "kernel32" (lpSystemTime As
SYSTEMTIME)
Public Declare Function SetSystemTime Lib "kernel32" (lpSystemTime As
SYSTEMTIME) As Long
Public Type SYSTEMTIME
        wYear As Integer
        wMonth As Integer
        wDayOfWeek As Integer
        wDay As Integer
        wHour As Integer
        wMinute As Integer
        wSecond As Integer
        wMilliseconds As Integer
End Type

Private Type vx3D
  x As Single
  y As Single
  z As Single
  sx As Long
  sy As Long
End Type
```

```
'Foot
 obj.vx(6).x = obj.vx(2).x + (LL(NthRHM, 9) * iUL): obj.vx(6).y =
 obj.vx(2).y: obj.vx(6).z = obj.vx(2).z
 obj.vx(7).x = obj.vx(5).x + (LL(NthRHM, 9) * iUL): obj.vx(7).y =
 obj.vx(5).y: obj.vx(7).z = obj.vx(5).z

 For i = 0 To 7
   obj.vx(i).z = obj.vx(i).z + (obj.vx(7).z * -1)
 Next

 'Trunk
 obj.vx(62).x = 0 * iUL: obj.vx(62).y = 0 * iUL: obj.vx(62).z = obj.vx(0).z
 obj.vx(63).x = 0 * iUL: obj.vx(63).y = 0 * iUL: obj.vx(63).z = obj.vx(0).z +
 (LL(NthRHM, 5) * iUL)
 obj.vx(64).x = 0 * iUL: obj.vx(64).y = LL(NthRHM, 1) / 2 * iUL:
 obj.vx(64).z = obj.vx(63).z
 obj.vx(65).x = 0 * iUL: obj.vx(65).y = -LL(NthRHM, 1) / 2 * iUL:
 obj.vx(65).z = obj.vx(63).z

 'Upper Limbs
 obj.vx(66).x = LL(NthRHM, 2) * Sin(SF / 180 * 3.14) * iUL: obj.vx(66).y =
             (LL(NthRHM, 1) / 2 + LL(NthRHM, 2) * Sin(SA / 180 *
             3.14)) * iUL: obj.vx(66).z = obj.vx(50).z + ((LL(NthRHM, 5)
             - LL(NthRHM, 2) * Cos(SF / 180 * 3.14) * Cos(SA / 180 *
             3.14)) * iUL)
 obj.vx(67).x = obj.vx(66).x + LL(NthRHM, 3) * Sin(EF / 180 * 3.14) * iUL:
             obj.vx(67).y = (LL(NthRHM, 1) / 2 + LL(NthRHM, 3) *
             Sin(SA / 180 * 3.14)) * iUL: obj.vx(67).z = obj.vx(66).z -
```

```
Private Type Polygon3D
   v_pointer(2) As Long
   colr As Long
End Type

Public Type Object3D
   vx() As vx3D
   polygon() As Polygon3D
End Type
Public Sub LoadObject(obj As Object3D)
   ReDim obj.vx(100)
   Const iUL = 0.01

   ' Ground
   obj.vx(54).x = -100 * iUL: obj.vx(54).y = 100 * iUL: obj.vx(54).z = 0
   obj.vx(55).x = 100 * iUL: obj.vx(55).y = 100 * iUL: obj.vx(55).z = 0
   obj.vx(56).x = 100 * iUL: obj.vx(56).y = -100 * iUL: obj.vx(56).z = 0
   obj.vx(57).x = -100 * iUL: obj.vx(57).y = -100 * iUL: obj.vx(57).z = 0

   'Seat
   obj.vx(50).x = -LL(NthRHM, 12) * iUL: obj.vx(50).y = 43 / 2 * iUL:
                  obj.vx(50).z = SeatHeight * iUL
   obj.vx(51).x = (40 - LL(NthRHM, 12)) * Cos(HF / 180 * 3.14) * iUL:
                  obj.vx(51).y = 43 / 2 * iUL: obj.vx(51).z = (SeatHeight +
                  SeatHeight * Sin(-1 * HF / 180 * 3.14)) * iUL
   obj.vx(52).x = (40 - LL(NthRHM, 12)) * Cos(HF / 180 * 3.14) * iUL:
                  obj.vx(52).y = -43 / 2 * iUL: obj.vx(52).z = (SeatHeight +
                  SeatHeight * Sin(-1 * HF / 180 * 3.14)) * iUL
   obj.vx(53).x = -LL(NthRHM, 12) * iUL: obj.vx(53).y = -43 / 2 * iUL:
                  obj.vx(53).z = SeatHeight * iUL

   'SRP
   obj.vx(68).x = -(LL(NthRHM, 12) + 0.5) * iUL: obj.vx(68).y = 0.5 * iUL:
                  obj.vx(68).z = SeatHeight * iUL
   obj.vx(69).x = -(LL(NthRHM, 12) - 0.5) * iUL: obj.vx(69).y = 0.5 * iUL:
                  obj.vx(69).z = SeatHeight * iUL
   obj.vx(70).x = -(LL(NthRHM, 12) - 0.5) * iUL: obj.vx(70).y = -0.5 * iUL:
                  obj.vx(70).z = SeatHeight * iUL
   obj.vx(71).x = -(LL(NthRHM, 12) + 0.5) * iUL: obj.vx(71).y = -0.5 *
                  iUL: obj.vx(71).z = SeatHeight * iUL

   'Table
   obj.vx(58).x = 10 * iUL: obj.vx(58).y = 70 / 2 * iUL: obj.vx(58).z =
   TableHeight * iUL: obj.vx(59).x = 90 * iUL: obj.vx(59).y = 70 / 2 * iUL:
   obj.vx(59).z = TableHeight * iUL: obj.vx(60).x = 90 * iUL: obj.vx(60).y
   = -70 / 2 * iUL: obj.vx(60).z = TableHeight * iUL: obj.vx(61).x = 10 *
   iUL: obj.vx(61).y = -70 / 2 * iUL: obj.vx(61).z = TableHeight * iUL

   'Right Armrest
   obj.vx(74).x = -7.7 * iUL: obj.vx(74).y = (ArmrestClearance / 2 + 3) *
   iUL: obj.vx(74).z = ArmrestHeight * iUL
   obj.vx(75).x = -(7.7 - 30) * iUL: obj.vx(75).y = (ArmrestClearance / 2 +
   3) * iUL: obj.vx(75).z = ArmrestHeight * iUL
   obj.vx(76).x = -(7.7 - 30) * iUL: obj.vx(76).y = (ArmrestClearance / 2 - 3)
   * iUL: obj.vx(76).z = ArmrestHeight * iUL
   obj.vx(77).x = -7.7 * iUL: obj.vx(77).y = (ArmrestClearance / 2 - 3) *
   iUL: obj.vx(77).z = ArmrestHeight * iUL

   'Right Armrest
   obj.vx(78).x = -7.7 * iUL: obj.vx(78).y = -(ArmrestClearance / 2 + 3) *
   iUL: obj.vx(78).z = ArmrestHeight * iUL
   obj.vx(79).x = -(7.7 - 30) * iUL: obj.vx(79).y = -(ArmrestClearance / 2 +
   3) * iUL: obj.vx(79).z = ArmrestHeight * iUL
   obj.vx(80).x = -(7.7 - 30) * iUL: obj.vx(80).y = -(ArmrestClearance / 2 -
   3) * iUL: obj.vx(80).z = ArmrestHeight * iUL
   obj.vx(81).x = -7.7 * iUL: obj.vx(81).y = -(ArmrestClearance / 2 - 3) *
   iUL: obj.vx(81).z = ArmrestHeight * iUL

   'Lower Limbs
   obj.vx(0).x = 0: obj.vx(0).y = LL(NthRHM, 6) / 2 * iUL: obj.vx(0).z = 0
   obj.vx(1).x = LL(NthRHM, 7) * Cos(-1 * HF / 180 * 3.14) * iUL:
                 obj.vx(1).y = LL(NthRHM, 6) / 2 * iUL: obj.vx(1).z =
                 LL(NthRHM, 7) * Sin(-1 * HF / 180 * 3.14) * iUL
   obj.vx(2).x = (LL(NthRHM, 7) * Cos(-1 * HF / 180 * 3.14) +
                 (LL(NthRHM, 8) + LL(i, 10)) * Cos(KF / 180 * 3.14)) *
                 iUL: obj.vx(2).y = LL(NthRHM, 6) / 2 * iUL: obj.vx(2).z =
                 -((LL(NthRHM, 8) + LL(i, 10)) * Sin(KF / 180 * 3.14) -
                 LL(i, 7) * Sin(HF / 180 * 3.14) + 2.5) * iUL
                  (LL(NthRHM, 3) * Cos(EF / 180 * 3.14) * iUL)
   obj.vx(72).x = LL(NthRHM, 2) * Sin(SF / 180 * 3.14) * iUL: obj.vx(72).y = -
                  (LL(NthRHM, 1) / 2 + LL(NthRHM, 2) * Sin(SA / 180 *
                  3.14)) * iUL: obj.vx(72).z = obj.vx(50).z + ((LL(NthRHM, 5)
                  - LL(NthRHM, 2) * Cos(SF / 180 * 3.14) * Cos(SA / 180 *
                  3.14)) * iUL)
   obj.vx(73).x = obj.vx(66).x + LL(NthRHM, 3) * Sin(EF / 180 * 3.14) * iUL:
                  obj.vx(73).y = -(LL(NthRHM, 1) / 2 + LL(NthRHM, 3) *
                  Sin(SA / 180 * 3.14)) * iUL: obj.vx(73).z = obj.vx(66).z -
                  (LL(NthRHM, 3) * Cos(EF / 180 * 3.14) * iUL)

End Sub
Public Sub DisplayObject(obj As Object3D, frm As Object)

  'Ground Level
  frm.Line (obj.vx(54).sx, obj.vx(54).sy)-(obj.vx(55).sx, obj.vx(55).sy), vbGreen
  frm.Line (obj.vx(55).sx, obj.vx(55).sy)-(obj.vx(56).sx, obj.vx(56).sy), vbGreen
  frm.Line (obj.vx(56).sx, obj.vx(56).sy)-(obj.vx(57).sx, obj.vx(57).sy), vbGreen
  frm.Line (obj.vx(57).sx, obj.vx(57).sy)-(obj.vx(54).sx, obj.vx(54).sy), vbGreen

  'Seat
  frm.Line (obj.vx(50).sx, obj.vx(50).sy)-(obj.vx(51).sx, obj.vx(51).sy), vbWhite
  frm.Line (obj.vx(51).sx, obj.vx(51).sy)-(obj.vx(52).sx, obj.vx(52).sy), vbWhite
  frm.Line (obj.vx(52).sx, obj.vx(52).sy)-(obj.vx(53).sx, obj.vx(53).sy), vbWhite
  frm.Line (obj.vx(53).sx, obj.vx(53).sy)-(obj.vx(50).sx, obj.vx(50).sy), vbWhite

  'SRP
  frm.Line (obj.vx(68).sx, obj.vx(68).sy)-(obj.vx(69).sx, obj.vx(69).sy), vbRed
  frm.Line (obj.vx(69).sx, obj.vx(69).sy)-(obj.vx(70).sx, obj.vx(70).sy), vbRed
  frm.Line (obj.vx(70).sx, obj.vx(70).sy)-(obj.vx(71).sx, obj.vx(71).sy), vbRed
  frm.Line (obj.vx(71).sx, obj.vx(71).sy)-(obj.vx(68).sx, obj.vx(68).sy), vbRed

  'Table
  frm.Line (obj.vx(58).sx, obj.vx(58).sy)-(obj.vx(59).sx, obj.vx(59).sy), vbWhite
  frm.Line (obj.vx(59).sx, obj.vx(59).sy)-(obj.vx(60).sx, obj.vx(60).sy), vbWhite
  frm.Line (obj.vx(60).sx, obj.vx(60).sy)-(obj.vx(61).sx, obj.vx(61).sy), vbWhite
  frm.Line (obj.vx(61).sx, obj.vx(61).sy)-(obj.vx(58).sx, obj.vx(58).sy), vbWhite

  'Lower Limbs
  frm.Line (obj.vx(0).sx, obj.vx(0).sy)-(obj.vx(1).sx, obj.vx(1).sy), vbRed
  frm.Line (obj.vx(1).sx, obj.vx(1).sy)-(obj.vx(2).sx, obj.vx(2).sy), vbRed
  frm.Line (obj.vx(0).sx, obj.vx(0).sy)-(obj.vx(3).sx, obj.vx(3).sy), vbRed
  frm.Line (obj.vx(3).sx, obj.vx(3).sy)-(obj.vx(4).sx, obj.vx(4).sy), vbRed
  frm.Line (obj.vx(4).sx, obj.vx(4).sy)-(obj.vx(5).sx, obj.vx(5).sy), vbRed
  frm.Line (obj.vx(2).sx, obj.vx(2).sy)-(obj.vx(6).sx, obj.vx(6).sy), vbRed
  frm.Line (obj.vx(5).sx, obj.vx(5).sy)-(obj.vx(7).sx, obj.vx(7).sy), vbRed

  'Trunk
  frm.Line (obj.vx(62).sx, obj.vx(62).sy)-(obj.vx(63).sx, obj.vx(63).sy), vbRed
  frm.Line (obj.vx(64).sx, obj.vx(64).sy)-(obj.vx(65).sx, obj.vx(65).sy), vbRed

  'Upper Limbs
  frm.Line (obj.vx(64).sx, obj.vx(64).sy)-(obj.vx(66).sx, obj.vx(66).sy), vbRed
  frm.Line (obj.vx(66).sx, obj.vx(66).sy)-(obj.vx(67).sx, obj.vx(67).sy), vbRed
  frm.Line (obj.vx(65).sx, obj.vx(65).sy)-(obj.vx(72).sx, obj.vx(72).sy), vbRed
  frm.Line (obj.vx(72).sx, obj.vx(72).sy)-(obj.vx(73).sx, obj.vx(73).sy), vbRed
End Sub

Public Sub ProjectObject(obj As Object3D, frm As Object)
   Dim pnt As Long, dz As Single
   For pnt = 0 To UBound(obj.vx())
      dz = obj.vx(pnt).z: If dz <= 0 Then dz = 0.001
      obj.vx(pnt).sx = (MainForm.Picture1.ScaleWidth / 2) + ((obj.vx(pnt).x *
300) / dz)
      obj.vx(pnt).sy = (MainForm.Picture1.ScaleHeight / 2) + ((obj.vx(pnt).y *
300) / dz)
   Next
End Sub
Public Sub RotateObject(pit As Single, yaw As Single, rol As Single, obj As
Object3D)
   Dim pnt As Long
   Dim x0 As Single, y0 As Single, z0 As Single
   Dim x1 As Single, y1 As Single, z1 As Single
   Dim x2 As Single, y2 As Single, z2 As Single
      obj.vx(pnt).x = x2
      obj.vx(pnt).y = y2
      obj.vx(pnt).z = z2
   Next
End Sub
```

obj.vx(3).x = 0: obj.vx(3).y = -LL(NthRHM, 6) / 2 * iUL: obj.vx(3).z = 0 obj.vx(4).x = LL(NthRHM, 7) * Cos(-1 * HF / 180 * 3.14) * iUL: obj.vx(4).y = -LL(NthRHM, 6) / 2 * iUL: obj.vx(4).z = LL(NthRHM, 7) * Sin(-1 * HF / 180 * 3.14) * iUL obj.vx(5).x = (LL(NthRHM, 7) * Cos(-1 * HF / 180 * 3.14) + (LL(NthRHM, 8) + LL(i, 10)) * Cos(KF / 180 * 3.14)) * iUL: obj.vx(5).y = -LL(NthRHM, 6) / 2 * iUL: obj.vx(5).z = -((LL(NthRHM, 8) + LL(i, 10)) * Sin(KF / 180 * 3.14) - LL(i, 7) * Sin(HF / 180 * 3.14) + 2.5) * iUL For pnt = 0 To UBound(obj.vx()) x0 = Cos(yaw) * obj.vx(pnt).x + Sin(yaw) * obj.vx(pnt).z y0 = obj.vx(pnt).y z0 = Sin(yaw) * obj.vx(pnt).x - Cos(yaw) * obj.vx(pnt).z x1 = x0 y1 = Cos(pit) * y0 + Sin(pit) * z0 z1 = Sin(pit) * y0 - Cos(pit) * z0 x2 = Cos(rol) * x1 + Sin(rol) * y1 y2 = Sin(rol) * x1 - Cos(rol) * y1 z2 = z1	Public Sub ScaleObject(xs As Single, ys As Single, zs As Single, obj As Object3D) Dim pnt As Long For pnt = 0 To UBound(obj.vx()) obj.vx(pnt).x = obj.vx(pnt).x * xs obj.vx(pnt).y = obj.vx(pnt).y * ys obj.vx(pnt).z = obj.vx(pnt).z * zs Next End Sub Public Sub TranslateObject(tx As Long, ty As Long, tz As Long, obj As Object3D) Dim pnt As Long For pnt = 0 To UBound(obj.vx()) obj.vx(pnt).x = obj.vx(pnt).x + tx obj.vx(pnt).y = obj.vx(pnt).y + ty obj.vx(pnt).z = obj.vx(pnt).z + tz Next End Sub