# A SENSITIVITY ANALYSIS OF CIRCULAR ERROR PROBABLE APPROXIMATION TECHNIQUES

THESIS

Peter Puhek
Captain, USAF

AFIT/GOR/ENS/92M-23



DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY
AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

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THESIS

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Peter Puhek, B.S.
Captain, USAF

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| COMMITTEE | NAME/DEPARTMENT | SIGNATURE |
| --- | --- | --- |
| Advisor | Major Paul F. Auclair<br>Department of<br>Operational Sciences | Paul F. Auclair |
| Reader | Major J. Andreas Howell<br>Department of<br>Operational Sciences | [illegible] |

## *Preface*

This study examines the sensitivities of several circular error probable (CEP) estimation methods to varying levels of sample size, bias, correlation, and ellipticity. It was recommended by both former and current ICBM accuracy analysts and sponsored by the HQ SAC/XPSW directorate. The results of this study should be useful to this office and to anyone interested in estimating CEPs from data which follow a bivariate normal distribution.

I would like to acknowledge several people for their contributions to this thesis. Major Dave Berg sponsored this thesis and taught me most of my computer programming skills. Major Paul Auclair patiently advised me in this endeavor, and Major Andy Howell added numerous insightful contributions. I thank my parents for starting me off on the right path in life, and my brother, Major Jim Puhek, for introducing me to the great Air Force life. Most importantly, I thank Jesus Christ for being my personal Savior, Lord, and Master, and I look forward to eternal life with Him soon.

Peter Puhek

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## *Abstract*

Several algebraic CEP estimation models were examined in this study. Each assumes that the crossrange and downrange miss distances of the sample data follow a bivariate normal distribution. The analysis determined the sensitivities of these models to changes in the parameters of sample size, bias, correlation, and ellipticity. The accuracy of each model is expressed in terms of relative error, and the parameter regions in which a certain method dominated as the most accurate were noted. In general, it was found that bias was the most significant parameter in determining the best CEP method. A simple method, based on the Rayleigh distribution dominated as the best when bias was 0, .25, .5, .75, or 1, and the Grubbs-Patnaik/chi-square method dominated for the bias setting of 2 regardless of the settings of the other parameters. Levels of bias greater than 2 were not addressed.

# A SENSITIVITY ANALYSIS OF CIRCULAR ERROR PROBABLE APPROXIMATION TECHNIQUES

## *I. Introduction*

### *1.1 Background*

The Strategic Air Command (SAC) conducts operational flight tests of its intercontinental ballistic missiles (ICBMs) to monitor and demonstrate their flight-worthiness. Weapon system performance analysts use the data generated by these tests in estimating the accuracy and reliability of Air Force ICBMs. During an ICBM test, each re-entry vehicle (RV) has a simulated fuze point at a selected longitude, latitude, and height of burst, which could be as low as zero in the case of a simulated ground burst. The difference between the simulated and intended fuze points is referred to as the miss distance. ICBM accuracy is a function of miss distance, and this thesis focuses on those techniques used to estimate ICBM accuracy.

ICBM accuracy is generally given in terms of a circular error probable (CEP) measure. CEP is the radius of a circle, centered on the mean or intended fuze point, in which 50% of the RVs can be expected to arrive or in which a single RV has a 0.5 probability of arriving [8:1]. SAC has several CEP estimation techniques. The two most accurate techniques require numerical integration and can take several hours to run on a personal computer [2:1-2,4-6]. Some of the other approximation techniques are much quicker, but according to previous research, they require sample sizes of 30 or more to accurately estimate CEP [2:1-2].

The precision of a CEP estimation technique is expressed in terms of relative error (RE), which is defined as the percentage difference between a CEP estimate given by a quick method and that given by the *exact* method for the same test scores. The *exact* method is a numerical integration technique which uses infinite series expansion, and it will be discussed in detail in Chapter 3. Thus, the *exact* method is the benchmark for comparing the precision of the other CEP estimation techniques. Equation (1.1) expresses relative error in mathematical terms [14:9].

$$RE = \frac{CEP_{approx} - CEP_{exact}}{CEP_{exact}} \tag{1.1}$$

In 1986, an Air Force Institute of Technology (AFIT) thesis entitled *An Examination of Circular Error Probable Approximation Techniques* reported that an 80286-class personal computer could generate CEP estimates using the quick methods in about two seconds or less [2:4-2,4-4,4-5]. The important conclusion of the thesis is that the quick methods have less than three percent RE for sample sizes of 40 or more and are substantially faster than the numerical integration methods of estimating CEPs. Because these quick methods give approximately the same results as the time-consuming numerical integration methods at a fraction of the time, they are often preferred for operational analyses. The disadvantage of the quicker approximation techniques is that their accuracy under a number of conditions is not documented. Variations in the characteristics of the data such as bias, ellipticity, correlation, and sample size could potentially induce unacceptably high REs in the CEP estimates. For valid applications, the precision of the quick methods under varying data characteristics must be assessed.

The current and projected limits placed on SAC's ICBM flight test program motivated this research. Fiscal and political constraints indicate that the ICBM flight test rate may be reduced to as few as three test firings per year for each system [1]. As a result, it may be virtually impossible to attain the sample sizes assumed in previous research efforts. SAC is interested in determining how well the quick methods estimate the true CEP of an ICBM, given only three to fifteen flight tests and data with varying degrees of bias, correlation, and ellipticity [1].

## *1.2 Objective*

The objective of this study is to determine the RE of the various quick CEP estimation methods under a number of combinations of sample size, bias, ellipticity, and correlation.

## *1.3 Research Plan*

*1.3.1 Background.* The CEP estimation methods which apply to this study are introduced in Chapter 2. Several different categories of methods are discussed along with their specific models. The previous work applicable to this study and the extensions to the previous work made by this study are presented at the end of Chapter 2.

*1.3.2 Experiment.* Chapter 3 describes the purpose, design, and conduct of the experiment. The crux of the experiment entailed coding the CEP estimation methods into computer programs, executing these programs over a wide variety of data conditions, and observing the resulting CEP estimates. Every aspect relating to the conduct of the experiment is discussed in detail; the results of the experiment and corresponding analysis are addressed in subsequent chapters.

*1.3.3 Analysis and Results.* The analysis and discussion of the results of the experiment are given in Chapter 4. The CEP estimation methods are analyzed in terms of their relative errors. Statistics are presented to facilitate an individual and comparative assessment of the relative errors for each method. Figures are used to complement and verify the statistical results and to visualize the accuracies and parameter sensitivities of each CEP estimation method. The chapter closes with a discussion of each method's ability to accurately estimate CEPs and of any problems encountered implementing the methods.

*1.3.4 Conclusions and Recommendations.* Chapter 5 summarizes the important findings and conclusions of the experiment. Recommendations on how to best use and possibly extend the findings of this research close both the chapter and the study.

# II. Literature Search

## *2.1 Introduction*

The following paragraphs summarize the literature pertinent to this study. Specifically, the discussion covers the topics of the relevant ICBM CEP estimation methods, the previous work done in researching these methods, and the extension to the previous work that this present study will attempt to accomplish.

## *2.2 Discussion*

*2.2.1 CEP Methods.* There are numerous ICBM CEP estimation methods.

> The available methods of CEP estimation fall into one of the following categories: 1) nonparametric methods; 2) closed-form integration of the bivariate normal density function; 3) numerical integration of the bivariate normal distribution function; 4) Monte Carlo sampling techniques; 5) algebraic approximation of CEP. [14:2]

The pertinent CEP methods will be discussed in the context of these five categories.

*2.2.1.1 Nonparametric Methods.*

> The term *nonparametric statistics* has no standard definition that is agreed upon by all statisticians. However, most would agree that nonparametric statistical methods work well under fairly general assumptions about the nature of any probability distributions or parameters that are involved in an inferential problem. As a working definition we will define parametric methods as those that apply to problems where the distribution from which the sample is taken is specified except for the values of a finite number of parameters. Nonparametric methods apply in all other instances. [9:672]

One nonparametric CEP method is of interest. This method involves the radial miss distances, which are calculated as

$$r_i = \sqrt{D_i^2 + C_i^2} \tag{2.1}$$

where

$r_i$ = radial miss distance of the $i^{th}$ observation

$D_i$ = downrange miss distance of the $i^{th}$ observation

$C_i$ = crossrange miss distance of the $i^{th}$ observation [14:2]

The median can be determined quickly in terms of order statistics. If the number of samples is odd, the median is the $r_{[\frac{n+1}{2}]}$ order statistic of the radial miss distances. If the number of samples is even, the median is calculated as $\frac{1}{2}(r_{[\frac{n}{2}]} + r_{[\frac{n+2}{2}]})$ by using the two central order statistics of the $r_i$.

> For large sample size[s,] the sample median of $\{r_i\}$ is a good estimate of the population median and, hence, CEP. In flight test analysis, however, large sample sizes occur infrequently. The nonparametric approach is, therefore, usually unsuitable. [14:2]

The following CEP estimation method is a parametric method, but it will be discussed here because it also uses the radial miss distance. It results from integrating the Rayleigh distribution from its center to the radial distance that includes 50 percent of its density, as outlined in a 1983 Air Command and Staff College (ACSC) report [3:10-11]. It will be referred to as the "CEP3" method since it is listed as the third CEP estimation method in the ACSC report. Equation (2.2) shows the simplicity of this method.

$$CEP = .9394(\frac{\sum_{i=1}^{n} r_i}{n}) \tag{2.2}$$

"To use this CEP estimator, one needs only to estimate the mean radial error" [3:11]. The $r_i$ in equation (2.2) is calculated using equation (2.1).

*2.2.1.2 Closed-form Integration of the Bivariate Normal Density Function.* The CEP is found by doubly integrating the density function with respect to crossrange and downrange miss distance variables and by finding the CEP value that is the solution to equation (2.3):

$$\iint_{C_{CEP}} f(x,y)dxdy = 0.5 \tag{2.3}$$

where

$C_{CEP}$ = a circle centered at the target with radius CEP

$f(x,y)$ = the bivariate normal density function

$x$ = the crossrange miss distance

$y$ = the downrange miss distance [2:1-1]

The joint probability density function is given as

$$f(x,y) = \frac{1}{2\pi\sigma_x\sigma_y\sqrt{1-\rho_{xy}^2}}\left[exp(-\Omega)\right] \tag{2.4}$$

where

$$\Omega = \frac{1}{2(1-\rho_{xy}^2)}\left\{\left[\frac{x-\mu_x}{\sigma_x}\right]^2 - 2\rho_{xy}\left[\frac{(x-\mu_x)(y-\mu_y)}{\sigma_x\sigma_y}\right] + \left[\frac{y-\mu_y}{\sigma_y}\right]^2\right\}$$

and

$x$ is normally distributed with mean, $\mu_x$, and variance, $\sigma_x^2$

$y$ is normally distributed with mean, $\mu_y$, and variance, $\sigma_y^2$

$\rho_{xy}$ = correlation of $x$ and $y$ such that

$$\rho_{xy} = \frac{\sigma_{xy}}{\sigma_x\sigma_y}$$

> In general, a closed-form integration for the bivariate normal distribution does not exist. Given certain restrictions, such as uncorrelated samples with zero mean, and equal downrange and crossrange standard deviations, a closed-form solution can be determined. Similar, simple solutions exist for less restrictive cases, however, uncorrelated samples with zero mean and equal down and crossrange standard deviations are rarely found in flight test analysis. Hence, the closed-form integration approach is usually suitable only for initial CEP estimates. [14:2-3]

Previous work which analyzed this function showed that for the ideal conditions of no bias, ellipticity, or correlation, $CEP = 1.1774\sigma$ [3:7-8]. This result of stating CEP as a function of $\sigma$ is mentioned later in the discussion of the development of the RAND-234 tables and in the design of the experiment in Chapter 3.

*2.2.1.3 Numerical Integration.* ICBMs entered the Air Force weapons inventory in the early 1960s. During the early history of ICBMs, analysts did not have easy access to computers. Before the computer proliferation of the 1970s, numerically integrating the bivariate normal density function as a means to estimate CEP involved using one of a number of table look-up techniques. Three of the techniques will be discussed in the following paragraphs.

In 1960. H. Leon Harter published look-up tables to aid in estimating CEP. He converted the rectangular coordinate system variables of crossrange and downrange to the polar coordinate system variables of radius and offset angle. He integrated with respect to the radius variable, leaving an expression that included a single integral with respect to the offset angle. Instead of making the second integration, he provided two sets of tables which yield the CEP based on the ellipticity of the data. Both tables use the three variables of radius, ellipticity, and probability. Since, by definition, the probability of the radius equalling the CEP is 0.5, the CEP can be found by either table with knowledge of only the ellipticity [6:725-728]. This method allows for ellipticity, but not for bias or correlation.

In 1949, H. H. Germond of RAND published a study which doubly integrated the bivariate normal distribution. His method allows for both ellipticity and bias. However, the double integration resulted in four unknown variables—the downrange and crossrange coordinates of the center of the ellipse and the lengths of its semi-major and semi-minor axes. He set up tables to display the results of the numerical integration based on the four variables. As exhaustive tables listing all possible combinations of the four variables would be too voluminous, he developed worksheets to allow the user to make hand calculations at the required variable settings [4:1-13]. This method goes one step beyond Harter's in that it allows for bias as well as correlation.

In 1952, the RAND Corporation published CEP tables based on the results of the numerical integration of an offset bivariate normal density function [10:1-17]. These tables specifically account for aim points which are offset, or not coincident, with the center of a target. Use of these tables requires three varables. The first variable is bias, which is the distance of the target from the aimpoint or weapon arrival point. The second variable is the standard deviation of the weapon's arrival distribution. The standard deviation is calculated by dividing the CEP centered on the mean point of impact by 1.1774. The third variable is the radius of the intended target. Given these three variables, the associated probability can be found or interpolated from the tables. These tables are very important because a later method uses a cubic polynomial model to fit the data in the tables with their corresponding CEPs. This later method is the modified RAND-234 method, and it will be discussed later in the algebraic approximation section.

These first three numerical integration techniques are examples of the state-of-the-art for CEP estimations during the early ICBM era. However, with the proliferation of computers in the 1970's and beyond, the capability to more accurately estimate CEPs became available at the analyst level. Two methods were developed to exploit the use of computers and eliminate the need for tables: the Correlated Bivariate Normal (CBN) method and the infinite series expansion method.

In 1974, L. S. Simkins of John Hopkins University published an article entitled "Calculation of Circle of Equiprobability for a Biased, Correlated, Bivariate, Normal Distribution" [13:1]. Simkins used the capability of computers to exploit an earlier work done by DiDonato and Jarnagin, which reduced the double integration of the general bivariate normal distribution to a large algebraic expression with many terms.

> ...this procedure ...requires not that we calculate the probability, P, associated with a given [CEP], but that we find the [CEP] for which P = .50. An iterative procedure mentioned previously has been validated and usually converges after five to ten iterations (depending on the accuracy required, and upon the first estimate of [CEP]) [13:6].

The CBN method has three strong points and one weak point. First, the use of a computer eliminates the tedium of using tables. Second, the CBN method is generally more accurate than any of the methods that require the use of tables. It attains its level of precision by continuing to iterate until the proportion of the distribution contained within a circle of radius CEP does not differ from 0.5 by more then a user specified error limit. With specified error limits typically a small fraction of one percent, the CEP given by the CBN method is at least as accurate as the table interpolation methods. The third strong point of the CBN method is that it can handle bias, ellipticity, and correlation. Its one weak point is that it can take a considerable amount of computer time to calculate a CEP, depending upon the number of intervals the integral is broken into. Previous work using an 80286-class personal computer showed that the CBN algorithm required 10 minutes for 40 intervals, 1 hour for 100 intervals, and 16 hours for 400 intervals [3:4-6]. "The more intervals the integral is broken into, the more accurate the approximation. At times the CBN takes longer than the *exact* method to give a CEP" [3:4-5]. This assertion will be discussed further after presentation of the next and final numerical integration technique.

In 1984, C. C. Smith of the TRW Corporation presented a second numerical integration technique in her paper, "CEP Calculation Using Infinite Series" [15:1-7]. This technique became known as the *exact* method because "... it is the benchmark against which all the other approximation techniques were measured" [3:4-6]. The infinite series method requires an initial CEP estimate and then iterates the procedure until a CEP is found which gives a probability of 0.5 to within the user specified error limit. The infinite series expansion yields a CEP that is more accurate than the CBN method, but it generally takes more computer time [2:2-2]. Since the infinite series method is more accurate than the CBN method, the CBN method will not be discussed beyond this chapter. The infinite series method will be discussed in detail in Chapter 3.

Modern computers achieve greater accuracy than the table look-up techniques, but the CBN and infinite series methods are computationally intensive and require a great deal of computer processing time on a personal computer.

> While numerical integration methods provide good estimates of CEP, and can be used to evaluate the accuracy of the other CEP approximation methods, they require considerable computer time, and are usually impractical in flight test analysis. [14:3]

Later in this chapter, a few algebraic CEP approximation methods will be discussed. They are very fast compared to the CBN and the infinite series methods [2:4-2,4-4,4-5]. The infinite series method will be used as the standard or benchmark to compare how well these algebraic methods estimate CEP, and hence, will be referred to as the *exact* method for the remainder of this study.

*2.2.1.4 Algebraic Approximation of CEP.* There are three noteworthy algebraic CEP estimation methods. These methods are called quick CEP estimation methods because they produce estimates in about two seconds or less on an 80286-class personal computer [2:4-2,4-4,4-5]. "They are fast, accurate and require few assumptions" [14:4].

The first method is the modified RAND-234 method.

> It is a mathematical expression for circular error probable that approximates the tabular R-234 probabilities mentioned earlier in this chapter. A least-squares fit to a third order polynomial was used to derive the CEP formula. [16:2]

The modified RAND-234 method will be discussed in detail in Chapter 3.

The second and third quick CEP estimation methods are similar. Both were originally presented in 1964 by Frank E. Grubbs in an article entitled "Approximate Circular and Noncircular Offset Probabilities of Hitting" [5:1]. His methods are designed to incorporate the following guidance:

> For equal or unequal delivery errors and an offset point of aim, the chance that the burst point of a warhead occurs within a given distance of a selected point of the target is approximated by reference to weighted noncentral chi-square distributions. [5:1]

The two methods proposed by Grubbs are the Grubbs-Patnaik/chi-square method and the Grubbs-Patnaik/Wilson-Hilferty method. The two methods are similar in algebra and, therefore, give similar results. However, the Grubbs-Patnaik/chi-square method uses an inverse chi-square function based on the fact that the bias is a sum of noncentral chi-square random variables [2:3-2]. The incorporation of the inverse chi-square function into the Grubbs-Patnaik/chi-square method makes it generally more accurate than the Grubbs-Patnaik/Wilson-Hilferty method [2:4-8]. Since the Grubbs-Patnaik/chi-square method is usually the more accurate of the two Grubbs methods, only the Grubbs-Patnaik/chi-square method will be tested in Chapter 3.

*2.2.1.5 Monte Carlo Sampling Methods.* Another category of CEP estimation techniques includes the Monte Carlo sampling methods.

> Monte Carlo sampling methods of CEP determination are used to calculate the probability of impact given a circle of known radius. As in the case of numerical integration, Monte Carlo methods require an iterative scheme of estimation and considerable computer time, rendering them impractical in flight test analysis, but a good measure in evaluating other CEP approximation methods [14:3].

None of the CEP approximation methods use Monte Carlo sampling methods, so there will be no further discussion of this topic.

*2.2.2 Previous Work.* The present project is an extension of three previous studies that analyzed several CEP calculation methods. The following discussion summarizes these studies, noting their objectives and contributions to the analysis of the CEP estimation methods.

In 1982, C. C. Smith of the TRW Corporation submitted a study entitled "Methods of CEP Calculation" to the Air Force [14:1]. It classified ICBM CEP calculation methods into a number of categories and described several methods in detail [14:1-9]. The paper included the results of comparing the three quick methods with each other while varying the parameters of bias, ellipticity, or correlation [14:11-13]. The underlying assumption of the analysis is a known bivariate normal density function. The strong point of the study is the graphical section which clearly presents the effects of varying one of the parameters while holding the other two constant. There are two weak points to the study. First, the effects of varying two or all three parameters simultaneously are not included in the analysis because it examined changes in only one parameter at a time. The second weakness was that the experiments did not consider sample size. With small sample sizes and varying data conditions commonplace in operational testing, further research to address these matters is warranted.

In 1986, Captain Rich Elder of the Air Force Institute of Technology (AFIT) expanded on Smith's study. His thesis answered the following question:

> Given non-correlated sample impacts, how do common CEP approximation techniques (Grubbs-Patnaik/chi-square, Modified RAND-234, Grubbs-Patnaik/Wilson-Hilferty, or CBN) compare in accuracy and computational effort (measured by computer time) to the *exact* method (numerical integration) over the possible range of the parameters bias and ellipticity? [2:1-5]

There are three main differences between the two studies. Smith's study did not consider sample size, while Elder set the sample size at 40 and 400. The second difference was the emphasis Elder placed on personal computer processing time. Smith's study contains no information regarding computer processing time for any method. Third, the two studies present the results differently. The graphic presentation in Smith's study is easily understood. Elder listed his results in tables, which are more difficult to interpret. Concerning the objective of his thesis, Elder concluded:

> In general it was found that each of the approximation techniques is best in some regime of the parameter space with the Grubbs-Patnaik/chi-square technique being the most reliable estimator. For fast calculations of CEP, the correlated bivariate normal and the *exact* method may not be feasible because both are computationally rigorous and require from 2 minutes to several hours of computer time (on a personal computer) to give an estimate of CEP. [2:viii]

Elder addresses two important points in his thesis. First, Elder presented valuable information in comparing the CEP methods with respect to personal computer processing time [2:4-2,4-4,4-5]. Second, his explicit discussion of sample size revealed that the quick methods performed very well with sample sizes of 40 and 400 [2:2-5]. However, Elder did not address the effects upon the predictive accuracy of the quick CEP methods caused by simultaneously varying the parameters of sample size, bias, ellipticity, and correlation. This important issue still needs to be analyzed by further research.

The third study addresses the issue of small sample sizes, but it is substantially different in purpose than the first two studies. In 1983, Major Ronald A. Ethridge wrote an Air Command and Staff College report entitled "Robust Estimation of Circular Error Probable for Small Sample Sizes" [3]. The paper developed and tested a robust estimation procedure for estimating CEP given small samples of miss-distance data [3:2]. A key advantage of robust estimation procedures is their relative insensitivity to underlying assumptions [3:21]. "[A] robust estimator attempts to use more of the information contained in the sample data than nonparametric estimators, while avoiding the assumption problems of parametric estimators by using a broad family of underlying distributions"[3:ix]. To show that his proposed estimator is robust, Ethridge uses the estimator property called efficiency.

> Given two unbiased estimators, $\hat{\theta}_1$ and $\hat{\theta}_2$, of a parameter $\theta$, with variances $V(\hat{\theta}_1)$ and $V(\hat{\theta}_2)$, respectively, the efficiency of $\hat{\theta}_2$ relative to $\hat{\theta}_1$ is defined to be the ratio
>
> $$efficiency = \frac{V(\hat{\theta}_1)}{V(\hat{\theta}_2)}$$
>
> If $V(\hat{\theta}_2) < V(\hat{\theta}_1)$, the $\hat{\theta}_2$ is a better unbiased estimator than $\hat{\theta}_1$. [9:390]

Ethridge used the property of efficiency as the measure-of-effectiveness in his tests. His paper begins by listing nine other CEP methods. Eight of these methods are parametric [3:5-18], and one of these methods is nonparametric [3:18-19]. The next portion of his report develops his proposed robust CEP estimator [3:21-28]. After presenting the nine CEP methods and his proposed robust CEP estimator, Ethridge discusses the experiment he used to analyze the efficiencies of the 10 CEP estimators listed in his report.

The test was a Monte Carlo study with the following elements:

1) Sample sizes of 5, 7, 9, 11, 13, 15, 17, 19, and 21

2) 2000 replications for each sample size

3) $\mu_x = \mu_y = 0$

4) Ellipticity values of .2, .4, .6, .8, 1.0

5) Correlation values of .4, .5, .6, .7 [3:29-35].

Ethridge concludes his report by stating:

> No single estimation technique was judged "best" for all sample sizes and underlying distributions. Statistical tests of the underlying assumptions should be used to choose the most efficient estimator for the sample. For the "small deviations" tested in this study, the proposed estimator did prove to be robust. The maximum regret (loss in efficiency from best estimator) for the robust estimator was less than five percent. The estimator was also always more efficient than the sample median as an estimator of CEP. Since these two estimators were the only estimators considered in this study which are not based on a normal underlying distribution, the real savings from the robust estimator may come when the assumption of normality is violated. Little efficiency is lost when normality is present and much is gained if normality is violated. Therefore, the efficiency of this robust estimator should be tested for large deviations in the underlying assumptions. [3:x]

In his report, Ethridge emphasized the efficiency of CEP estimators. No attempt was made to show how well the CEP methods actually estimate CEP. A logical extension of Ethridge's report would be to assess the accuracy of Ethridge's new CEP estimator.

*2.2.3 Extensions.* Despite the contributions of Smith, Elder, and Ethridge, at least three issues remain unresolved. The first relates to how various combinations of bias, ellipticity, and correlation affect the accuracy of the CEP estimation methods.

The second unresolved issue concerns the effects of small sample sizes upon the accuracy of the quick CEP estimation methods. Smith did not address sample size, and the smallest sample size Elder used was 40. Although Ethridge studied sample sizes as small as 5, his emphasis was on efficiency, not on the ability of a method to estimate CEP. This study will use the following five small sample sizes: 3, 5, 7, 10, and 15.

The third issue is the determination of the accuracy of Ethridge's new estimator. This study will analyze and document the accuracy results of the Ethridge estimator. These extensions of the previous studies should provide the information necessary to determine which CEP estimation method should be used during some specific test or study.

### *2.3 Summary*

This chapter summarized the literature pertinent to this study. The chapter began with a brief overview of the general categories of ICBM CEP estimation methods. Each of the general categories was discussed in detail, and several important CEP estimation methods were introduced. The next section of the chapter highlighted the previous research done to analyze the effects of independently varying sample size, bias, correlation, and ellipticity on the predictive accuracy of the quick CEP estimation methods. The chapter concluded with a discussion of the extensions of the previous research attempted in this study.

# III. The Experiment

## 3.1 Purpose

The purpose of the experiment was to determine the accuracy and sensitivity of several ICBM CEP estimation methods, assuming that the underlying distribution of the accuracy data is bivariate normal. Since the important parameters of an empirical bivariate normal distribution are bias, ellipticity, and correlation, these parameters were set to several representative values that could possibly be observed in actual ICBM accuracy tests.

The intent of this study was not to find a specific optimal range of the parameters, as they are not under the control of the analyst. However, the results of this study should enable the analyst to determine which CEP estimation method would be most appropriate for a given set of parameter values. Appropriateness in this sense implies that the selected CEP estimation method has the least amount of relative error in the given parameter region.

## 3.2 The Mathematical Models

The experiment included the following five CEP estimation methods:

1) Infinite series expansion
2) Grubbs-Patnaik/chi-square
3) Modified RAND-234
4) Ethridge Estimator
5) CEP3

The mathematical models for each of these methods are given in this section. and the computer code implementing them is in Appendix B. Before presenting these models, some preliminary definitions common to all the models are given.

*3.2.1 Preliminary Definitions.* The coordinate system used to measure errors is the (x,y)-axis system centered on the aim point.

x = crossrange error axis
(positive to the right of the aimpoint,
negative to the left of the aim point)

y = downrange error axis
(positive beyond the aim point,
negative short of the aim point)

$\bar{x}$ = crossrange sample mean, equation (3.1)

$\bar{y}$ = downrange sample mean, equation (3.2)

n = sample size

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n} \tag{3.1}$$

$$\bar{y} = \frac{\sum_{i=1}^{n} y_i}{n} \tag{3.2}$$

$S_x$ = sample standard deviation of crossrange errors, equation (3.3)

$S_y$ = sample standard deviation of downrange errors, equation (3.4)

$$S_x = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}} \tag{3.3}$$

$$S_y = \sqrt{\frac{\sum_{i=1}^{n}(y_i - \bar{y})^2}{n-1}} \tag{3.4}$$

$$bias\ (b) = \sqrt{\bar{x}^2 + \bar{y}^2} \tag{3.5}$$

$$ellipticity\ (\epsilon) = \frac{S_x}{S_y} \tag{3.6}$$

$$correlation\ (\rho) = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{[\sum_{i=1}^{n}(x_i - \bar{x})^2][\sum_{i=1}^{n}(y_i - \bar{y})^2]}} \tag{3.7}$$

$$radial\ miss\ distance\ (r_i) = \sqrt{x_i^2 + y_i^2} \tag{3.8}$$

*3.2.2 Infinite Series Expansion.* This is the method referred to as the *exact* method. The method is defined in equation (3.9) and further explained in equations (3.10) to (3.12).

$$P(R) = \frac{R^2}{2} D \sum_{k=0}^{\infty} \sum_{j=0}^{\infty} x_k y_j \frac{(k+1)!(j+1)!}{(k+j+1)!} \tag{3.9}$$

where

P(R) = Probability of a circle of radius, R,
including a specified percentage of the scores.
In this case P(R) = 0.5 so that R = CEP.

$$D = \frac{1}{S_x S_y} exp\left[-\left(\frac{\bar{x}^2}{2S_x^2} + \frac{\bar{y}^2}{2S_y^2}\right)\right] \tag{3.10}$$

$$x_k = \frac{(2k)!}{(k+1)!(k!)^2}\left(\frac{-R^2}{8S_x^2}\right)^k \sum_{l=0}^{k} \frac{k!}{(k-l)!(2l)!}\left(\frac{-2\bar{x}^2}{S_x^2}\right)^l \tag{3.11}$$

$$y_j = \frac{(2j)!}{(j+1)!(j!)^2}\left(\frac{-R^2}{8S_y^2}\right)^j \sum_{i=0}^{j} \frac{j!}{(j-i)!(2i)!}\left(\frac{-2\bar{y}^2}{S_y^2}\right)^i \tag{3.12}$$

For a more detailed discussion of this method, refer to Smith's article [15:1-16].

*3.2.3 Grubbs-Patnaik/Chi-square.* The CEP estimation method is defined in equation (3.13). Further definition of terms are given in equations (3.14) to (3.17).

$$CEP = \sqrt{\frac{kv}{2m}} \tag{3.13}$$

where

$$m = (S_x^2 + S_y^2 + \bar{x}^2 + \bar{y}^2) \tag{3.14}$$

$$v = 2(S_x^4 + 2\rho^2 S_x^2 S_y^2 + S_y^4) + 4(\bar{x}^2 S_x^2 + 2\bar{x}\bar{y}\rho S_x S_y + \bar{y}^2 S_y^2) \tag{3.15}$$

$$k = \chi^{-1}(0.5) \tag{3.16}$$

$$df = \frac{2m^2}{v} \tag{3.17}$$

The $\chi^{-1}(0.5)$ in equation (3.16) is the inverse of the chi-square density function with $2m^2/v$ degrees of freedom at the cumulative probability setting of 0.5 [2:3-3]. For a more detailed description of this method, refer to Elder's thesis [2:3-2,3-3].

*3.2.4 Modified RAND-234.* This CEP estimation method is defined in equation (3.18). The terms are further defined from equation (3.19) to (3.22).

$$CEP = CEP_{MPI}(1.0039 - 0.0528v + 0.478v^2 - 0.0793v^3) \qquad (3.18)$$

where

$CEP_{MPI}$ = CEP centered on the mean point of impact

$$CEP_{MPI} = 0.614S_S + 0.563S_L \qquad (3.19)$$

$S_S$ = smaller of the two standard deviations

$S_L$ = larger of the two standard deviations

$$S_S = \sqrt{\frac{S_x^2 + S_y^2 - \sqrt{(S_x^2 - S_y^2)^2 + 4\rho^2 S_x^2 S_y^2}}{2}} \qquad (3.20)$$

$$S_L = \sqrt{\frac{S_x^2 + S_y^2 + \sqrt{(S_x^2 - S_y^2)^2 + 4\rho^2 S_x^2 S_y^2}}{2}} \qquad (3.21)$$

$$v = \frac{bias}{CEP_{MPI}} \qquad (3.22)$$

For a more detailed description of this method, refer to Elder's thesis [2:3-4,3-5].

*3.2.5 CEP3.* This simple CEP estimation method is defined in equation (3.23).

$$CEP = .9394\left(\frac{\sum_{i=1}^{n} r_i}{n}\right) \qquad (3.23)$$

For a more detailed description of this method, refer to Ethridge's ACSC report [3:10-11].

*3.2.6 Ethridge Estimator.* This CEP estimator is defined in equation (3.24). Further details of the terms are found in equations (3.25) to (3.30).

$$CEP = e^{\hat{\mu}} \tag{3.24}$$

where

$$\hat{\mu} = \sum_{i=1}^{n} w_i t_i \tag{3.25}$$

$$w_i = \frac{\frac{1}{d_i}}{\sum_{i=1}^{n}(\frac{1}{d_i})} \tag{3.26}$$

$$d_i = max[1 - \frac{(.03)(k_s - 3)^3(t_i - \dot{t})^2}{s^2}, 0.01] \tag{3.27}$$

$k_s$ = sample kurtosis

$$k_s = \frac{n\sum_{i=1}^{n}(t_i - \bar{t})^4}{[\sum_{i=1}^{n}(t_i - \bar{t})^2]^2} \tag{3.28}$$

$$\bar{t} = \frac{\sum_{i=1}^{n} t_i}{n} \tag{3.29}$$

$$t_i = ln(r_i) \tag{3.30}$$

$t_i$ = natural logarithm of the $i^{th}$ radial error

$\dot{t}$ = sample median

$s^2$ = sample variance of the natural logarithms of radial errors

For a more detailed description of this method, refer to Ethridge's ACSC report [3:23-27].

## 3.3 *Parameters*

The assumption of this thesis is that the underlying distribution of ICBM test data is the bivariate normal density function. The parameters that describe the location and shape of this function are bias, ellipticity, and correlation. A density plot of ideal test data would look like a circle centered on the origin of the (x,y)-axis system. If the test data are biased, the density plot would be centered at a position on the (x,y)-axis system other than the origin. The further the density plot is from the origin, the greater the bias. The other two parameters, ellipticity and correlation, describe the shape of the density plot. Even though a circle is a special case of an ellipse with equal major and minor axes, the density plot will be considered elliptical in this study when its shape is oval. If the density plot is elliptical and the major and minor axes do not coincide with the x-axis or the y-axis, the downrange and crossrange scores which make up the density plot are correlated. A density plot which is biased, elliptical, and correlated can be thought of as an ellipse whose major and minor axes do not coincide with the x-axis or the y-axis and whose center is not at the origin.

The true values of bias, ellipticity, and correlation can be estimated accurately for large sample sizes. However, in the case of sample sizes of 15 or less, accurately estimating the values of bias, ellipticity, and correlation is nearly impossible. Thus, CEP estimation requires methods that are not sensitive to moderate deviations from the ideal condition of unbiased, circular accuracy distributions.

This experiment determined the relative errors of the CEP estimation methods for a variety of departures from the ideal case. The parameters of sample size, bias, ellipticity, and correlation were set to several different levels to produce 875 design points. The specific parameter settings are listed in the next section.

### *3.4 Test Design Points*

There are a total of 875 test design points. Each point represents a unique combination of the values of sample size, bias, ellipticity, and correlation. In distributional terms, each point represents a unique density plot with respect to shape, location, and orientation. The values of the different parameters are listed in Table 3.1. Each of the 875 test design points is made of a unique combination of the values listed in Table 3.1.

Table 3.1. Parameter Values for Experiment

| | |
|---|---|
| Sample sizes | 3, 5, 7, 10, 15 |
| Bias | 0, .25, .5, .75, 1, 1.5, 2 |
| Ellipticity | .2, .4, .6, .8, 1 |
| Correlation | 0, .4, .7, .85, 1 |

## *3.5 Data*

In order to analyze the accuracy of the CEP estimation methods, sample data for each of the 875 design points was generated. Each of the methods produced CEP estimates from this data, with the *exact* method being the standard for determining the accuracy of the other four methods. The measure of accuracy used in this study is relative error (RE) as calculated in equation (1.1). The remainder of this chapter discusses the process of generating sample data, the procedures taken to verify sample data, and the methods used to calculate and record the REs.

*3.5.1 Generation of Sample Data.* The process of generating sample data required two steps. First, a random number generator was used to produce 10,000 sample (x,y)-scores based on an ideal bivariate normal density function. The random number generator was part of the SLAM II simulation language developed by Pritsker & Associates [11:vii]. The parameter settings of the random number generator were a mean of zero and a standard deviation of one. The 10,000 sample scores were put into a data file and formed the basis for generating the scores for the 875 design points. The second step of the data-generating process involved transforming the scores in the file to reflect the different data characteristics of the 875 design points. A computer program written in the C programming language performed the data transformation. All of the C programs in this study were developed on the author's CompuAdd 386-SX personal computer using the Borland International C++ compiler.

The C program that performed the second step in the above process was part of a series of C programs linked together in a batch file. This series of C programs not only performed the second step of transforming the scores for the 875 test design points, but it also proceeded to calculate the CEP estimates for each of the methods. The C programs in the batch file serially performed the following three steps for each of the 875 design points:

*Step 1*: Generate 10,000 (x,y)-scores from an ideal bivariate normal density function.

*Step 2*: Transform scores to reflect the data characteristics of the 875 test design points.

*Step 3*: Input the transformed scores into the CEP estimation methods to calculate CEPs.

The SLAM II program written to perform Step 1 is listed in Appendix A. The C programs which perform Step 2 and Step 3 are listed in Appendix B. The batch file that linked the programs together is listed at the end of Appendix B.

*3.5.1.1 Verification and Validation of Random Number Generator.* The 10,000 (x,y)-scores were produced by combining two random number streams of 10,000 numbers each. Two different seeds were used in the random number generator to produce the two different streams of numbers. As mentioned above, the source code necessary to produce these two random number streams is listed in Appendix A. With a knowledge of and access to a SLAM II software package, verification of the source code in Appendix A can be accomplished by simply typing the program and running it.

The validation of the two random number streams was done with a C program. Appendix C contains the source code of this program, which calculates the means, standard deviations, and cumulative probabilities of the two random number streams. Table 3.2 summarizes the output of the program. Column 1 gives the

Table 3.2. Standard Normal Cumulative Probabilities

| (1) Upper Bound of Interval | (2) Expected Cumulative Probabilities | (3) Cumulative Probabilities for Stream 1 | (4) Cumulative Probabilities for Stream 2 |
|---|---|---|---|
| -3.0 | 0.0014 | 0.0010 | 0.0011 |
| -2.5 | 0.0062 | 0.0063 | 0.0058 |
| -2.0 | 0.0228 | 0.0221 | 0.0227 |
| -1.5 | 0.0668 | 0.0648 | 0.0673 |
| -1.0 | 0.1587 | 0.1610 | 0.1594 |
| -0.5 | 0.3085 | 0.3064 | 0.3085 |
| 0.0 | 0.5000 | 0.4919 | 0.5025 |
| 0.5 | 0.6915 | 0.6873 | 0.6906 |
| 1.0 | 0.8413 | 0.8367 | 0.8396 |
| 1.5 | 0.9332 | 0.9322 | 0.9355 |
| 2.0 | 0.9772 | 0.9759 | 0.9767 |
| 2.5 | 0.9938 | 0.9931 | 0.9937 |
| 3.0 | 0.9986 | 0.9988 | 0.9995 |
| $+\infty$ | 1.0000 | 1.0000 | 1.0000 |
| Mean | 0.0000 | 0.0141 | 0.0002 |
| Std Dev | 1.0000 | 1.0052 | 0.9986 |

upper bounds of the interval, column 2 gives the expected cumulative probabilities of the intervals [9:760], column 3 gives the cumulative probability of stream 1, and column 4 gives the cumulative probabilities of stream 2. The results in Table 3.2 show that the two random number streams perform to expectation almost perfectly. Note the two bottom rows of Table 3.2. The last two rows of Table 3.2 list the means and standard deviations of the two random number streams. By definition, a standard normal distribution has a mean of zero and a standard deviation of one. Both stream 1 and stream 2 have means and standard deviations of approximately zero and one respectively. The logical conclusion pertaining to the data listed in

Table 3.2 is that the SLAM II random number generator produced valid standard normal random number streams.

*3.5.1.2 Correlation Study of Input Data.* The previous section verified that the two random streams were distributed normally with means of zero and standard deviations of one. This section examines the correlation between the two data streams. Since the simulated downrange and crossrange data was composed of merging the two data streams, it is important to show that there is no correlation between the two streams of random numbers. When the two streams of random numbers are not correlated, the observed correlations are due to the correlation induced by the experiment and to random variations.

Two C programs were written for this correlation study. Both programs are included in Appendix D. Table 3.3 displays the results of examining 1000 randomly generated pairs of standard normal deviates.

The data reveal that the correlation between the 1000 pairs of points is zero. If the larger sample sizes yielded correlations other than those close to zero, it would indicate that the two data streams were correlated. Similarly, the average correlation for smaller sample sizes is also approximately zero. The negligible average correlations for all sample sizes imply that the assumption of independent random numbers is a reasonable one. However, there are observations of higher correlations as sample size decreases, especially when the sample size is 10 or less. The higher correlations with the smaller sample sizes are presumably the result of random chance. Despite these random correlations, average correlation observed for each sample size is approximately zero. Thus, the generated pairs of points appear to be uncorrelated, but relatively high random correlations may occur in actual or simulated data when the sample size is small.

*3.5.1.3 Determination of Sample Size.* The decision to use 10,000 scores for this experiment was based upon the results of confidence interval analysis. The

Table 3.3. X,Y Correlation Analysis

| Range | 5 | 10 | 20 | 50 | 100 | 500 | 1000 |
|---|---|---|---|---|---|---|---|
| (.9,1) | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| (.8,.9) | 6 | 0 | 0 | 0 | 0 | 0 | 0 |
| (.7,.8) | 10 | 2 | 0 | 0 | 0 | 0 | 0 |
| (.6,.7) | 10 | 3 | 0 | 0 | 0 | 0 | 0 |
| (.5,.6) | 12 | 4 | 1 | 0 | 0 | 0 | 0 |
| (.4,.5) | 7 | 5 | 2 | 0 | 0 | 0 | 0 |
| (.3,.4) | 15 | 11 | 4 | 1 | 0 | 0 | 0 |
| (.2,.3) | 14 | 9 | 7 | 3 | 1 | 0 | 0 |
| (.1,.2) | 7 | 11 | 5 | 4 | 2 | 0 | 0 |
| (0,.1) | 17 | 6 | 6 | 2 | 3 | 1 | 1 |
| (-.1,0) | 10 | 8 | 5 | 3 | 1 | 1 | 0 |
| (-.2,-.1) | 15 | 4 | 7 | 2 | 2 | 0 | 0 |
| (-.3,-.2) | 12 | 8 | 6 | 4 | 1 | 0 | 0 |
| (-.4,-.3) | 9 | 14 | 4 | 1 | 0 | 0 | 0 |
| (-.5,-.4) | 12 | 9 | 3 | 0 | 0 | 0 | 0 |
| (-.6,-.5) | 14 | 4 | 0 | 0 | 0 | 0 | 0 |
| (-.7,-.6) | 6 | 2 | 0 | 0 | 0 | 0 | 0 |
| (-.8,-.7) | 10 | 0 | 0 | 0 | 0 | 0 | 0 |
| (-.9,-.8) | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| (-1,-.9) | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mean | -.02 | .00 | .00 | .01 | .01 | .01 | .00 |

reason for using a large sample size was to reduce the variance of the estimates of the mean CEP for a given technique and set of experimental conditions. The experiment would not produce useful results if estimates for the mean CEP had large confidence intervals, which would impair the ability to discriminate between alternative approximation techniques. The following mathematical statements define the lower and upper confidence bounds for the mean CEP estimate.

$$Lowerbound = \overline{CEP} - z_{(1-\alpha/2)} * \sqrt{\frac{\sum_{i=1}^{n}(CEP_i - \overline{CEP})^2}{n(n-1)}} \qquad (3.31)$$

$$Upperbound = \overline{CEP} + z_{(1-\alpha/2)} * \sqrt{\frac{\sum_{i=1}^{n}(CEP_i - \overline{CEP})^2}{n(n-1)}} \qquad (3.32)$$

where

$n$ = number of CEPs in analysis

$CEP_i$ = the CEP for observation $i$

$\overline{CEP}$ = mean CEP

$\alpha$ = level of confidence

$z_{(1-\alpha/2)}$ = the standard normal statistic for half of the confidence level

The lower and upper bounds above define the confidence interval for the estimate of the mean CEP. As the number of CEPs included in the analysis approaches infinity, the lower and upper bounds would converge to the mean CEP. However, to conduct this experiment on the available computer within reasonable time limits, a finite number of CEPs had to be chosen. Obviously, the sample size had to be small enough for the computer to handle, but large enough to generate acceptable confidence intervals. An examination of the confidence interval half-width provided the basis to strike a compromise between sample size and precision. Half-width for the mean CEP is defined in equation (3.33).

$$Half - width = z_{(1-\alpha/2)} * \sqrt{\frac{\sum_{i=1}^{n}(CEP_i - \overline{CEP})^2}{n(n-1)}} \tag{3.33}$$

The half-width is one-half of the confidence interval. A desired objective for this experiment was to use a number of CEPs which made the half-width one foot or less. If this objective could not be attained, then the secondary objective was to use a large enough sample to make the half-width less than one percent of the mean CEP. Since the mean CEP for the ideal case should be around 1000 for each method, the half-width under the secondary objective should be 10 or less.

Table 3.4 lists the mean and half-width of CEP estimates obtained by applying the Grubbs-Patnaik/chi-square method to data sets of varying sample sizes. Notice

Table 3.4. Half-width Analysis

| Sample Size | Half-Width | Mean CEP |
|---|---|---|
| 2000 | 0.853 | 956.24 |
| 4000 | 0.034 | 952.98 |
| 6000 | 0.797 | 955.53 |
| 8000 | 0.739 | 960.90 |
| 10000 | 0.342 | 961.16 |
| 12000 | 0.174 | 960.60 |
| 14000 | 0.161 | 963.26 |
| 16000 | 0.097 | 958.95 |
| 18000 | 0.364 | 958.19 |
| 20000 | 0.056 | 958.95 |

in Table 3.4 that the half-width is less than one for each of the sample sizes listed. Figure 3.1 shows a plot of the half-width as a function of sample size. Since the primary goal was to determine the sample size where half-width is less than one foot, the goal could likely be attained with a sample size of 2,000 or more.

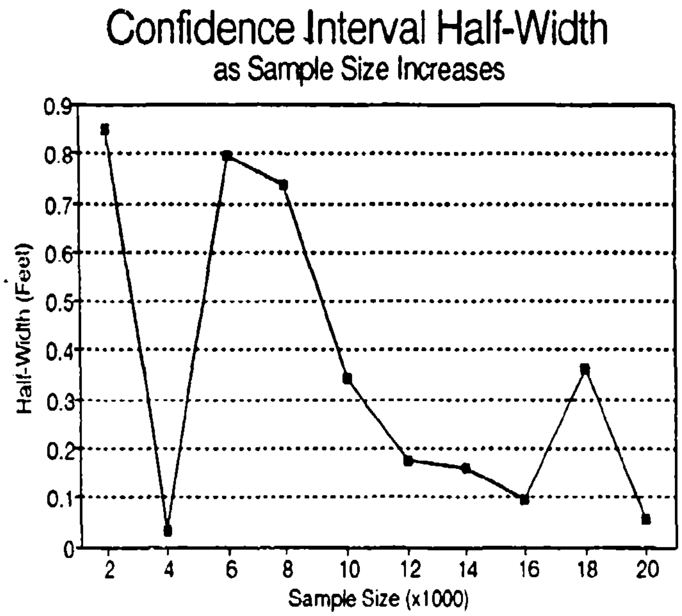


Figure 3.1. Half-width as a Function of Sample Size

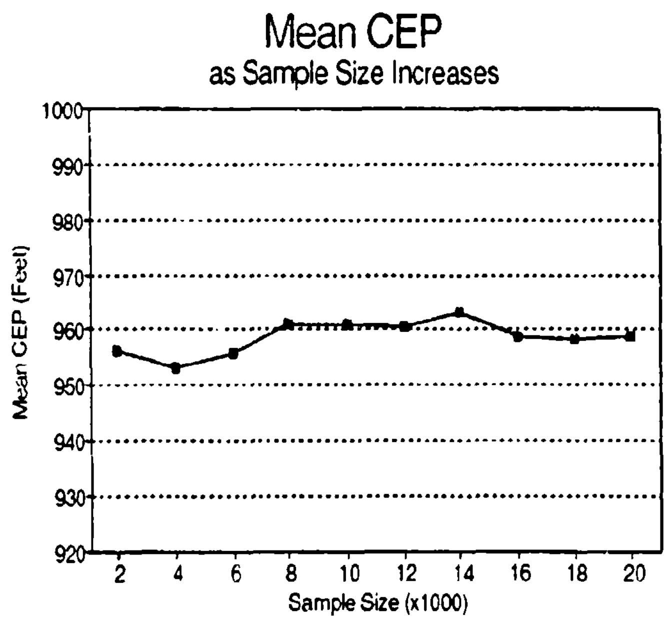


Figure 3.2. Mean CEP as a Function of Sample Size

The plot of this data in Figure 3.2 reveals that the mean CEP estimates do not vary much as sample size increases. In fact, beyond a sample size of 8,000, there is little change in the mean CEP estimates. From the data in Table 3.4, Figure 3.1, and Figure 3.2, it appeared that a sample size of 10,000 (x,y)-scores should be adequate to conduct the experiment. The mean CEP estimates are stable and the 95 percent confidence interval is within less than one-tenth of one percent of the mean CEP.

*3.5.2 Method of Data Collection.* The computer programs used to generate the data for this experiment are listed in Appendix B. They yielded mean CEP and relative error values for each approximation technique at each design point. Tables of these results are provided in Appendices E and F.

# *IV. Analysis and Discussion of Results*

## *4.1 Results*

The results of the experiment are listed in Appendices E, F, and G. Appendix E lists the CEP estimates produced by each method for each of the 875 test points. The relative errors of these estimates are included in Appendix F. Multiplying the relative errors by 100 would give the percent deviation from the CEP calculated by the *exact* method. Appendix G compares the estimates at each test point by assigning a letter grade to each of them. These grades indicate the magnitude of the relative error associated with each estimate. The grades progress from "A" to "G", with "A" representing the least relative error and "G" representing the largest relative error.

*4.1.1 Statistical Summary.* Table 4.1 summarizes some of the sample statistics for the absolute values of the relative errors listed in Appendix F. It lists the

Table 4.1. Sample Statistics of Absolute Relative Errors

| Method | Mean | Std Dev | Min | Max | Range |
|---|---|---|---|---|---|
| Grubbs | 0.061 | 0.054 | 0.000 | 0.346 | 0.346 |
| Rand | 0.132 | 0.065 | 0.010 | 0.291 | 0.281 |
| Eth | 0.133 | 0.066 | 0.002 | 0.324 | 0.322 |
| CEP3 | 0.038 | 0.031 | 0.000 | 0.117 | 0.117 |

mean, standard deviation, minimum, maximum, and corresponding range of the absolute values of the relative errors for each method. Absolute values were used in the table because the magnitude of the relative error, rather than its sign, was of interest. Based on the absolute value of the minimum and maximum values, the Grubbs method has errors as great as 34.6%; the Rand method, 29.1%; the Ethridge method, 32.4%; and the CEP3 method, 11.7%. The standard deviations of the absolute values of the relative errors are comparable, but the means are noticeably different. The CEP3 method has a mean absolute relative error of 3.8%; Grubbs, 6.1%; Rand, 13.2%; and Ethridge, 13.3%. The information in Table 4.1 is not conclusive in any particular matter; but, the relatively small means of the CEP3 and Grubbs methods tend to indicate a possible overall dominance over the other two methods in the parameter space of this test.

*4.1.2 Frequency Summaries.* The following two tables and corresponding figures summarize the important data listed in Appendix G. Table 4.2 and Figure 4.1 show the frequency that each method ranked first, second, third, and fourth in terms of lowest relative error for each of the 875 test points. Although every method is the best for some of the test points, either the CEP3 or Grubbs method is best for most of them.

Table 4.2. Frequencies of Rankings

| Method | First | Second | Third | Fourth |
|---|---|---|---|---|
| Grubbs | 265 | 371 | 164 | 75 |
| Rand | 37 | 81 | 374 | 383 |
| Eth | 27 | 131 | 300 | 417 |
| CEP3 | 546 | 292 | 37 | 0 |

Table 4.3 and Figure 4.2 summarize the quality of the 875 CEP estimates for each method. As mentioned earlier, the letter grades correspond to the magnitude of the relative errors. A grade of "A" represents the smallest relative errors and "G" the largest.

The data reveals that all of the methods yield "A" quality estimates for some test points. Furthermore, the CEP3 and Grubbs methods produce more estimates with less than 10% relative error and fewer with greater than 10% relative error than the other two methods. Thus, the CEP3 and Grubbs methods are generally superior to the other two in terms of the ranking and quality of their estimates.

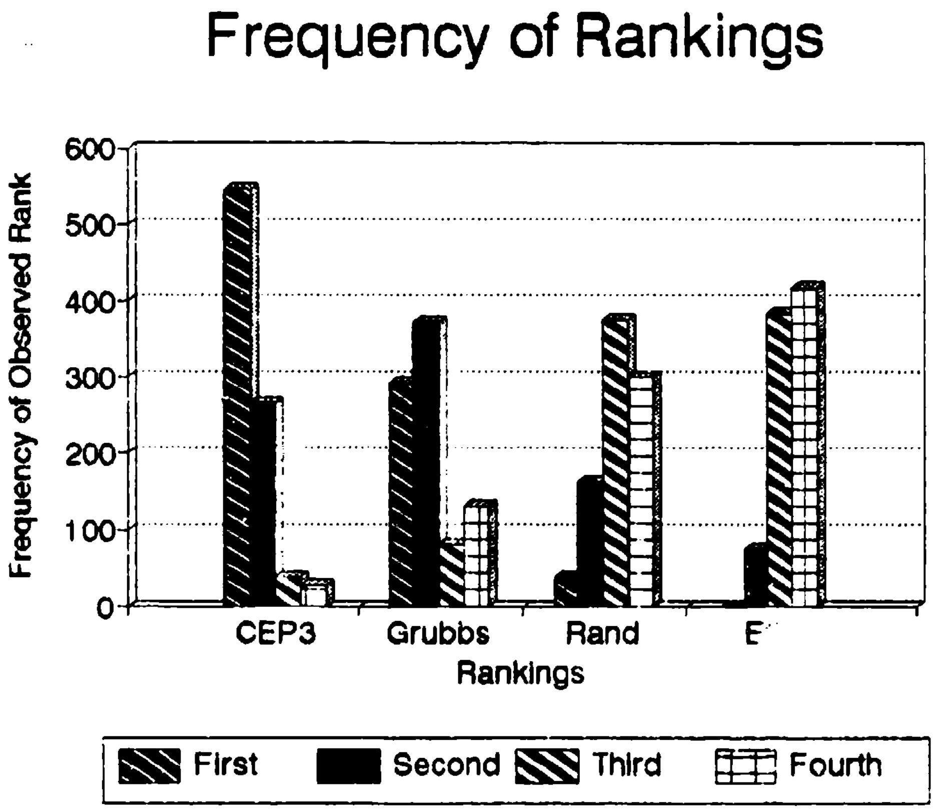


Figure 4.1. Frequencies of Rankings

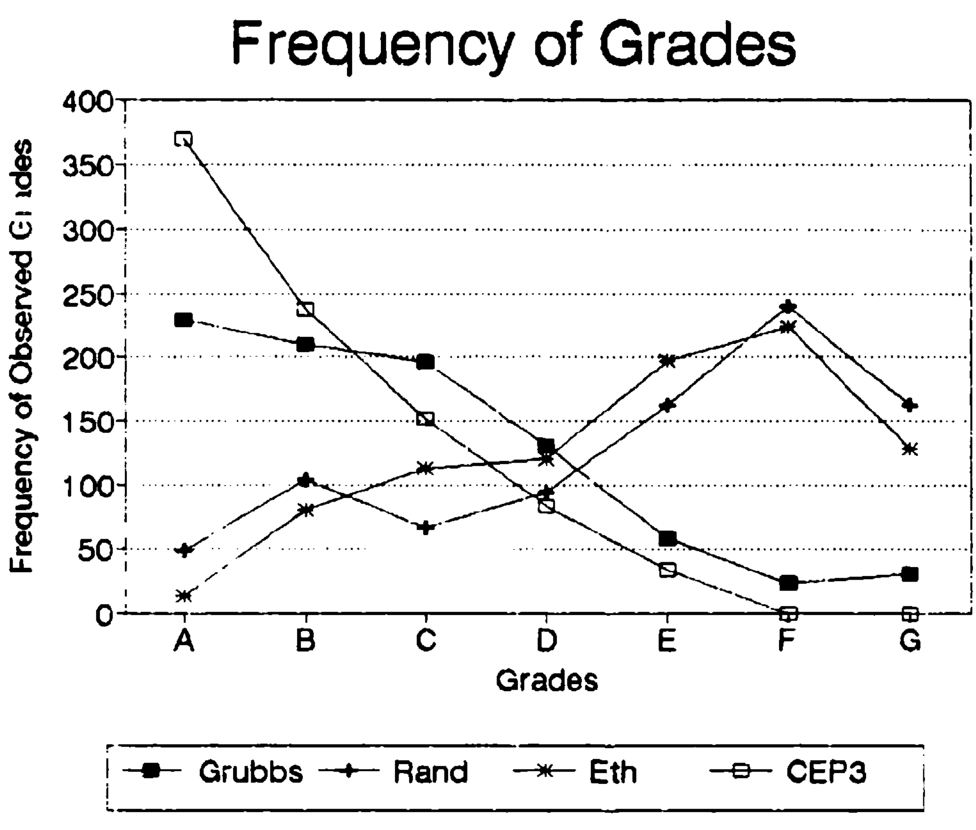


Figure 4.2. Frequency of Grades

Table 4.3. Frequency of Grades

| Grade | Relative Error Range | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|
| A | 0% → 2.5% | 229 | 49 | 14 | 370 |
| B | 2.5% → 5% | 209 | 103 | 80 | 237 |
| C | 5% → 7.5% | 196 | 66 | 113 | 151 |
| D | 7.5% → 10% | 130 | 93 | 120 | 83 |
| E | 10% → 15% | 58 | 162 | 197 | 34 |
| F | 15% → 20% | 23 | 240 | 223 | 0 |
| G | 20% → 40% | 30 | 162 | 128 | 0 |

*4.1.3 SAS Results.* SAS is the statistical software package that was used to analyze the relative errors of each method [12]. The goal of the SAS analysis was to determine the sensitivities of each of the methods to sample size, bias, ellipticity, and correlation.

The first statistic of interest is the Pearson Correlation Coefficient. This correlation coefficient ranges from minus one to plus one. If the value of the coefficient is near zero, it indicates little or no linear relationship between two parameters. If the value of the coefficient is near plus or minus one, it indicates a strong linear relationship between two parameters. Table 4.4 summarizes the Pearson correlation coefficients for each of the method's relative errors versus the four parameters of sample size, bias, ellipticity, and correlation. Table 4.4 shows that sample size has

Table 4.4. SAS Pearson Correlation Coefficients

| Method | Sample Size | Bias | Ellip | Corr |
|---|---|---|---|---|
| Grubbs | -0.174 | -0.315 | -0.388 | -0.329 |
| Rand | -0.138 | 0.872 | -0.166 | 0.037 |
| Eth | -0.749 | -0.152 | 0.394 | -0.317 |
| CEP3 | 0.001 | -0.567 | 0.150 | -0.567 |

no relationship with the relative errors from CEP3, and that correlation has a very small relationship with the relative errors from the Rand method. On the other hand, there is a stong relationship between bias and the relative errors from the Rand method, and between sample size and the relative errors from the Ethridge method. One last important point to note about the correlation analysis that is not listed in Table 4.4 is that the correlation coefficients between each of the parameters are zero for all four methods. This zero correlation between the parameters means that covariance is zero and, therefore, does not have to be addressed.

The next SAS statistics of interest are the Type I and Type II sums of squares. The model sums of squares are broken down into the sums of squares that each parameter contributes to it. The Type I sums of squares are the extra sums of squares that each parameter adds to the model sums of squares given that the previously listed parameters are already in the model. Since there is no correlation between any of the parameters, the order that the parameters are listed does not affect the Type I sums of squares.

The Type II sums of squares are the partial sums of squares that a parameter contributes to the model sums of squares, given that all of the other parameters are in the model. Since there is no correlation between the parameters, the partial sums of squares for each parameter are not dependent on which parameters are already in the model. Having zero correlation between the parameters means that the Type I and Type II listings of the sums of squares are equal. Since the Type I and Type II sums of squares are the same for the analysis, only Type I sums of squares will be given in Table 4.5. The important point to note about Table 4.5 is that within each

Table 4.5. Type I Sums of Squares

| Method | Sample Size | Bias | Ellip | Corr |
|---|---|---|---|---|
| Grubbs | 0.100 | 0.330 | 0.499 | 0.359 |
| Rand | 0.071 | 2.849 | 0.104 | 0.005 |
| Eth | 2.150 | 0.089 | 0.594 | 0.386 |
| CEP3 | 0.000 | 0.513 | 0.036 | 0.512 |

row, some numbers are noticeably larger than the others. The larger numbers in each row indicate the corresponding parameters that explain a substantial degree of the variation in the model's predicted response. For example, the level of bias in the data is the predominant factor for the Rand method. On the other hand, the Ethridge estimator appears to be most sensitive to sample size.

The next operation SAS performed was a stepwise regression study to determine which parameters were significant at the 0.01 level. Table 4.6 shows that all

Table 4.6. Stepwise Regression Summary

| Method | Sample Size | Bias | Ellip | Corr |
|---|---|---|---|---|
| Grubbs | YES | YES | YES | YES |
| Rand | YES | YES | YES | NO |
| Eth | YES | YES | YES | YES |
| CEP3 | NO | YES | YES | YES |

the parameters are significant in the regression models except sample size for CEP3 and correlation for Rand.

The final SAS statistic of interest is the model $R^2$ value, given that the parameters are included as shown in Table 4.6. The model $R^2$ values listed in Table 4.7 represent the percent of the total variation accounted for by the parameters in the

Table 4.7. Model Correlation Coefficients

| Method | Model $R^2$ |
|---|---|
| Grubbs | 0.3883 |
| Rand | 0.8071 |
| Eth | 0.8406 |
| CEP3 | 0.6664 |

model. Note that the $R^2$ values given here represent the ratio of the model sums of squares to the total sums of squares uncorrected for the mean. A low $R^2$, such as 0.3883 for the Grubbs method indicates that over 60% of the variation in the total model is due to randomness, assuming that the regression model is linear. Even with four significant parameters in the Grubbs regression, the overall model explains 38.83% of the total variation in the observed response. This low percentage indicates a lack of sensitivity of the Grubbs method to systematic changes in the four parameters. The CEP3 model explains 66.64% of the total variation, which indicates a moderate sensitivity to changes in its three significant parameters. Both the Rand and Ethridge models explain over 80% of the total variation in their corresponding responses, which indicates a strong sensitivity of their relative errors to changes in at least one of the parameters.

*4.1.4 Summary of Results.* Examining the data in Appendices E, F, and G revealed that the relative errors of the CEP3 and Grubbs methods are usually less than 10% and are consistently lower than those of the Rand and Ethridge estimators. However, each method is the best in some parameter region, and no method totally dominates the others. Each method also exhibits differing levels of sensitivity to changes in the four parameters. The Rand method is very sensitive to changes in bias, while the Ethridge method is very sensitive to changes in sample size. The CEP3 method is equally sensitive to changes in bias and correlation, and the Grubbs method is not particularly sensitive to changes in any of the parameters.

### *4.2 General Trends*

Appendix G lists the best CEP method for each parameter region. Overall, the CEP3 method is the best 546 times, and the Grubbs method is the best 265 times for a combined total of the two methods being the best for 811 out of the 875 test points. In general, bias was the most significant parameter affecting which method was the best. For bias settings of 0, .25, .5, .75, and 1, the CEP3 method was usually the best regardless of the other parameter settings. For the bias setting of 1.5, both CEP3 and Grubbs were always the best, but neither dominated the other. For the bias setting of 2, the Grubbs method was usually the best regardless of the other parameter settings. The following sections discuss the general trends of each method.

*4.2.1 CEP3.* The CEP3 method ranked first or second 838 times out of the 875 test points. Of its 875 relative errors, 607 were less than 5%. Figure 4.3 shows some of the relative errors as a function of the annotated parameter settings. The figure highlights the methods's sensitivity to bias. The top portion of Figure 4.3 shows an interaction between bias and correlation. The effect of correlation is different at different levels of bias. Comparing the top and bottom portions of Figure 4.3 indicates an interaction between ellipticity and correlation. Correlation has a different effect based on the level of ellipticity. When bias is 0, .25, .5, .75, or 1, the relative errors are less than 5% for all other parameter settings except for when ellipticity is .2 or .4. When bias is 1.5 or 2, the relative errors are all greater than 5% for all parameter settings except when ellipticity equals one. In general, the CEP3 method is insensitive and accurate for all parameter settings given that bias is 0, .25, .5, .75, or 1.

*4.2.2 Grubbs.* The Grubbs method ranked first or second 636 times out of the 875 test points. Of its 875 relative errors, 438 were less than 5%. Figures 4.4 to 4.7 show some of the relative errors as a function of the annotated parameter settings. Figures 4.4 and 4.5 reveal that the Grubbs method is more accurate for larger values of bias. A comparison of the two figures reveals that the Grubbs method performs better with large sample sizes. Examining Figure 4.4 alone also indicates that the Grubbs method is more accurate for larger values of ellipticity, that is, a more circular distribution, when sample size is small. Figures 4.6 and 4.7 both show that the method is more accurate for higher levels of correlation. Comparing Figures 4.6 and 4.7 implies, once again, that the Grubbs method performs better with larger sample sizes. Examining Figures 4.4 to 4.7 indicates that a number of interaction terms such as correlation and bias may be significant. The Grubbs

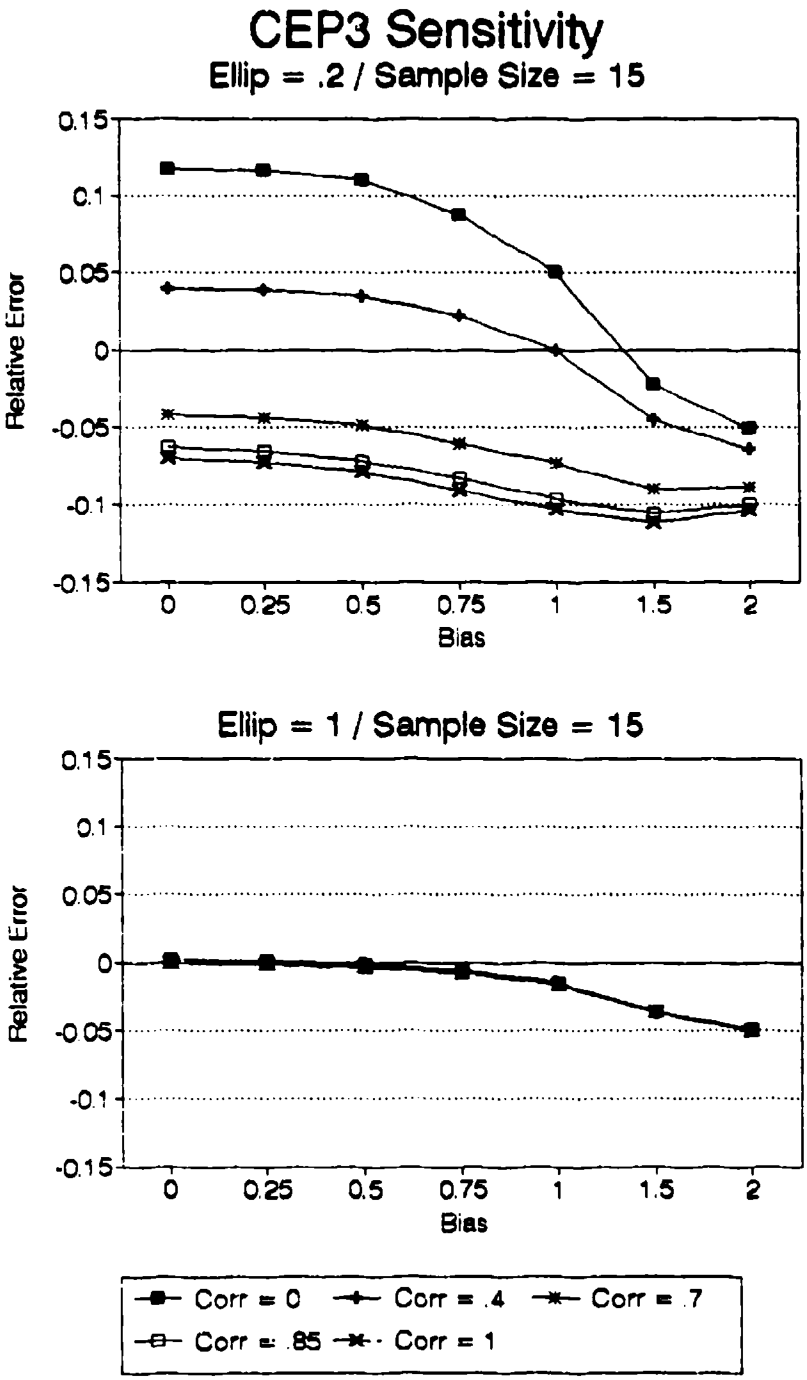


Figure 4.3. CEP3 Sensitivity Analysis

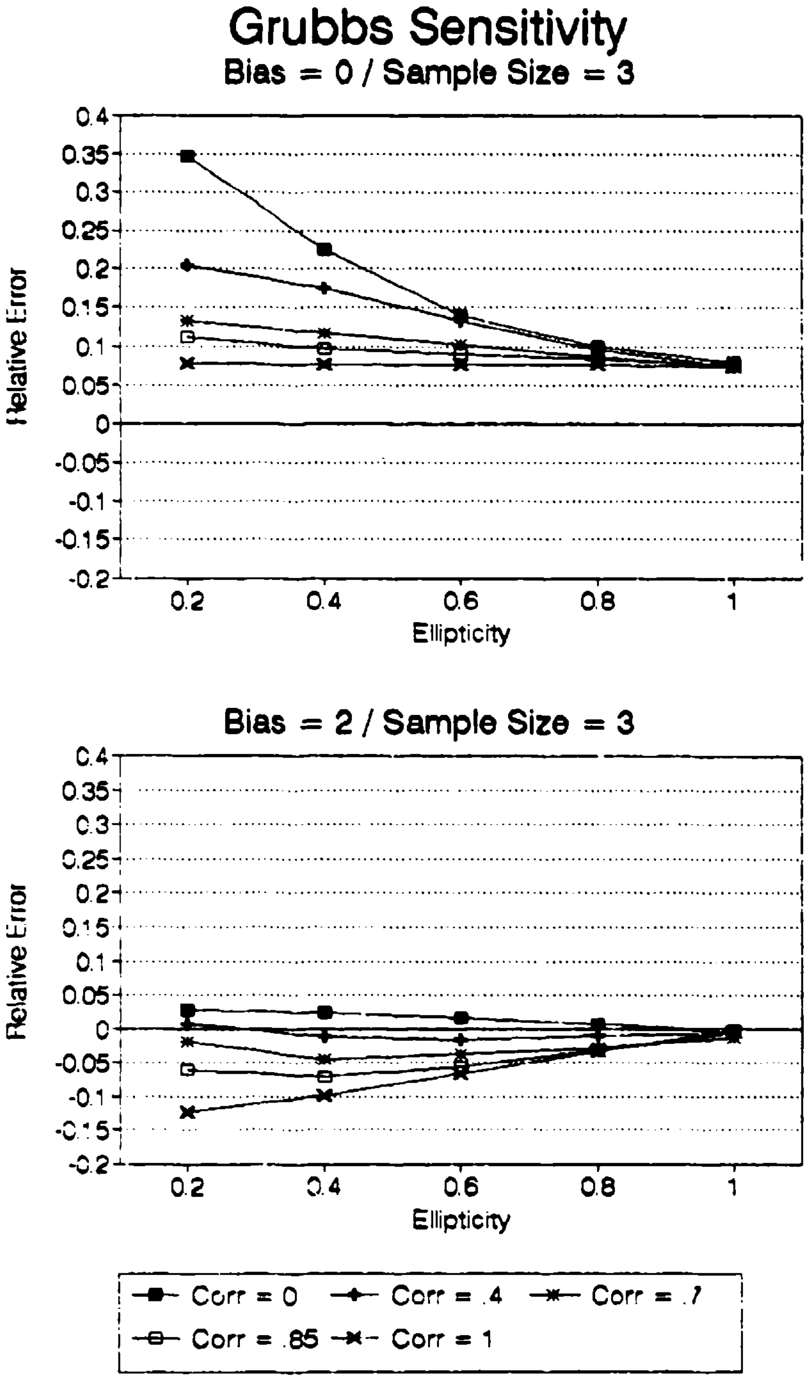


Figure 4.4. Grubbs Sensitivity Analysis - Part 1

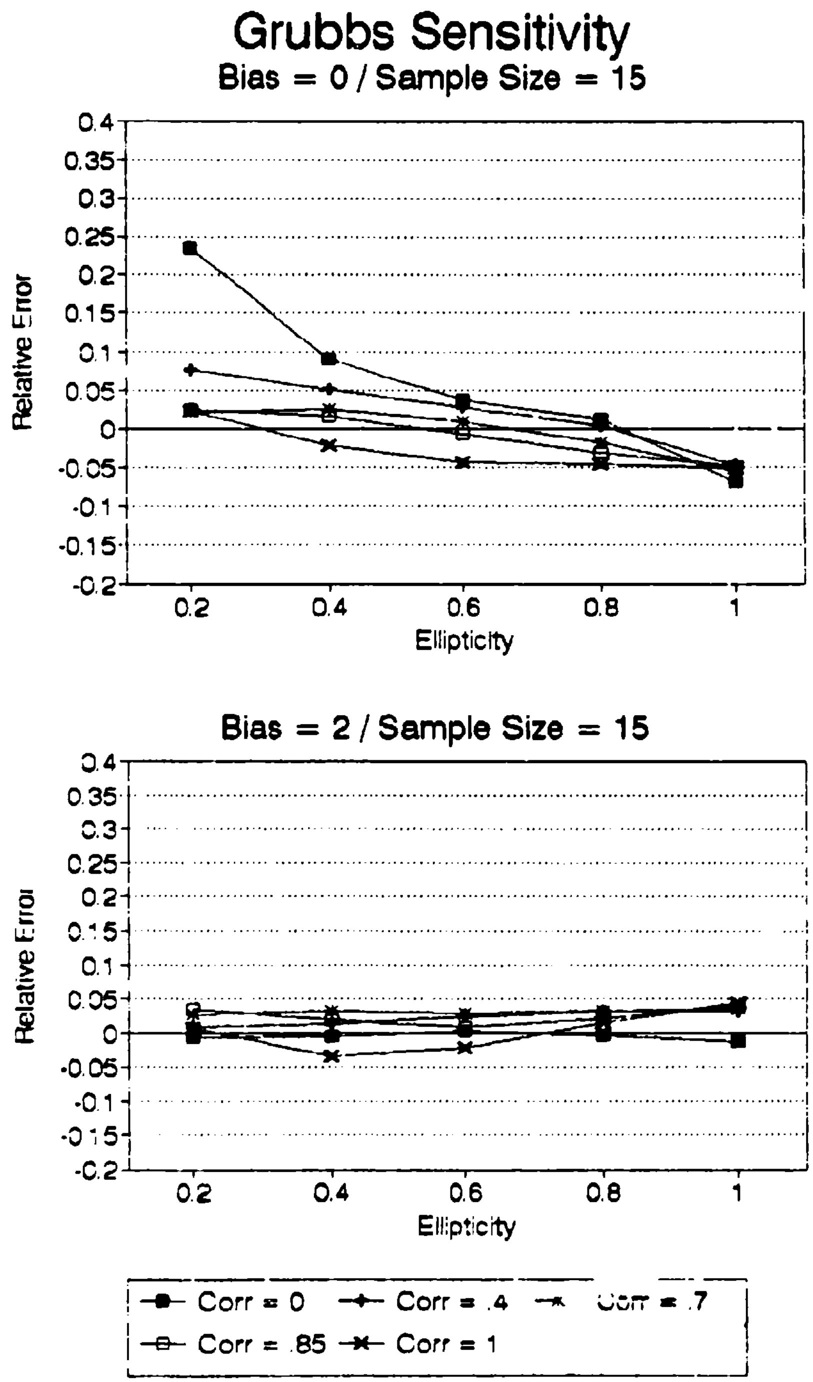


Figure 4.5. Grubbs Sensitivity Analysis - Part 2

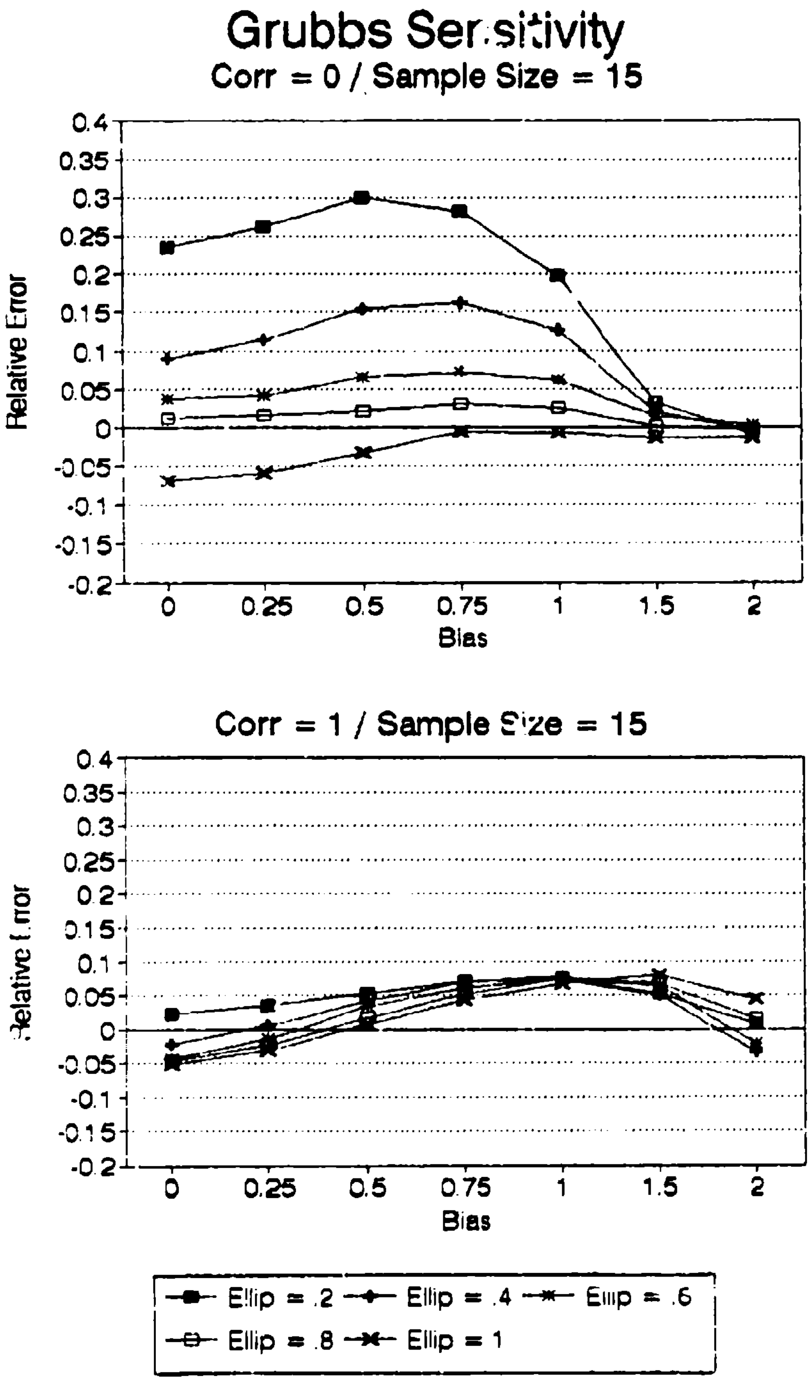


Figure 4.6. Grubbs Sensitivity Analysis - Part 3

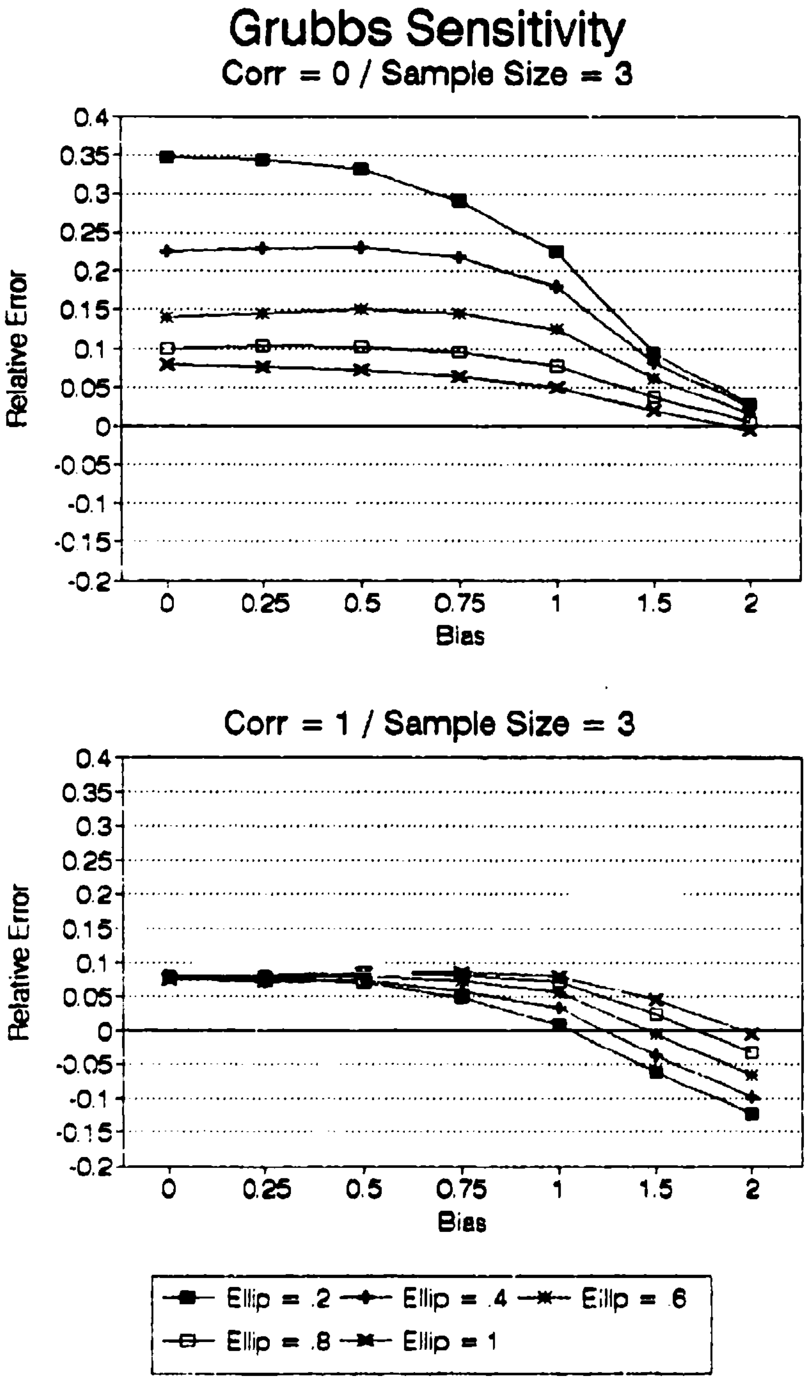


Figure 4.7. Grubbs Sensitivity Analysis - Part 4

method is most accurate when correlation is near 1, sample size is near 15, and bias is near 2.

*4.2.3 Rand.* The Rand method ranked first or second 118 times out of the 875 test points. Of its 875 relative errors, 152 were less than 5%. Figure 4.8 shows some of the relative errors as a function of the annotated parameter settings. The figure highlights this method's sensitivity to bias. The method is accurate in the parameter regions of low bias and large sample size; specifically, when bias is 0, .25, and .5, and when sample size is 10 and 15. The parameter values of ellipticity and correlation have a negligible influence on the relative errors produced by this method. The method is not generally accurate in any other parameter region.

*4.2.4 Ethridge.* The Ethridge method ranked first or second 158 times for the 875 test points. Of its 875 relative errors, 94 were less than 5%. Figures 4.9 and 4.10 show some of the relative errors as a function of the annotated parameter settings. The figures highlight this method's sensitivity to sample size and ellipticity. In general, this method has small relative errors and appears to be unbiased only when sample size is three or five, ellipticity is close to one, bias is close to zero, and correlation is close to zero.

### *4.3 Problems Encountered*

Several problems surfaced during this experiment. Some of these problems were minor and others were fundamental to impacting the success of the experiment. Each of these problems is addressed below.

*4.3.1 Random Number Generator* This experiment used random numbers from the SLAM II simulation package. An earlier attempt was made to produce a portable personal computer based random number generator. The portable random number generator would have freed this experiment from any necessity to use the

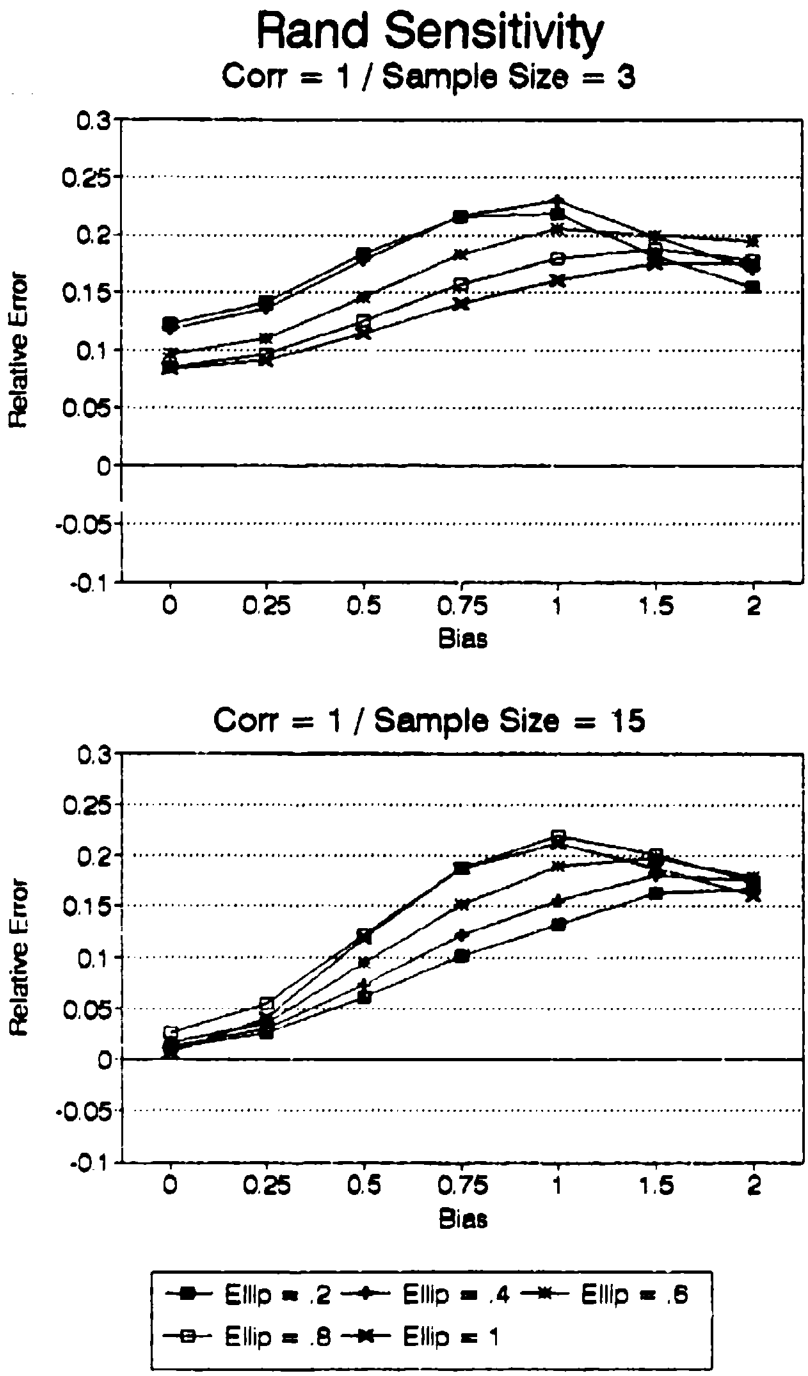


Figure 4.8. Rand Sensitivity Analysis

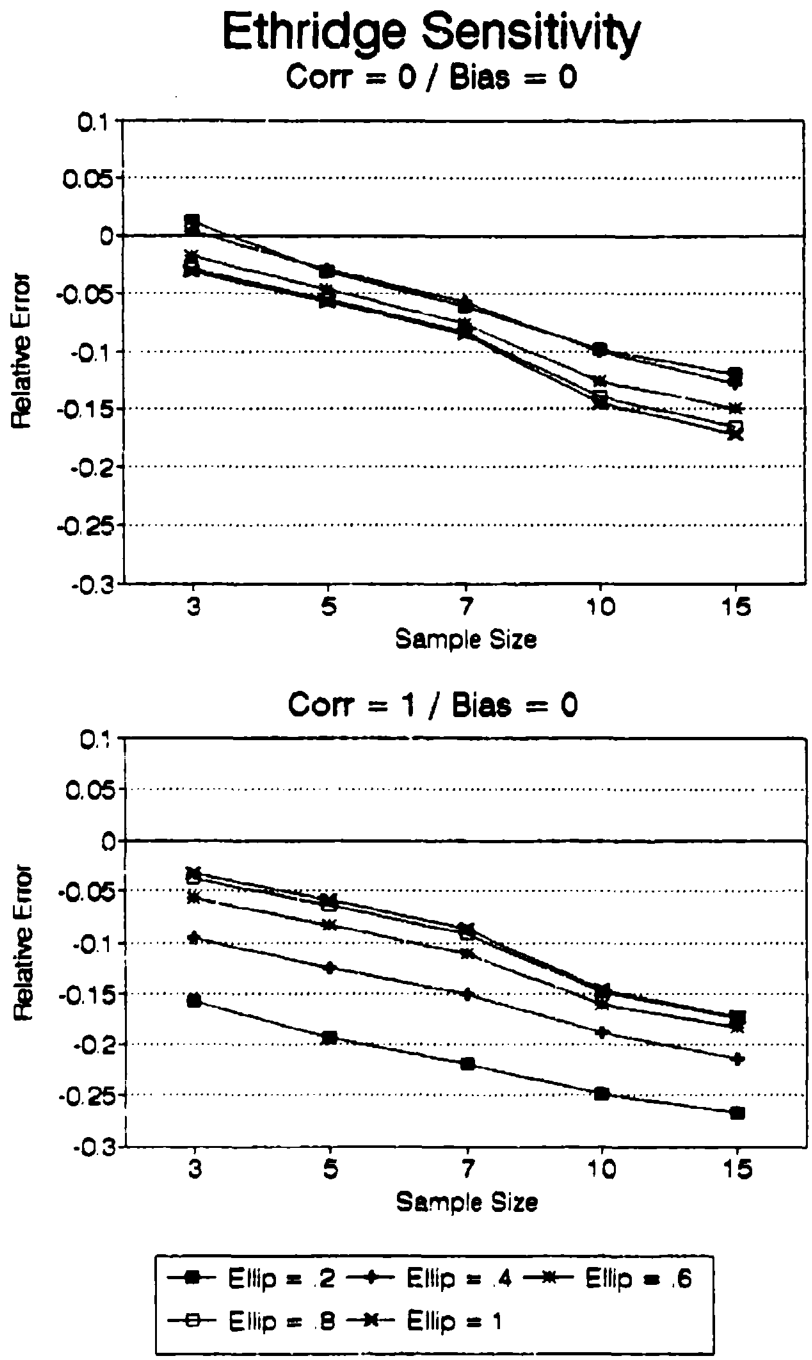


Figure 4.9. Ethridge Sensitivity Analysis - Part 1

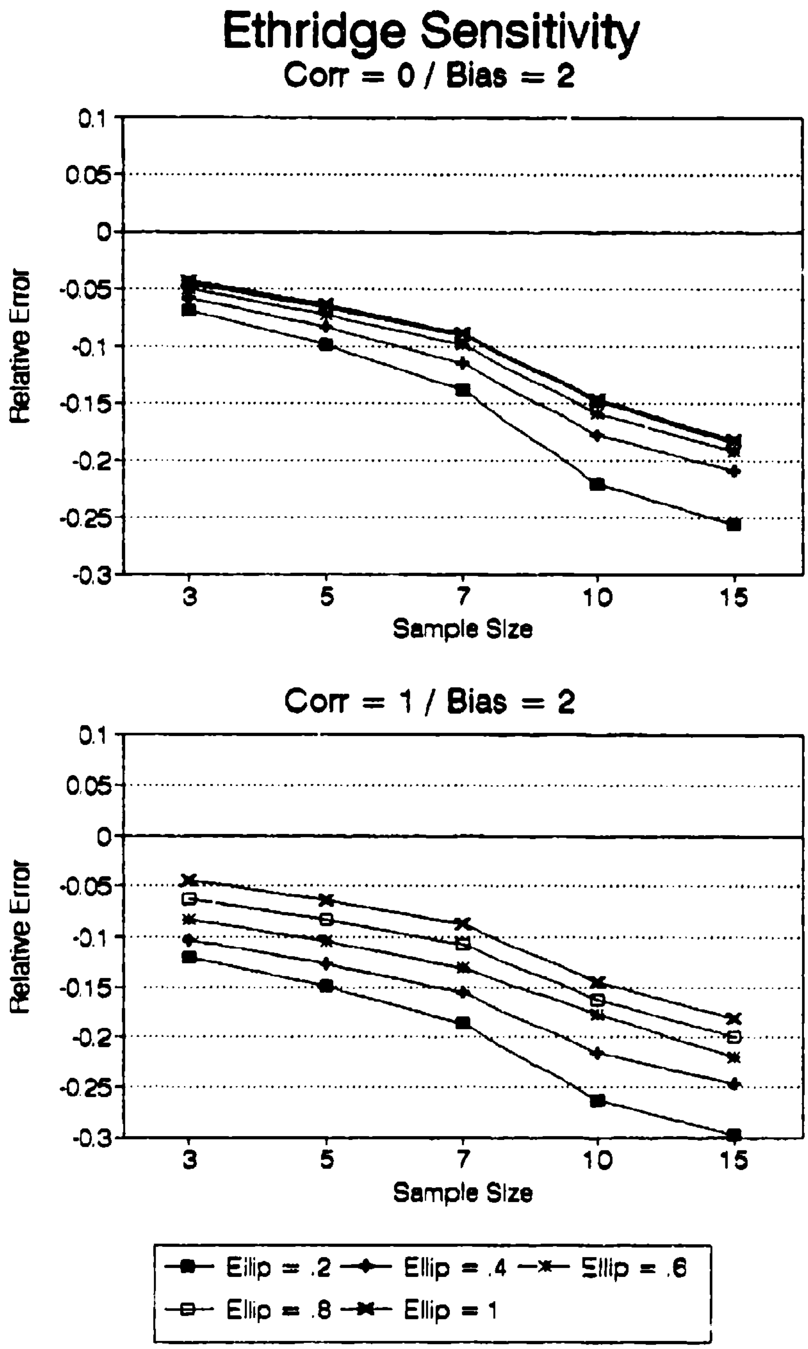


Figure 4.10. Ethridge Sensitivity Analysis - Part 2

larger mini or mainframe computers. A random number generator was written in the C programming language on the author's personal computer. During the verification and validation process, it was found that the variates produced by the random number generator did not represent the distributions which they were trying to simulate. This attempt was abandoned and the SLAM II random number generator was adopted.

*4.3.2 Shortcomings of the Infinite Series Expansion Method.* One problem was encountered while implementing this method concerning the determination of the summation limits of $j$ and $k$ in equation (3.9). Since the summation limits of $j$ and $k$ are theoretically $+\infty$, the computer implementation required the specification of limits to stop the summations when a tolerance limit was reached. For most test points, 10 was an adequate limit. Certain mixes of parameter values such as ellipticities of .4 or .2 coupled with a correlation of zero, required higher limits of $j$ and $k$. This mix of ellipticities and correlation for biases of one or less required $j$ and $k$ to be set to 40. As bias increased to two, the required limits of $j$ and $k$ were as high as 90 for the mix of ellipticity less than .4 and correlation of zero.

Previous research suggested that the infinite series method produces inaccurate results or fails to converge for ellipticity values of .2 or less [2:4-7]. Consequently, all of the results were verified with the MathCAD mathematical software package [7] on a SUN computer at the Air Force Institute of Technology. MathCAD provided the ability to numerically integrate the functional form of the bivariate normal density function directly. There were no convergence problems with MathCAD, and all answers were calculated in 15 seconds of less. The results from MathCAD were identical to the results of the infinite series expansion method for values of ellipticity of .2, .4, .6, .8, and 1.

*4.3.3 Grubbs Method.* One problem was encountered while implementing the Grubbs method. This problem involved equation (3.15) and its impact on equations

(3.13) and (3.17). The value of $v$ must be positive or else it would cause a negative value within the square root of equation (3.13), and a negative number of degrees of freedom in equation (3.17). There were a few test scores which produced large negative values for $\bar{y}$ in equation (3.15). The large negative $\bar{y}$'s caused $v$ to be negative, resulting in computer errors. Computer code was added to check for negative values of $v$, and to reverse the sign when this condition was found. This code solved the problem, but further research should look into the shortcoming of the model in this area, and whether there is any significant impact on the accuracy of this model caused by the reversal of the sign of $v$ when this condition is encountered.

# V. Conclusions and Recommendations

## 5.1 Conclusions

The objective of this study was to determine the relative errors of the various quick CEP estimation methods under a number of combinations of small sample sizes, bias, ellipticity, and correlation. This study, in essence, computed the points of a coarse grid response surface. This information should provide ICBM accuracy analysts a better understanding of the sensitivities of these methods to different combinations of data characteristics. The analyst can calculate preliminary statistics from the test data, and then use the results of this study to see which CEP method is the best in the given parameter region.

The results of the experiment give both general and specific guidance on choosing which CEP method is best in a given parameter region. In general, although three to four main effects are significant for each method, RE is primarily determined by one or two parameters. With few exceptions, the best method is solely a function of the setting of bias. The CEP3 method is the method of choice when bias is 0, .25, .5, .75, or 1, independent of the values of the other parameters. The Grubbs method is generally the most accurate method for the bias setting of 2 independent of the values of the other parameters. Beyond this general guidance, information was provided to help the analyst see the dynamics of each CEP method to assess their sensitivities to different combinations of parameter settings. Several plots were shown to observe the interaction effects of the parameters. Since there are some parameter regions where the general rule concerning bias does not hold, evaluating RE at different combinations of parameter levels is important to be certain that the best method is chosen for the given test data.

Overall, the CEP3 and Grubbs methods are superior to the other two methods. In the few cases where the Rand and Ethridge methods were the best, the CEP3 or

Grubbs methods were almost as good. All of the resultant data from the experiment are listed in the appendices as a resource for the analyst. A more detailed analysis of the performance of the CEP methods in a given parameter region can be performed as desired.

An important issue regarding the general objective of this study dealt with the ability to accurately estimate CEP for small sample sizes. The sample sizes of 3, 5, 7, 10, and 15 were thoroughly analyzed as one of the parameters of the experiment. Both the CEP3 and the Grubbs methods performed very well for each of the sample sizes, given the levels of bias specified for each method.

The graphical analysis of the accuracy of the CEP approximation methods revealed the possible existence of significant two-factor interactions among the four parameters considered. Thus, the models based on only the four main effects may be somewhat deficient and the corresponding $R^2$ values misleading. Developing more suitable models using two-factor and possibly three-factor interactions could possibly result in adequate metamodels of RE for each of the methods considered.

This study represents the first evaluation of the Ethridge estimator. Except for the nominal parameter settings of small sample size, low bias, low correlation, and a nearly circular data distribution, it appears to have a significant negative bias. Its use for approximately normally distributed downrange and crossrange miss-distance data does not seem to be warranted. Further research of its application as a robust estimator remains to be done.

## 5.2 *Recommendations*

Within the parameter regions of this study, the best method for a given set of data was determined to be a function of the value of bias. When bias equals 0, .25, .5, .75, or 1, the CEP3 method should be chosen. When bias equals 2, the Grubbs method should be chosen. Further research should look into refining the coarse grid response surface for bias values between 1 and 2 since this is the region where the best method transitions from CEP3 to Grubbs.

This study focused on the least biased estimator. Another study could examine a response surface of the mean square error of the relative errors to account for the variability in the estimates as well as the mean. Knowledge of both the mean and variance of the relative errors could further assist ICBM analysts in choosing which method is most appropriate for a given set of test data.

As computer technology advances, the ICBM accuracy analysts continue to gain new methods to improve the quality of their work. In the past, the quick CEP methods were used to provide timely and accurate CEP estimates so that the time-consuming process of integrating the bivariate normal distribution by the numerical integration methods could be avoided. This study compared the results of the *exact* method with the results of MathCAD as part of the validation process. It was found that the results of the two methods were identical. Future work in ICBM accuracy analysis could exploit the mathematical software available today, such as MathCAD or Mathematica. The quick CEP estimation methods are still important because of their convenience and ease of use. The importance of the new mathematical software could also be in the area of future studies that require accurate numerical integration of the bivariate normal density function. These math packages could supplement or replace the *exact* method as the new benchmark method.

If the *exact* method is to be used in the future, two important issues should be taken into account. First, this method required several hours to calculate one CEP when the data characteristics were highly elliptical, highly biased, and uncorrelated. The *exact* method should be programmed on a mainframe computer to reduce the time consumed by the process of obtaining the *exact* CEP estimates.

The second issue concerning the *exact* method is the summation limits of the infinite series expansions. Any computer program implementing this method must be dynamically flexible in determining when to stop the summations. If the limits are too small, the CEPs will be overestimated. If the limits are too large, the program might terminate with a floating point error. For highly elliptical, uncorrelated data with biases greater than 2, the author's computer could not accommodate the required summation limits of 90 or more. A more powerful computer should be used to attain the *exact* CEP estimates for cases when ellipticity is .4 or less.

If further research is to be done on the quick CEP methods, a personal computer based random number generator should be either developed or acquired. A random number generator of this nature will free the researcher from a dependency on mainframe computers for this capability. This is a matter of personal preference and convenience, but highly recommended.

This study assumed that the underlying distribution of the crossrange and downrange miss distances followed a bivariate normal density function. Further research could be done assuming nonnormal miss-distance data. Such studies should focus on nonparametric or robust estimators. The Ethridge estimator did not perform well in this experiment, but, as a robust estimator, it may perform best when the assumption of normality is violated.

# Appendix A. *Random Number Generator*

## *A.1 The Programs*

The 10,000 (x,y)-scores were taken from the SLAM II simulation language package. The extraction of the data required two programs. The first program is the SLAM II network flow program. It was written in such a way that two activities each require a service time with a distribution that is normally distributed with a mean of zero and a standard deviation of one. The second program is a FORTRAN program that records the service times of the two activities and outputs these times to data files. Each of the two activities has its own data file. One file will be used for the crossrange miss scores, and the other file will be used for the downrange miss scores. The respective two files in the program below are called X.DAT and Y.DAT. The SLAM II and FORTRAN programs are listed below.

### *A.1.1 SLAM II Network Program*

```
GEN,PUHEK,CEP,1/24/92,1,,N,,N,,72;
LIMITS,1,2,100;
;
NETWORK;
;
       CREATE,5.,0.;
       ACT/1,USERF(1),,Q1;
Q1     QUEUE(1),0;
       ACT/2,USERF(2),,T1;
T1     TERM,10000;
;
       END;
;
FIN;
```

### *A.1.2 FORTRAN Program*

```
       PROGRAM CEP
       DIMENSION NSET(5000)
```

```
      COMMON/SCOM1/ATRIB(100),DD(100),DDL(100),DTNOW,
     1II,MFA,MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,
     2NTAPE,SS(100),SSL(100),TNEXT,TNOW,XX(100)
      COMMON QSET(5000)
      EQUIVALENCE(NSET(1),QSET(1))
      NNSET=5000
      NCRDR=5
      NPRNT=6
      NTAPE=7
      OPEN(UNIT=8,FILE-'X.DAT',STATUS='NEW')
      OPEN(UNIT=9,FILE='Y.DAT',STATUS='NEW')
      CALL SLAM
      CLOSE(8)
      CLOSE(9)
      STOP
      END

C
C   THIS USERF FUNCTION EXTRACTS RANDOM NUMBERS
C
      FUNCTION USERF(I)
      GO TO (1,2) I
1     USERF = RNORM(0.,1.,1)
      WRITE(8,1000) USERF
      RETURN
2     USERF = RNORM(0.,1.,2)
      WRITE(9,1000) USERF
      RETURN
1000  FORMAT(1X,F8.4)
      END
```

# Appendix B. *C Programs*

## *B.1 Programs*

The following C programs process the 10,000 (x,y)-scores so that the final output is a list of the CEP estimates from the five methods. This appendix guides the interested reader through the process.

*B.1.1 Data Integration.* The first program is called "xy.c". The input to this file are the two data files from SLAM II called "x.dat" and "y.dat". The data in these files are still in their standard normal form with a mean of zero and a standard deviation of one. This program reads in data from "x.dat" as the crossrange error scores and the "y.dat" as the downrange error scores. The two files are merged into one file called "xy.dat" which has the crossrange scores in the left column and the downrange scores in the right column.

The study assumes that the CEP of interest is 1000 feet. If the bivariate normal density function is to have a CEP of 1000 feet, its standard deviation must be 1000/1.1774 or 849 feet. Since the data files contain standard normal values, each datum is multiplied by 849 to reflect a distribution whose CEP is 1000 feet. The program is listed as follows:

```
/* xy.c */

/* This program generates the (X,Y) scores.  */

#include <stdio.h>
#include <math.h>

#define N 10000               /* N is number of (X,Y) points */

main()
{
```

```
   FILE *inx,*iny,*outxy;     /* pointer for output file */
   int i;                     /* counter variables */
   float x,y;                 /* the (X,Y) miss point */
   float sigx,sigy;           /* standard deviations for x and y */

/* open external files */
   inx = fopen("x.dat", "r");
   iny = fopen("y.dat", "r");
   outxy = fopen("xy.dat", "w");

/* calculate the standard deviations for x and y */
   sigy = 1000./1.1774;
   sigx = 1000./1.1774;

   for (i=0;i<N;i++) {
      fscanf(inx, "%f", &x);   /* generate x random normal number */
      fscanf(iny, "%f", &y);   /* generate y random normal number */
      x *= sigx;               /* convert x to a crossrange score */
      y *= sigy;               /* convert y to a downrange score */
      fprintf(outxy,"%8.2f  %8.2f\n",x,y);
   }

   fclose(inx);
   fclose(iny);
   fclose(outxy);

   return;
}
```

*B.1.2 Data Transformation.* The program called "tweak.c" transforms the data in "xy.dat" to reflect the data characteristics of the current test design point. "tweak.c" reads in the values of bias, ellipticity, and correlation from a data file containing a database of the test design point parameter values. After the current parameter values are read in, the proper manipulations are made to the data in "xy.dat". The output file of the transformed data is called "tweak.dat". The program is listed as follows:

```
/* tweak.c */
```

```
/* This program does the data manipulation to the (X,Y) points to
   reflect the proper BIAS, ELLIPTICITY, and CORRELATION */

#include <stdio.h>
#include <math.h>

#define N 10000
#define PI 3.14159265358979323846

main()
{
   FILE *in1,*in2,*out;
   int i,j;
   float bias,theta,rad,ellip,rho,x,y,rotx,roty,m[2][2];

   in1 = fopen("xy.dat", "r");
   in2 = fopen("param.dat", "r");
   out = fopen("tweak.dat", "w");

   fscanf(in2,"%d %f %f %f",&j,&bias,&ellip,&rho);

/* calculate the correlation offset */
   theta = rho*45.;   /* theta expressed in degrees */
   rad = (theta/360.)*2.*PI;   /* theta converted to radians */

/* calculate rotation matrix, m */
   m[0][0] = m[1][1] = cos(rad);
   m[1][0] = -sin(rad);
   m[0][1] = sin(rad);

/* calculate bias */
   bias = bias*849.33;

/* manipulate data */
   for (i=0;i<N;i++) {
      fscanf(in1,"%f %f",&x,&y);
      y += bias;
      x *= ellip;
      rotx = x*m[0][0] + y*m[1][0];
      roty = x*m[0][1] + y*m[1][1];
      x = rotx;
```

```
    y = roty;
    fprintf(out,"%8.2f  %8.2f\n",x,y);
  }

  fclose(in1);
  fclose(in2);
  fclose(out);

  return;
}
```

*B.1.3 CEP Calculations.* The following five programs read in the transformed data from "tweak.dat" and calculate the appropriate CEP estimates. The first of these programs is "exact.c" which is the *exact* method. The *exact* method calculates one CEP for each of the 175 test design points. The "exact.c" program is listed as follows:

```
/* exact.c */

/* This program implements the "exact" method or rather Smith's
   infinite series expansion method.  The Grubbs-Patnaik/Chi-square
   method is used as the input for the first guess.  */

#include <stdio.h>
#include <math.h>

#define N 1

float EXACT(float sx,float sy,float mux,float muy,float cep);

main()
{
   FILE *in1,*in2,*out;
   int i,ii;              /* counter variable for loops and such */
   float x,y;
   float sx,sy;           /* standard errors for x and y */
   float sumx,sumy;
   float mux,muy;         /* means for x and y */
   float cep;             /* cep estimate */
```

```
float cepprob;          /* the probability of current cep */

in1 = fopen("tweak.dat", "r");
in2 = fopen("grubbs.dat", "r");
out = fopen("exact.dat", "w");

sumx = 0.0;
sumy = 0.0;
for (i=0;i<10000;i++) {
   fscanf(in1,"%f %f",&x,&y);
   sumx += x;
   sumy += y;
}

mux = sumx/10000.;
muy = sumy/10000.;

rewind(in1);

sx = 0.0;
sy = 0.0;
for (i=0;i<10000;i++) {
   fscanf(in1,"%f %f",&x,&y);
   sx += (x-mux)*(x-mux);
   sy += (y-muy)*(y-muy);
}

sx = sqrt(sx/9999.);
sy = sqrt(sy/9999.);

fscanf(in2,"%d %f",&ii,&cep);

cepprob = EXACT(sx,sy,mux,muy,cep);

if (cepprob <= .5) {
   while (cepprob < .5) {
cep += 10;
cepprob = EXACT(sx,sy,mux,muy,cep);
   }
   while (cepprob > .5) {
cep -= 1;
cepprob = EXACT(sx,sy,mux,muy,cep);
```

```
      }
      while (cepprob < .5) {
 cep += .1;
 cepprob = EXACT(sx,sy,mux,muy,cep);
      }
   }
   else {
      while (cepprob > .5) {
 cep -= 10.;
 cepprob = EXACT(sx,sy,mux,muy,cep);
      }
      while (cepprob < .5) {
 cep += 1.;
 cepprob = EXACT(sx,sy,mux,muy,cep);
      }
      while (cepprob > .5) {
 cep -= .1;
 cepprob = EXACT(sx,sy,mux,muy,cep);
      }
   }

   fprintf(out,"%f\n",cep);

   fclose(in1);
   fclose(in2);
   fclose(out);

   return;
}

float EXACT(float sx,float sy,float mux,float muy,float cep)
{
   int i,j,k,l,m,z,f1,f2,f3;
   float sum1,sum2,sum3,x1,x2,x3,x4,xsum;
   float y1,y2,y3,y4,ysum,xk,yj,temp;
   float P;      /* the probability of current cep estimate */
   float D;   /* D will be the up front conglomerate term */
   float ugly;
   float bigsum;

/* calculate D, the front conglomerate term */
   D = (cep*cep/(2.*sx*sy))*exp(-((mux*mux)/(2.*sx*sx)+
```

```
      (muy*muy)/(2.*sy*sy)));

   bigsum = 0.;
   for (k=0;k<10;k++) {
      for (j=0;j<10;j++) {

/* ugly factorial term */
 f1 = k+1;
 f2 = j+1;
 f3 = k+j+1;
 sum1 = sum2 = sum3 = 1.;
 for (m=1;m<=f1;m++) sum1 *= (float)m;
 for (m=1;m<=f2;m++) sum2 *= (float)m;
 for (m=1;m<=f3;m++) sum3 *= (float)m;
 ugly = (sum1/sum3)*sum2;

/* calculate xk */
 f1 = 2*k;
 f2 = k+1;
 f3 = k;
 sum1 = sum2 = sum3 = 1.;
 for (m=1;m<=f1;m++) sum1 *= (float)m;
 for (m=1;m<=f2;m++) sum2 *= (float)m;
 for (m=1;m<=f3;m++) sum3 *= (float)m;
 sum3 = sum3*sum3;
 x1 = (sum1/sum2)/sum3;

 temp = 1.;
 if (k == 0) x2 = 1.;
 else {
    x2 = (-(cep*cep)/(8.*sx*sx));
    for (m=1;m<=k;m++) temp *= x2;
    x2 = temp;
 }

 xsum = 0.;
 for (l=0;l<=k;l++) {
    f1 = k;
    f2 = k-l;
    f3 = 2*l;
    sum1 = sum2 = sum3 = 1.;
    for (m=1;m<=f1;m++) sum1 *= (float)m;
```

```
  for (m=1;m<=f2;m++) sum2 *= (float)m;
  for (m=1;m<=f3;m++) sum3 *= (float)m;
  x3 = (sum1/sum2)/sum3;

  temp = 1.;
  if (l == 0) x4 = 1.;
  else {
     x4 = (-(2.*mux*mux)/(sx*sx));
     for (m=1;m<=l;m++) temp *= x4;
     x4 = temp;
  }
  xsum += x3*x4;
}

xk = x1*x2*xsum;

/* calculate yj */
f1 = 2*j;
f2 = j+1;
f3 = j;
sum1 = sum2 = sum3 = 1.;
for (m=1;m<=f1;m++) sum1 *= (float)m;
for (m=1;m<=f2;m++) sum2 *= (float)m;
for (m=1;m<=f3;m++) sum3 *= (float)m;
sum3 = sum3*sum3;
y1 = (sum1/sum2)/sum3;

temp = 1.;
if (j == 0) y2 = 1.;
else {
   y2 = (-(cep*cep)/(8.*sy*sy));
   for (m=1;m<=j;m++) temp *= y2;
   y2 = temp;
}

ysum = 0.;
for (i=0;i<=j;i++) {
   f1 = j;
   f2 = j-i;
   f3 = 2*i;
   sum1 = sum2 = sum3 = 1.;
   for (m=1;m<=f1;m++) sum1 *= (float)m;
```

```
        for (m=1;m<=f2;m++) sum2 *= (float)m;
        for (m=1;m<=f3;m++) sum3 *= (float)m;
        y3 = (sum1/sum2)/sum3;

        temp = 1.;
        if (i == 0) y4 = 1.;
        else {
           y4 = (-(2.*muy*muy)/(sy*sy));
           for (m=1;m<=i;m++) temp *= y4;
           y4 = temp;
        }
        ysum += y3*y4;
     }
     yj = y1*y2*ysum;
     bigsum += xk*yj*ugly;
         }
      }
      P = D*bigsum;

      return (P);
}
```

The programs for the other four CEP methods also read in the transformed data from "tweak.dat", but in addition to calculating a CEP for each test design point, they also calculate CEPs for each of the sample sizes too. The Grubbs-Patnaik/chi-square program is listed as "grubbs.c", the Modified RAND-234 method is listed as "rand.c", the CEP3 method is listed as "cep3.c", and the Ethridge method is listed as "eth.c".

```
/* grubbs.c */

#include <stdio.h>
#include <math.h>

#define ROUND(a)   ((a)>0 ? (int)(a+0.5) : -(int)(0.5-a))

float interpolate(float a,float aup,float alow,float kup,float klow);
float GRUBBS(float store[2][15],int n);
```

```
main()
{
   FILE *in,*out;              /* pointers for external files */
   int i,j,n,z;                /* counter variables */
   float store[2][15];         /* stores x & y values for this rep */
   float GRUBBSCEP;            /* CEP from Grubbs-Patnaik/Chi-Square */
   float sum,avg;

   in = fopen("tweak.dat", "r");
   out = fopen("grubbs.dat", "w");

/* for sample size of 15 */
   n = 15;
   sum = 0.0;
   for (i=0;i<650;i++) {
      for (j=0;j<n;j++) {
 fscanf(in,"%f %f",&store[0][j],&store[1][j]);
      }
      GRUBBSCEP = GRUBBS(store,n);
      sum += GRUBBSCEP;
   }
   avg = sum/650.;
   fprintf(out,"%d  %f\n",n,avg);

/* for sample size of 10 */
   rewind(in);
   n = 10;
   sum = 0.0;
   for (i=0;i<1000;i++) {
      for (j=0;j<n;j++) {
 fscanf(in,"%f %f",&store[0][j],&store[1][j]);
      }
      GRUBBSCEP = GRUBBS(store,n);
      sum += GRUBBSCEP;
   }
   avg = sum/1000.;
   fprintf(out,"%d  %f\n",n,avg);

/* for sample size of 7 */
   rewind(in);
   n = 7;
```

```
  sum = 0.0;
  for (i=0;i<1400;i++) {
     for (j=0;j<n;j++) {
fscanf(in,"%f %f",&store[0][j],&store[1][j]);
     }
     GRUBBSCEP = GRUBBS(store,n);
     sum += GRUBBSCEP;
  }
  avg = sum/1400.;
  fprintf(out,"%d  %f\n",n,avg);

/* for sample size of 5 */
  rewind(in);
  n = 5;
  sum = 0.0;
  for (i=0;i<2000;i++) {
     for (j=0;j<n;j++) {
fscanf(in,"%f %f",&store[0][j],&store[1][j]);
     }
     GRUBBSCEP = GRUBBS(store,n);
     sum += GRUBBSCEP;
  }
  avg = sum/2000.;
  fprintf(out,"%d  %f\n",n,avg);

/* for sample size of 3 */
  rewind(in);
  n = 3;
  sum = 0.0;
  for (i=0;i<3300;i++) {
     for (j=0;j<n;j++) {
fscanf(in,"%f %f",&store[0][j],&store[1][j]);
     }
     GRUBBSCEP = GRUBBS(store,n);
     sum += GRUBBSCEP;
  }
  avg = sum/3300.;
  fprintf(out,"%d  %f\n",n,avg);

  fclose(in);
  fclose(out);
```

```
   return;
}

float GRUBBS(float store[2][15],int n)
{
   int r;
   float m,v,df,k;
   float sx,sy;
   float xbar,ybar,rho,rhotop,rhox,rhoy;
   float xsum,ysum;
   float GRUBBSCEP;     /* final CEP value */

   xsum = 0.;
   ysum = 0.;

   for (r=0;r<n;r++) {
      xsum += store[0][r];
      ysum += store[1][r];
   }

   xbar = xsum/(float)n;
   ybar = ysum/(float)n;

   xsum = 0.;
   ysum = 0.;

   for (r=0;r<n;r++) {
      xsum += (store[0][r]-xbar)*(store[0][r]-xbar);
      ysum += (store[1][r]-ybar)*(store[1][r]-ybar);
   }

   sx = sqrt(xsum/((float)n-1.));
   sy = sqrt(ysum/((float)n-1.));

   rhotop = 0.;
   rhox = 0.;
   rhoy = 0.;

   for (r=0;r<n;r++) {
      rhotop += (store[0][r]-xbar)*(store[0][r]-ybar);
      rhox += (store[0][r]-xbar)*(store[0][r]-xbar);
      rhoy += (store[1][r]-ybar)*(store[1][r]-ybar);
```

```
}

rho = rhotop/sqrt(rhox*rhoy);

m = sx*sx + sy*sy + xbar*xbar + ybar*ybar;

v = 2.*sx*sx*sx*sx + 2.*rho*rho*sx*sx*sy*sy + sy*sy*sy*sy +
    4.*(xbar*xbar*sx*sx + 2.*xbar*ybar*rho*sx*sy +
    ybar*ybar*sy*sy);

if (v >= 0.0) df = (2.*m*m)/v;
else {
   v = -v;
   df = 12.;
}

df = ROUND(df);

if (df >= 11)
   k = (df - 0.7);
else {
   switch (ROUND(df)) {
case 0:
  k = interpolate((float)df,1.,0.,0.455,0.);
  break;
case 1:
  k = interpolate((float)df,2.,1.,1.39,0.455);
  break;
case 2:
  k = interpolate((float)df,3.,2.,2.37,1.39);
  break;
case 3:
  k = interpolate((float)df,4.,3.,3.36,2.37);
  break;
case 4:
  k = interpolate((float)df,5.,4.,4.35,3.36);
  break;
case 5:
  k = interpolate((float)df,6.,5.,5.35,4.35);
  break;
case 6:
  k = interpolate((float)df,7.,6.,6.35,5.35);
```

```
        break;
     case 7:
        k = interpolate((float)df,8.,7.,7.34,6.35);
        break;
     case 8:
        k = interpolate((float)df,9.,8.,8.34,7.34);
        break;
     case 9:
        k = interpolate((float)df,10.,9.,9.34,8.34);
        break;
     case 10:
        k = interpolate((float)df,11.,10.,10.3,9.34);
     case 11:
        k = interpolate((float)df,12.,11.,11.3,10.34);
          }
      }

   GRUBBSCEP = sqrt((k*v)/(2.*m));

   return (GRUBBSCEP);
}

float interpolate(float a,float aup,float alow,float kup,float klow)
{
   float k,percent;

   percent = (a - alow)/(aup - alow);
   k = klow + (percent*(kup - klow));

   return (k);
}




/* rand.c */

/* This program implements the modified RAND-234 cep
   estimation method.*/

#include <stdio.h>
#include <math.h>
```

```
#define PI 3.14159265358979323846

float RAND234(float store[2][15],int n);

main()
{
   FILE *in,*out;            /* pointers to the external files */
   int i,j,n;                /* counter variables */
   float x,y;                /* (x,y) miss point */
   float store[2][15];       /* stores current x & y values */
   float RANDCEP;            /* CEP estimate of modified RAND-234 */
   float avg,sum;

   in = fopen("tweak.dat", "r");
   out = fopen("rand.dat", "w");

/* for sample size of 15 */
   n = 15;
   sum = 0.0;
   for (i=0;i<650;i++) {
      for (j=0;j<n;j++) {
 fscanf(in,"%f %f",&store[0][j],&store[1][j]);
      }
      RANDCEP = RAND234(store,n);
      sum += RANDCEP;
   }
   avg = sum/650.;
   fprintf(out,"%d  %f\n",n,avg);

/* for sample size of 10 */
   rewind(in);
   n = 10;
   sum = 0.0;
   for (i=0;i<1000;i++) {
      for (j=0;j<n;j++) {
 fscanf(in,"%f %f",&store[0][j],&store[1][j]);
      }
      RANDCEP = RAND234(store,n);
      sum += RANDCEP;
   }
   avg = sum/1000.;
```

```
  fprintf(out,"%d  %f\n",n,avg);

/* for sample size of 7 */
  rewind(in);
  n = 7;
  sum = 0.0;
  for (i=0;i<1400;i++) {
     for (j=0;j<n;j++) {
fscanf(in,"%f %f",&store[0][j],&store[1][j]);
     }
     RANDCEP = RAND234(store,n);
     sum += RANDCEP;
  }
  avg = sum/1400.;
  fprintf(out,"%d  %f\n",n,avg);

/* for sample size of 5 */
  rewind(in);
  n = 5;
  sum = 0.0;
  for (i=0;i<2000;i++) {
     for (j=0;j<n;j++) {
fscanf(in,"%f %f",&store[0][j],&store[1][j]);
     }
     RANDCEP = RAND234(store,n);
     sum += RANDCEP;
  }
  avg = sum/2000.;
  fprintf(out,"%d  %f\n",n,avg);

/* for sample size of 3 */
  rewind(in);
  n = 3;
  sum = 0.0;
  for (i=0;i<3300;i++) {
     for (j=0;j<n;j++) {
fscanf(in,"%f %f",&store[0][j],&store[1][j]);
     }
     RANDCEP = RAND234(store,n);
     sum += RANDCEP;
  }
  avg = sum/3300.;
```

```
   fprintf(out,"%d  %f\n",n,avg);

   fclose(in);
   fclose(out);

   return;
}

float RAND234(float store[2][15],int n)
{
   int r,s,t;               /* counter variables for loops and such */
   float xbar,ybar;
   float xsum,ysum;
   float RANDCEP;           /* CEP estimate for modified RAND-234 */
   float Cov[2][2];         /* Covariance matrix */
   float Corr[2][2];        /* Correlation matrix */
   float A[2][2];           /* Rotation matrix */
   float cross;             /* stores cross multiples for Cov */
   float inter;             /* stores inter multiples for Cov */
   float s1,s2;             /* the standard deviations */
   float theta,rad;         /* angle of rotation to principal axes */
   float b1,b2;             /* transformed mean vectors */
   float k1,k2;             /* transformed Cov matrix princ axes */
   float Large_sigma;       /* the larger of k1 and k2 */
   float Small_sigma;       /* the smaller of k1 and k2 */
   float CEPMPI;            /* CEP of mean point of impact */
   float BIAS;              /* bias for RAND-234 */
   float V;                 /* the critical value for CEP */

   xsum = 0.;
   ysum = 0.;

   for (r=0;r<n;r++) {
      xsum += store[0][r];
      ysum += store[1][r];
   }

   xbar = xsum/(float)n;
   ybar = ysum/(float)n;

 /* Calculate Covariance matrix Cov[2][2] */
   for (r=0;r<2;r++) {
```

```
      for (s=0;s<2;s++) {
 cross = 0.;
 inter = 0.;
 for (t=0;t<n;t++) {
    cross += store[r][t]*store[s][t];
    inter += store[r][t]*store[s][t];
 }
 cross *= (float)n;
 Cov[r][s] = (1./((float)n*((float)n-1.)))*(cross-inter);
      }
   }

/* Calculate the Standard deviations, s1 & s2 */
   s1 = sqrt(Cov[0][0]);
   s2 = sqrt(Cov[1][1]);

/* Calculate the Correlation matrix, Corr[2][2] */
   Corr[0][0] = Corr[1][1] = 1.;
   Corr[0][1] = Corr[1][0] = Cov[0][1]/(s2*s2);

/* Calculate angle of rotation to principal axes, theta */
   if (s1 == s2) {
      if (Corr[0][1] > 0.)
 theta = -45.;
      if (Corr[0][1] < 0.)
 theta = 45.;
   }
   else
      theta = .5*atan((2.*Corr[0][1]*s1*s2)/(s1*s1-s2*s2));

/* Calculate the Rotation matrix, A[2][2] */
   rad = (theta/360.)*2.*PI;
   A[0][0] = A[1][1] = cos(rad);
   A[0][1] = sin(rad);
   A[1][0] = -sin(rad);

/* reverse sin of angle if theta is negative */
   if (theta < 0.) {
      A[0][1] = -sin(rad);
      A[1][0] = sin(rad);
   }
```

```
/* Transform mean vector to principal axes, b1 & b2 */
   b1 = A[0][0]*xbar + A[0][1]*ybar;
   b2 = A[1][0]*xbar + A[1][1]*ybar;

/* Transform Covariance matrix to principal axes, k1 & k2 */
   k1 = sqrt(A[0][0]*(A[0][0]*Cov[0][0]+A[0][1]*Cov[1][0])+
     A[0][1]*(A[0][0]*Cov[0][1]+A[0][1]*Cov[1][1]));
   k2 = sqrt(A[1][0]*(A[1][0]*Cov[0][0]+A[1][1]*Cov[1][0])+
     A[1][1]*(A[1][0]*Cov[0][1]+A[1][1]*Cov[1][1]));

   if (k1 > k2) {
      Large_sigma = k1;
      Small_sigma = k2;
   }
   else {
      Large_sigma = k2;
      Small_sigma = k1;
   }

/* Calculate the CEPMPI */
   CEPMPI = 0.614*Small_sigma + 0.563*Large_sigma;

/* Calculate the BIAS */
   BIAS = sqrt(b1*b1+b2*b2);

/* Calculate V */
   V = BIAS/CEPMPI;

/* CALCULATE RANDCEP */
   RANDCEP = CEPMPI*(1.0039 - .0528*V + .4786*V*V - .0793*V*V*V);

   return (RANDCEP);
}



/* cep3.c */

/* This CEP method is given in the Ethridge ACSC paper.  It is
   listed as CEP method #3, so I call it the cep3 method.  It is
   based on a Rayleigh distribution and uses radial miss
```

```
   distance. */

#include <stdio.h>
#include <math.h>

main()
{
   FILE *in,*out;          /* pointers for external files */
   float radial[15];       /* radial error */
   float x,y;              /* x and y scores */
   float CEP3;             /* stores the newly estimated cep */
   float sum;              /* sums radial miss scores */
   int i,j,n;              /* counter variables */
   float avg,bigsum;

   in = fopen("tweak.dat", "r");
   out = fopen("cep3.dat", "w");

/* for a sample size of 10 */
   n = 10;
   bigsum = 0.0;
   for (i=0;i<1000;i++){
      sum = 0.0;
      for (j=0;j<n;j++) {
 fscanf(in,"%f %f",&x,&y);
 radial[j] = sqrt(x*x + y*y);
 sum += radial[j];
      }
      CEP3 = .9394*(sum/(float)n);
      bigsum += CEP3;
   }
   avg = bigsum/1000.;
   fprintf(out,"15  %f\n",avg);
   fprintf(out,"10  %f\n",avg);
   fprintf(out,"7   %f\n",avg);
   fprintf(out,"5   %f\n",avg);
   fprintf(out,"3   %f\n",avg);

   fclose(in);
   fclose(out);

   return;
```

```
}
```

```
/* eth.c */

/* This program implements Ethridge's robust estimator as presented
   in his ACSC paper. */

#include <stdio.h>
#include <math.h>

float ETHRIDGE(float rlist[15],int n);

main()
{
   FILE *in,*out;             /* pointers for external files */
   int i,j,n;                 /* counter variables for loops and such */
   float x,y;                 /* (x,y) miss scores */
   float rlist[15];           /* stores radial miss distances */
   float CEPETH;              /* CEP of the Ethridge method */
   float avg,sum;

   in = fopen("tweak.dat", "r");
   out = fopen("eth.dat", "w");

/* for a sample size of 15 */
   n = 15;
   sum = 0.0;
   for (i=0;i<650;i++) {
      for (j=0;j<n;j++) {
 fscanf(in,"%f %f",&x,&y);
 rlist[j] = sqrt(x*x + y*y);
      }
      CEPETH = ETHRIDGE(rlist,n);
      sum += CEPETH;
   }
   avg = sum/650.;
   fprintf(out,"%d  %f\n",n,avg);

/* for a sample size of 10 */
```

```
  rewind(in);
  n = 10;
  sum = 0.0;
  for (i=0;i<1000;i++) {
     for (j=0;j<n;j++) {
fscanf(in,"%f %f",&x,&y);
rlist[j] = sqrt(x*x + y*y);
if (rlist[j] < 1.) rlist[j] = 1.;
     }
     CEPETH = ETHRIDGE(rlist,n);
     sum += CEPETH;
  }
  avg = sum/1000.;
  fprintf(out,"%d  %f\n",n,avg);

/* for a sample size of 7 */
  rewind(in);
  n = 7;
  sum = 0.0;
  for (i=0;i<1000;i++) {
     for (j=0;j<n;j++) {
fscanf(in,"%f %f",&x,&y);
rlist[j] = sqrt(x*x + y*y);
if (rlist[j] < 1.) rlist[j] = 1.;
     }
     CEPETH = ETHRIDGE(rlist,n);
     sum += CEPETH;
  }
  avg = sum/1000.;
  fprintf(out,"%d  %f\n",n,avg);

/* for a sample size of 5 */
  rewind(in);
  n = 5;
  sum = 0.0;
  for (i=0;i<2000;i++) {
     for (j=0;j<n;j++) {
fscanf(in,"%f %f",&x,&y);
rlist[j] = sqrt(x*x + y*y);
if (rlist[j] < 1.) rlist[j] = 1.;
     }
     CEPETH = ETHRIDGE(rlist,n);
```

```
      sum += CEPETH;
   }
   avg = sum/2000.;
   fprintf(out,"%d  %f\n",n,avg);

/* for a sample size of 3 */
   rewind(in);
   n = 3;
   sum = 0.0;
   for (i=0;i<3300;i++) {
      for (j=0;j<n;j++) {
 fscanf(in,"%f %f",&x,&y);
 rlist[j] = sqrt(x*x + y*y);
 if (rlist[j] < 1.) rlist[j] = 1.;
      }
      CEPETH = ETHRIDGE(rlist,n);
      sum += CEPETH;
   }
   avg = sum/3300.;
   fprintf(out,"%d  %f\n",n,avg);

   fclose(in);
   fclose(out);

   return;
}

float ETHRIDGE(float rlist[15],int n)
{
   int r,s;              /* counter variables for loops and such */
   int detect;           /* used to store location in sorted array */
   float t[15];          /* store log of radial miss distances */
   float temp[15];       /* a temporary array */
   float min;            /* stores minimum value in sort array */
   float CEPETH;         /* stores the CEP estimate for this method */
   float tdot;           /* sample median */
   float tbar;           /* the mean of the t's */
   float kstop;          /* numerator term of kurtosis calculation */
   float ksbottom;       /* denominator term of kurtosis calculation */
   float ks;             /* kurtosis */
   float ssquare;        /* sample variance */
   float tsq;            /* sum of the t-squared terms */
```

```
   float d[15];         /* stores the array of d-values */
   float dstuff;        /* used in calculation of d-values */
   float w[15];         /* stores the array of w-values */
   float dinvsum;       /* sum of the inverse d-values */
   float muhat;         /* estimate of mu */
   float tdiff;         /* stores difference between t and tbar */

/* sort array of radial errors, rlist (in ascending order) */
   for (r=0;r<n;r++) {
      min = 10000.;
      for (s=0;s<n;s++) {
 if (rlist[s] <= min) {
    temp[r] = rlist[s];
    min = rlist[s];
    detect = s;
 }
      }
      rlist[detect] += 100000.;
   }

/* convert sorted radial miss array to log values */
   for (r=0;r<n;r++)
      t[r] = log(temp[r]);

/* calculate sample median, tdot */
   if (n % 2 == 0)
      tdot = (t[n/2]+t[(n/2)-1])/2.;
   else
      tdot = t[(n-1)/2];

/* calculate tbar, the mean */
   tbar = 0.;
   for (r=0;r<n;r++)
      tbar += t[r];
   tbar = tbar/(float)n;

/* calculate kurtosis, ks */
   kstop = 0.;
   ksbottom = 0.;
   for (r=0;r<n;r++) {
      tdiff = t[r]-tbar;
      kstop += tdiff*tdiff*tdiff*tdiff;
```

```
      ksbottom += tdiff*tdiff;
   }
   kstop = kstop*(float)n;
   ksbottom = ksbottom*ksbottom;
   ks = kstop/ksbottom;

/* calculate sample variance, ssquare */
   tsq = 0.;
   for (r=0;r<n;r++)
      tsq += (t[r]-tbar)*(t[r]-tbar);
   ssquare = tsq/((float)n-1.);

/* calculate d-values */
   for (r=0;r<n;r++) {
      dstuff = 1.-(.03)*(ks-3.)*(ks-3.)*(ks-3.)*
       (t[r]-tdot)*(t[r]-tdot)/ssquare;
      if (dstuff > 0.01)
 d[r] = dstuff;
      else
 d[r] = 0.01;
   }

/* calculate the w-values */
   dinvsum = 0.;
   for (r=0;r<n;r++)
      dinvsum += (1./d[r]);

   for (r=0;r<n;r++)
      w[r] = (1./d[r])/dinvsum;

/* calculate muhat */
   muhat = 0.;
   for (r=0;r<n;r++)
      muhat += w[r]*t[r];

/* calculate the Ethridge estimator */
   CEPETH = exp(muhat);

   return (CEPETH);
}
```

A batch file linked the above files into one continuous process.

It is listed as follows:

```
/* cep.bat */

tweak
exact
grubbs
cep3
eth
```

# Appendix C. *Data Validation Program*

There were two streams of standard normal random numbers that were produced by the SLAM II software package. The following C program compares the data to a standard normal distribution. Both random number streams should have means of zero and standard deviations of one. The empirical cumulative distribution function should also conform closely to that of the standard normal distribution. The C program partitions the data into 14 intervals to analyze the frequency of the numbers falling into these intervals. These frequencies are compared to standard mathematical table values of the standard normal cumulative distribution function.

```
/* valid.c */

/* This program produces that data necessary to validate the
   two SLAM II random number streams as standard normal */

#include <stdio.h>
#include <math.h>

main()
{
   FILE *in1,*in2,*out;
   int i,j,pit[14][2]={0};
   float x,y,xbar,ybar,sx,sy,sumx,sumy,prob[14][2];

   in1 = fopen("x.dat", "r");
   in2 = fopen("y.dat", "r");
   out = fopen("valid.dat", "w");

/* calculate means for x & y */
   sumx = 0.;
   sumy = 0.;

   for (i=0;i<10000;i++) {
      fscanf(in1,"%f",&x);
      fscanf(in2,"%f",&y);
      sumx += x;
```

```
    sumy += y;
  }

  xbar = sumx/10000.;
  ybar = sumy/10000.;

/* calculate standard deviations of x & y */
  rewind(in1);
  rewind(in2);

  sx = 0.;
  sy = 0.;

  for (i=0;i<10000;i++) {
    fscanf(in1,"%f",&x);
    fscanf(in2,"%f",&y);
    sx += (x-xbar)*(x-xbar);
    sy += (y-ybar)*(y-ybar);
  }

  sx = sqrt(sx/9999.);
  sy = sqrt(sy/9999.);

/* calculate cumulative probability densities */
  rewind(in1);
  rewind(in2);

  for(i=0;i<10000;i++) {
    fscanf(in1,"%f",&x);
    fscanf(in2,"%f",&y);
    if(x <= -3.) pit[0][0]++;
    if(y <= -3.) pit[0][1]++;
    if(x <= -2.5) pit[1][0]++;
    if(y <= -2.5) pit[1][1]++;
    if(x <= -2.) pit[2][0]++;
    if(y <= -2.) pit[2][1]++;
    if(x <= -1.5) pit[3][0]++;
    if(y <= -1.5) pit[3][1]++;
    if(x <= -1.) pit[4][0]++;
    if(y <= -1.) pit[4][1]++;
    if(x <= -.5) pit[5][0]++;
    if(y <= -.5) pit[5][1]++;
```

```
    if(x < 0.) pit[6][0]++;
    if(y < 0.) pit[6][1]++;
    if(x < .5) pit[7][0]++;
    if(y < .5) pit[7][1]++;
    if(x < 1.) pit[8][0]++;
    if(y < 1.) pit[8][1]++;
    if(x < 1.5) pit[9][0]++;
    if(y < 1.5) pit[9][1]++;
    if(x < 2.0) pit[10][0]++;
    if(y < 2.0) pit[10][1]++;
    if(x < 2.5) pit[11][0]++;
    if(y < 2.5) pit[11][1]++;
    if(x < 3.0) pit[12][0]++;
    if(y < 3.0) pit[12][1]++;
    if(x < 6.0) pit[13][0]++;
    if(y < 6.0) pit[13][1]++;
  }

  for (i=0;i<14;i++)
    for (j=0;j<2;j++)
prob[i][j] = (float)pit[i][j]/10000.;

  for (i=0;i<14;i++) {
    fprintf(out,"%2d    %6f    %6f\n",
    i+1,prob[i][0],prob[i][1]);
  }

  fprintf(out,"xbar: %f    ybar: %f\n",xbar,ybar);
  fprintf(out,"sx: %f    sy: %f\n",sx,sy);

  fclose(in1);
  fclose(in2);
  fclose(out);

  return;
}
```

## Appendix D. *Correlation Study*

A correlation study was made with the random number streams from the SLAM II random number generator. This study looks at the first 1000 (x,y)-points to calculate the correlation coefficient. The two data streams were generated independently and should have a correlation of zero. This analysis concluded that the correlation between these two random number streams is approximately zero and, therefore, the two streams are uncorrelated.

Two C programs were written to make the necessary calculations. The first C program is called "corr.c". "core.c" conducted independent studies of the 1000 points for each of the seven sample sizes. The second C program called "table.c" took the correlations from "core.c" and summed them up into Table 3.3. The source code for these two programs is given below.

```
/* corr.c */

#include <stdio.h>
#include <math.h>

main()
{
   FILE *in,*out;
   int i,j,k,m;
   float x[1000],y[1000];
   float xbar,ybar,rho,xdiff,ydiff,f1,f2,f3;
   float xsum,ysum;

   in = fopen("xydata.dat", "r");
   out = fopen("corr.dat", "w");

   fprintf(out,"CORRELATION ANALYSIS ");
   fprintf(out,"BETWEEN THE X & Y SCORES\n\n\n");
   fprintf(out,"SAMPLE     RUN\n");
   fprintf(out," SIZE     NUMBER     CORRELATION\n");
   fprintf(out,"------    ------     -----------\n");
```

```
  for (i=0;i<1000;i++) fscanf(in,"%f %f",&x[i],&y[i]);

  k = 0;
  for (i=0;i<200;i++) {
      xsum = ysum = f1 = f2 = f3 = 0.;
      for (j=0;j<5;j++) {
xsum += x[k];
ysum += y[k];
k++;
      }
      xbar = xsum/5.;
      ybar = ysum/5.;
      k -= 5;
      for (j=0;j<5;j++) {
f1 += (x[k]-xbar)*(y[k]-ybar);
f2 += (x[k]-xbar)*(x[k]-xbar);
f3 += (y[k]-ybar)*(y[k]-ybar);
k++;
      }
      rho = f1/(sqrt(f2*f3));
      fprintf(out,"   5        %3d         %5.2f\n",i+1,rho);
  }


  k = 0;
  for (i=0;i<100;i++) {
      xsum = ysum = f1 = f2 = f3 = 0.;
      for (j=0;j   );j++) {
xsum += x[k];
ysum += y[k];
k++;
      }
      xbar = xsum/10.;
      ybar = ysum/10.;
      k -= 10;
      for (j=0;j<10;j++) {
f1 += (x[k]-xbar)*(y[k]-ybar);
f2 += (x[k]-xbar)*(x[k]-xbar);
f3 += (y[k]-ybar)*(y[k]-ybar);
k++;
      }
```

```
    rho = f1/(sqrt(f2*f3));
    fprintf(out,"  10        %3d         %5.2f\n",i+1,rho);
  }

  k = 0;
  for (i=0;i<50;i++) {
    xsum = ysum = f1 = f2 = f3 = 0.;
    for (j=0;j<20;j++) {
xsum += x[k];
ysum += y[k];
k++;
    }
    xbar = xsum/20.;
    ybar = ysum/20.;
    k -= 20;
    for (j=0;j<20;j++) {
f1 += (x[k]-xbar)*(y[k]-ybar);
f2 += (x[k]-xbar)*(x[k]-xbar);
f3 += (y[k]-ybar)*(y[k]-ybar);
k++;
    }
    rho = f1/(sqrt(f2*f3));
    fprintf(out,"  20        %2d         %5.2f\n",i+1,rho);
  }

  k = 0;
  for (i=0;i<40;i++) {
    xsum = ysum = f1 = f2 = f3 = 0.;
    for (j=0;j<25;j++) {
xsum += x[k];
ysum += y[k];
k++;
    }
    xbar = xsum/25.;
    ybar = ysum/25.;
    k -= 25;
    for (j=0;j<25;j++) {
f1 += (x[k]-xbar)*(y[k]-ybar);
f2 += (x[k]-xbar)*(x[k]-xbar);
f3 += (y[k]-ybar)*(y[k]-ybar);
k++;
    }
```

```
    rho = f1/(sqrt(f2*f3));
    fprintf(out,"  25          %2d          %5.2f\n",i+1,rho);
  }

  k = 0;
  for (i=0;i<20;i++) {
    xsum = ysum = f1 = f2 = f3 = 0.;
    for (j=0;j<50;j++) {
xsum += x[k];
ysum += y[k];
k++;
    }
    xbar = xsum/50.;
    ybar = ysum/50.;
    k -= 50;
    for (j=0;j<50;j++) {
f1 += (x[k]-xbar)*(y[k]-ybar);
f2 += (x[k]-xbar)*(x[k]-xbar);
f3 += (y[k]-ybar)*(y[k]-ybar);
k++;
    }
    rho = f1/(sqrt(f2*f3));
    fprintf(out,"  50          %2d          %5.2f\n",i+1,rho);
  }

  k = 0;
  for (i=0;i<10;i++) {
    xsum = ysum = f1 = f2 = f3 = 0.;
    for (j=0;j<100;j++) {
xsum += x[k];
ysum += y[k];
k++;
    }
    xbar = xsum/100.;
    ybar = ysum/100.;
    k -= 100;
    for (j=0;j<100;j++) {
f1 += (x[k]-xbar)*(y[k]-ybar);
f2 += (x[k]-xbar)*(x[k]-xbar);
f3 += (y[k]-ybar)*(y[k]-ybar);
k++;
    }
```

```
    rho = f1/(sqrt(f2*f3));
    fprintf(out," 100         %2d         %5.2f\n",i+1,rho);
  }

  k = 0;
  for (i=0;i<2;i++) {
    xsum = ysum = f1 = f2 = f3 = 0.;
    for (j=0;j<500;j++) {
xsum += x[k];
ysum += y[k];
k++;
    }
    xbar = xsum/500.;
    ybar = ysum/500.;
    k -= 500;
    for (j=0;j<500;j++) {
f1 += (x[k]-xbar)*(y[k]-ybar);
f2 += (x[k]-xbar)*(x[k]-xbar);
f3 += (y[k]-ybar)*(y[k]-ybar);
k++;
    }
    rho = f1/(sqrt(f2*f3));
    fprintf(out," 500         %d         %5.2f\n",i+1,rho);
  }

  k = 0;
  for (i=0;i<1;i++) {
    xsum = ysum = f1 = f2 = f3 = 0.;
    for (j=0;j<1000;j++) {
xsum += x[k];
ysum += y[k];
k++;
    }
    xbar = xsum/1000.;
    ybar = ysum/1000.;
    k -= 1000;
    for (j=0;j<1000;j++) {
f1 += (x[k]-xbar)*(y[k]-ybar);
f2 += (x[k]-xbar)*(x[k]-xbar);
f3 += (y[k]-ybar)*(y[k]-ybar);
k++;
    }
```

```
      rho = f1/(sqrt(f2*f3));
      fprintf(out,"1000          %d         %5.2f\n",i+1,rho);
   }

   fclose(in);
   fclose(out);

   return;
}
```

* * * * * * * * * * * * * * * * * * * * *

```
/* table.c */

/* This program generates a table which contains the
   frequency distribution of correlation of given
   ranges for several sample sizes. */

#include <stdio.h>

main()
{
   FILE *in,*out;
   int i,j,size,num,m[20][8]={0};
   float avg5,avg10,avg20,avg25;
   float avg50,avg100,avg500,avg1000;
   float corr;

   avg5 = avg10 = avg20 = avg25 = avg50 = 0.;
   avg100 = avg500 = avg1000 = 0.;

   in = fopen("corr.dat", "r");
   out = fopen("newtable.dat", "w");

   fprintf(out,"                           X,Y ");
   fprintf(out,"CORRELATION ANALYSIS\n\n");
   fprintf(out,"                 NUMBER OF ");
   fprintf(out,"OBSERVATIONS PER SAMPLE SIZE\n\n");
   fprintf(out,"   RANGE  |  5    10    20    25    ");
   fprintf(out,"50    100   500   ");
   fprintf(out,"1000\n");
```

```
fprintf(out,"----------|----- ----- ----- ----- ");
fprintf(out,"----- ----- ----- ");
fprintf(out,"-----\n");

for (i=0;i<200;i++) {
   fscanf(in,"%d %d %f",&size,&num,&corr);
   avg5 += corr;
   if (corr >= .9) m[0][0]++;
   if (corr >= .8 && corr < .9) m[1][0]++;
   if (corr >= .7 && corr < .8) m[2][0]++;
   if (corr >= .6 && corr < .7) m[3][0]++;
   if (corr >= .5 && corr < .6) m[4][0]++;
   if (corr >= .4 && corr < .5) m[5][0]++;
   if (corr >= .3 && corr < .4) m[6][0]++;
   if (corr >= .2 && corr < .3) m[7][0]++;
   if (corr >= .1 && corr < .2) m[8][0]++;
   if (corr >= 0. && corr < .1) m[9][0]++;
   if (corr > -.1 && corr < 0) m[10][0]++;
   if (corr > -.2 && corr <= -.1) m[11][0]++;
   if (corr > -.3 && corr <= -.2) m[12][0]++;
   if (corr > -.4 && corr <= -.3) m[13][0]++;
   if (corr > -.5 && corr <= -.4) m[14][0]++;
   if (corr > -.6 && corr <= -.5) m[15][0]++;
   if (corr > -.7 && corr <= -.6) m[16][0]++;
   if (corr > -.8 && corr <= -.7) m[17][0]++;
   if (corr > -.9 && corr <= -.8) m[18][0]++;
   if (corr > -1. && corr <= -.9) m[19][0]++;
}
avg5 = avg5/200.;

for (i=0;i<100;i++) {
   fscanf(in,"%d %d %f",&size,&num,&corr);
   avg10 += corr;
   if (corr >= .9) m[0][1]++;
   if (corr >= .8 && corr < .9) m[1][1]++;
   if (corr >= .7 && corr < .8) m[2][1]++;
   if (corr >= .6 && corr < .7) m[3][1]++;
   if (corr >= .5 && corr < .6) m[4][1]++;
   if (corr >= .4 && corr < .5) m[5][1]++;
   if (corr >= .3 && corr < .4) m[6][1]++;
   if (corr >= .2 && corr < .3) m[7][1]++;
   if (corr >= .1 && corr < .2) m[8][1]++;
```

```
   if (corr >= 0. && corr < .1) m[9][1]++;
   if (corr > -.1 && corr < 0) m[10][1]++;
   if (corr > -.2 && corr <= -.1) m[11][1]++;
   if (corr > -.3 && corr <= -.2) m[12][1]++;
   if (corr > -.4 && corr <= -.3) m[13][1]++;
   if (corr > -.5 && corr <= -.4) m[14][1]++;
   if (corr > -.6 && corr <= -.5) m[15][1]++;
   if (corr > -.7 && corr <= -.6) m[16][1]++;
   if (corr > -.8 && corr <= -.7) m[17][1]++;
   if (corr > -.9 && corr <= -.8) m[18][1]++;
   if (corr > -1. && corr <= -.9) m[19][1]++;
}
avg10 = avg10/100.;

for (i=0;i<50;i++) {
   fscanf(in,"%d %d %f",&size,&num,&corr);
   avg20 += corr;
   if (corr >= .9) m[0][2]++;
   if (corr >= .8 && corr < .9) m[1][2]++;
   if (corr >= .7 && corr < .8) m[2][2]++;
   if (corr >= .6 && corr < .7) m[3][2]++;
   if (corr >= .5 && corr < .6) m[4][2]++;
   if (corr >= .4 && corr < .5) m[5][2]++;
   if (corr >= .3 && corr < .4) m[6][2]++;
   if (corr >= .2 && corr < .3) m[7][2]++;
   if (corr >= .1 && corr < .2) m[8][2]++;
   if (corr >= 0. && corr < .1) m[9][2]++;
   if (corr > -.1 && corr < 0) m[10][2]++;
   if (corr > -.2 && corr <= -.1) m[11][2]++;
   if (corr > -.3 && corr <= -.2) m[12][2]++;
   if (corr > -.4 && corr <= -.3) m[13][2]++;
   if (corr > -.5 && corr <= -.4) m[14][2]++;
   if (corr > -.6 && corr <= -.5) m[15][2]++;
   if (corr > -.7 && corr <= -.6) m[16][2]++;
   if (corr > -.8 && corr <= -.7) m[17][2]++;
   if (corr > -.9 && corr <= -.8) m[18][2]++;
   if (corr > -1. && corr <= -.9) m[19][2]++;
}
avg20 = avg20/50.;

for (i=0;i<40;i++) {
   fscanf(in,"%d %d %f",&size,&num,&corr);
```

```
    avg25 += corr;
    if (corr >= .9) m[0][3]++;
    if (corr >= .8 && corr < .9) m[1][3]++;
    if (corr >= .7 && corr < .8) m[2][3]++;
    if (corr >= .6 && corr < .7) m[3][3]++;
    if (corr >= .5 && corr < .6) m[4][3]++;
    if (corr >= .4 && corr < .5) m[5][3]++;
    if (corr >= .3 && corr < .4) m[6][3]++;
    if (corr >= .2 && corr < .3) m[7][3]++;
    if (corr >= .1 && corr < .2) m[8][3]++;
    if (corr >= 0. && corr < .1) m[9][3]++;
    if (corr > -.1 && corr < 0) m[10][3]++;
    if (corr > -.2 && corr <= -.1) m[11][3]++;
    if (corr > -.3 && corr <= -.2) m[12][3]++;
    if (corr > -.4 && corr <= -.3) m[13][3]++;
    if (corr > -.5 && corr <= -.4) m[14][3]++;
    if (corr > -.6 && corr <= -.5) m[15][3]++;
    if (corr > -.7 && corr <= -.6) m[16][3]++;
    if (corr > -.8 && corr <= -.7) m[17][3]++;
    if (corr > -.9 && corr <= -.8) m[18][3]++;
    if (corr > -1. && corr <= -.9) m[19][3]++;
}
avg25 = avg25/40.;

for (i=0;i<20;i++) {
    fscanf(in,"%d %d %f",&size,&num,&corr);
    avg50 += corr;
    if (corr >= .9) m[0][4]++;
    if (corr >= .8 && corr < .9) m[1][4]++;
    if (corr >= .7 && corr < .8) m[2][4]++;
    if (corr >= .6 && corr < .7) m[3][4]++;
    if (corr >= .5 && corr < .6) m[4][4]++;
    if (corr >= .4 && corr < .5) m[5][4]++;
    if (corr >= .3 && corr < .4) m[6][4]++;
    if (corr >= .2 && corr < .3) m[7][4]++;
    if (corr >= .1 && corr < .2) m[8][4]++;
    if (corr >= 0. && corr < .1) m[9][4]++;
    if (corr > -.1 && corr < 0) m[10][4]++;
    if (corr > -.2 && corr <= -.1) m[11][4]++;
    if (corr > -.3 && corr <= -.2) m[12][4]++;
    if (corr > -.4 && corr <= -.3) m[13][4]++;
    if (corr > -.5 && corr <= -.4) m[14][4]++;
```

```
    if (corr > -.6 && corr <= -.5) m[15][4]++;
    if (corr > -.7 && corr <= -.6) m[16][4]++;
    if (corr > -.8 && corr <= -.7) m[17][4]++;
    if (corr > -.9 && corr <= -.8) m[18][4]++;
    if (corr > -1. && corr <= -.9) m[19][4]++;
}
avg50 = avg50/20.;

for (i=0;i<10;i++) {
    fscanf(in,"%d %d %f",&size,&num,&corr);
    avg100 += corr;
    if (corr >= .9) m[0][5]++;
    if (corr >= .8 && corr < .9) m[1][5]++;
    if (corr >= .7 && corr < .8) m[2][5]++;
    if (corr >= .6 && corr < .7) m[3][5]++;
    if (corr >= .5 && corr < .6) m[4][5]++;
    if (corr >= .4 && corr < .5) m[5][5]++;
    if (corr >= .3 && corr < .4) m[6][5]++;
    if (corr >= .2 && corr < .3) m[7][5]++;
    if (corr >= .1 && corr < .2) m[8][5]++;
    if (corr >= 0. && corr < .1) m[9][5]++;
    if (corr > -.1 && corr < 0) m[10][5]++;
    if (corr > -.2 && corr <= -.1) m[11][5]++;
    if (corr > -.3 && corr <= -.2) m[12][5]++;
    if (corr > -.4 && corr <= -.3) m[13][5]++;
    if (corr > -.5 && corr <= -.4) m[14][5]++;
    if (corr > -.6 && corr <= -.5) m[15][5]++;
    if (corr > -.7 && corr <= -.6) m[16][5]++;
    if (corr > -.8 && corr <= -.7) m[17][5]++;
    if (corr > -.9 && corr <= -.8) m[18][5]++;
    if (corr > -1. && corr <= -.9) m[19][5]++;
}
avg100 = avg100/10.;

for (i=0;i<2;i++) {
    fscanf(in,"%d %d %f",&size,&num,&corr);
    avg500 += corr;
    if (corr >= .9) m[0][6]++;
    if (corr >= .8 && corr < .9) m[1][6]++;
    if (corr >= .7 && corr < .8) m[2][6]++;
    if (corr >= .6 && corr < .7) m[3][6]++;
    if (corr >= .5 && corr < .6) m[4][6]++;
```

```
    if (corr >= .4 && corr < .5) m[5][6]++;
    if (corr >= .3 && corr < .4) m[6][6]++;
    if (corr >= .2 && corr < .3) m[7][6]++;
    if (corr >= .1 && corr < .2) m[8][6]++;
    if (corr >= 0. && corr < .1) m[9][6]++;
    if (corr > -.1 && corr < 0) m[10][6]++;
    if (corr > -.2 && corr <= -.1) m[11][6]++;
    if (corr > -.3 && corr <= -.2) m[12][6]++;
    if (corr > -.4 && corr <= -.3) m[13][6]++;
    if (corr > -.5 && corr <= -.4) m[14][6]++;
    if (corr > -.6 && corr <= -.5) m[15][6]++;
    if (corr > -.7 && corr <= -.6) m[16][6]++;
    if (corr > -.8 && corr <= -.7) m[17][6]++;
    if (corr > -.9 && corr <= -.8) m[18][6]++;
    if (corr > -1. && corr <= -.9) m[19][6]++;
}
avg500 = avg500/2.;

for (i=0;i<1;i++) {
    fscanf(in,"%d %d %f",&size,&num,&corr);
    avg1000 += corr;
    if (corr >= .9) m[0][7]++;
    if (corr >= .8 && corr < .9) m[1][7]++;
    if (corr >= .7 && corr < .8) m[2][7]++;
    if (corr >= .6 && corr < .7) m[3][7]++;
    if (corr >= .5 && corr < .6) m[4][7]++;
    if (corr >= .4 && corr < .5) m[5][7]++;
    if (corr >= .3 && corr < .4) m[6][7]++;
    if (corr >= .2 && corr < .3) m[7][7]++;
    if (corr >= .1 && corr < .2) m[8][7]++;
    if (corr >= 0. && corr < .1) m[9][7]++;
    if (corr > -.1 && corr < 0) m[10][7]++;
    if (corr > -.2 && corr <= -.1) m[11][7]++;
    if (corr > -.3 && corr <= -.2) m[12][7]++;
    if (corr > -.4 && corr <= -.3) m[13][7]++;
    if (corr > -.5 && corr <= -.4) m[14][7]++;
    if (corr > -.6 && corr <= -.5) m[15][7]++;
    if (corr > -.7 && corr <= -.6) m[16][7]++;
    if (corr > -.8 && corr <= -.7) m[17][7]++;
    if (corr > -.9 && corr <= -.8) m[18][7]++;
    if (corr > -1. && corr <= -.9) m[19][7]++;
}
```

```
fprintf(out,"   [.9,1] | %3d%6d%6d%6d%6d%6d%6d%6d\n",
m[0][0],m[0][1],m[0][2],m[0][3],m[0][4],
m[0][5],m[0][6],m[0][7]);
fprintf(out,"  [.8,.9) | %3d%6d%6d%6d%6d%6d%6d%6d\n",
m[1][0],m[1][1],m[1][2],m[1][3],m[1][4],
m[0][5],m[1][6],m[1][7]);
fprintf(out,"  [.7,.8) | %3d%6d%6d%6d%6d%6d%6d%6d\n",
m[2][0],m[2][1],m[2][2],m[2][3],m[2][4],
m[2][5],m[2][6],m[2][7]);
fprintf(out,"  [.6,.7) | %3d%6d%6d%6d%6d%6d%6d%6d\n",
m[3][0],m[3][1],m[3][2],m[3][3],m[3][4],
m[3][5],m[3][6],m[3][7]);
fprintf(out,"  [.5,.6) | %3d%6d%6d%6d%6d%6d%6d%6d\n",
m[4][0],m[4][1],m[4][2],m[4][3],m[4][4],
m[4][5],m[4][6],m[4][7]);
fprintf(out,"  [.4,.5) | %3d%6d%6d%6d%6d%6d%6d%6d\n",
m[5][0],m[5][1],m[5][2],m[5][3],m[5][4],
m[5][5],m[5][6],m[5][7]);
fprintf(out,"  [.3,.4) | %3d%6d%6d%6d%6d%6d%6d%6d\n",
m[6][0],m[6][1],m[6][2],m[6][3],m[6][4],
m[6][5],m[6][6],m[6][7]);
fprintf(out,"  [.2,.3) | %3d%6d%6d%6d%6d%6d%6d%6d\n",
m[7][0],m[7][1],m[7][2],m[7][3],m[7][4],
m[7][5],m[7][6],m[7][7]);
fprintf(out,"  [.1,.2) | %3d%6d%6d%6d%6d%6d%6d%6d\n",
m[8][0],m[8][1],m[8][2],m[8][3],m[8][4],
m[8][5],m[8][6],m[8][7]);
fprintf(out,"   [0,.1) | %3d%6d%6d%6d%6d%6d%6d%6d\n",
m[9][0],m[9][1],m[9][2],m[9][3],m[9][4],
m[9][5],m[9][6],m[9][7]);
fprintf(out,"  (-.1,0) | %3d%6d%6d%6d%6d%6d%6d%6d\n",
m[10][0],m[10][1],m[10][2],m[10][3],m[10][4],
m[10][5],m[10][6],m[10][7]);
fprintf(out,"(-.2,-.1] | %3d%6d%6d%6d%6d%6d%6d%6d\n",
m[11][0],m[11][1],m[11][2],m[11][3],m[11][4],
m[11][5],m[11][6],m[11][7]);
fprintf(out,"(-.3,-.2] | %3d%6d%6d%6d%6d%6d%6d%6d\n",
m[12][0],m[12][1],m[12][2],m[12][3],m[12][4],
m[12][5],m[12][6],m[12][7]);
fprintf(out,"(-.4,-.3] | %3d%6d%6d%6d%6d%6d%6d%6d\n",
m[13][0],m[13][1],m[13][2],m[13][3],m[13][4],
```

```
    m[13][5],m[13][6],m[13][7]);
    fprintf(out,"(-.5,-.4] | %3d%6d%6d%6d%6d%6d%6d%6d\n",
    m[14][0],m[14][1],m[14][2],m[14][3],m[14][4],
    m[14][5],m[14][6],m[14][7]);
    fprintf(out,"(-.6,-.5] | %3d%6d%6d%6d%6d%6d%6d%6d\n",
    m[15][0],m[15][1],m[15][2],m[15][3],m[15][4],
    m[15][5],m[15][6],m[15][7]);
    fprintf(out,"(-.7,-.6] | %3d%6d%6d%6d%6d%6d%6d%6d\n",
    m[16][0],m[16][1],m[16][2],m[16][3],m[16][4],
    m[16][5],m[16][6],m[16][7]);
    fprintf(out,"(-.8,-.7] | %3d%6d%6d%6d%6d%6d%6d%6d\n",
    m[17][0],m[17][1],m[17][2],m[17][3],m[17][4],
    m[17][5],m[17][6],m[17][7]);
    fprintf(out,"(-.9,-.8] | %3d%6d%6d%6d%6d%6d%6d%6d\n",
    m[18][0],m[18][1],m[18][2],m[18][3],m[18][4],
    m[18][5],m[18][6],m[18][7]);
    fprintf(out," [-1,-.9] | %3d%6d%6d%6d%6d%6d%6d%6d\n",
    m[19][0],m[19][1],m[19][2],m[19][3],m[19][4],
    m[19][5],m[19][6],m[19][7]);
    fprintf(out,"---------------------------------------");
    fprintf(out,"----------");
    fprintf(out,"---------\n\n");
    fprintf(out," MEAN     %5.2f%6.2f%6.2f%6.2f%6.2f%6.2f",
    avg5,avg10,avg20,avg25,avg50,avg100);
    fprintf(out,"%6.2f%6.2f\n",avg500,avg1000);

    fclose(in);
    fclose(out);

    return;
}
```

# Appendix E. *CEP Estimates*

This Appendix lists the CEP estimates for each of the 875 test design points. The names of the four parameters and the names of the CEP estimation methods for this experiment are abbreviated in the table headings as follows:

<u>Index</u>

Test Point - TP

<u>Parameters</u>

Sample Size - SS

Bias - Bias

Ellipticity - Ell

Correlation - Corr

<u>Estimation Methods</u>

Exact - Exact

Grubbs-Patnaik/chi-square method - Grubbs

Modified RAND-234 method - Rand

Ethridge method - Eth

CEP3 method - CEP3

| TP | SS | Bias | Ell | Corr | Exact | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 0.00 | 1.0 | 0.00 | 1000.0 | 1080.4 | 1082.7 | 969.5 | 1002.2 |
| 2 | 3 | 0.00 | 1.0 | 0.40 | 1002.0 | 1076.2 | 1083.2 | 969.5 | 1002.2 |
| 3 | 3 | 0.00 | 1.0 | 0.70 | 1002.0 | 1075.9 | 1082.5 | 969.5 | 1002.2 |
| 4 | 3 | 0.00 | 1.0 | 0.85 | 1002.0 | 1078.2 | 1082.0 | 969.5 | 1002.2 |
| 5 | 3 | 0.00 | 1.0 | 1.00 | 1002.0 | 1076.4 | 1081.3 | 969.5 | 1002.2 |
| 6 | 3 | 0.00 | 0.8 | 0.00 | 898.4 | 988.1 | 974.7 | 873.0 | 904.5 |
| 7 | 3 | 0.00 | 0.8 | 0.40 | 902.2 | 988.8 | 976.5 | 873.0 | 904.5 |
| 8 | 3 | 0.00 | 0.8 | 0.70 | 905.3 | 983.3 | 978.0 | 873.0 | 904.5 |
| 9 | 3 | 0.00 | 0.8 | 0.85 | 906.3 | 982.3 | 978.2 | 873.0 | 904.5 |
| 10 | 3 | 0.00 | 0.8 | 1.00 | 906.7 | 976.5 | 978.0 | 873.0 | 904.5 |
| 11 | 3 | 0.00 | 0.6 | 0.00 | 793.1 | 904.7 | 869.0 | 779.0 | 813.9 |

| TP | SS | Bias | Ell | Corr | Exact | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|---|
| 12 | 3 | 0.00 | 0.6 | 0.40 | 805.1 | 911.9 | 876.3 | 779.0 | 813.9 |
| 13 | 3 | 0.00 | 0.6 | 0.70 | 818.8 | 902.3 | 885.1 | 779.0 | 813.9 |
| 14 | 3 | 0.00 | 0.6 | 0.85 | 823.4 | 898.0 | 887.8 | 779.0 | 813.9 |
| 15 | 3 | 0.00 | 0.6 | 1.00 | 825.0 | 887.4 | 888.7 | 779.0 | 813.9 |
| 16 | 3 | 0.00 | 0.4 | 0.00 | 686.3 | 841.2 | 767.2 | 688.8 | 733.5 |
| 17 | 3 | 0.00 | 0.4 | 0.40 | 714.7 | 840.1 | 786.6 | 688.8 | 733.5 |
| 18 | 3 | 0.00 | 0.4 | 0.70 | 747.4 | 835.9 | 808.5 | 688.8 | 733.5 |
| 19 | 3 | 0.00 | 0.4 | 0.85 | 757.7 | 831.1 | 815.6 | 688.8 | 733.5 |
| 20 | 3 | 0.00 | 0.4 | 1.00 | 761.3 | 820.3 | 818.3 | 688.8 | 733.5 |
| 21 | 3 | 0.00 | 0.2 | 0.00 | 599.6 | 806.9 | 672.6 | 606.8 | 669.6 |
| 22 | 3 | 0.00 | 0.2 | 0.40 | 643.8 | 775.9 | 717.0 | 606.8 | 669.6 |
| 23 | 3 | 0.00 | 0.2 | 0.70 | 698.7 | 791.6 | 755.9 | 606.8 | 669.6 |
| 24 | 3 | 0.00 | 0.2 | 0.85 | 714.8 | 794.1 | 767.8 | 606.8 | 669.6 |
| 25 | 3 | 0.00 | 0.2 | 1.00 | 720.3 | 777.3 | 772.8 | 606.8 | 669.6 |
| 26 | 3 | 0.25 | 1.0 | 0.00 | 1015.8 | 1094.5 | 1108.6 | 983.2 | 1016.7 |
| 27 | 3 | 0.25 | 1.0 | 0.40 | 1017.8 | 1092.3 | 1109.0 | 983.2 | 1016.7 |
| 28 | 3 | 0.25 | 1.0 | 0.70 | 1017.7 | 1097.2 | 1108.3 | 983.2 | 1016.7 |
| 29 | 3 | 0.25 | 1.0 | 0.85 | 1017.7 | 1094.6 | 1107.8 | 983.2 | 1016.7 |
| 30 | 3 | 0.25 | 1.0 | 1.00 | 1017.7 | 1092.2 | 1107.2 | 983.2 | 1016.7 |
| 31 | 3 | 0.25 | 0.8 | 0.00 | 913.7 | 1008.6 | 1001.5 | 887.5 | 919.9 |
| 32 | 3 | 0.25 | 0.8 | 0.40 | 918.1 | 1009.3 | 1003.6 | 887.5 | 919.9 |
| 33 | 3 | 0.25 | 0.8 | 0.70 | 923.5 | 1003.5 | 1005.7 | 887.5 | 919.9 |
| 34 | 3 | 0.25 | 0.8 | 0.85 | 924.0 | 1002.5 | 1006.2 | 887.5 | 919.9 |
| 35 | 3 | 0.25 | 0.8 | 1.00 | 924.0 | 997.0 | 1006.1 | 887.5 | 919.9 |
| 36 | 3 | 0.25 | 0.6 | 0.00 | 808.0 | 925.7 | 896.9 | 794.2 | 830.3 |
| 37 | 3 | 0.25 | 0.6 | 0.40 | 821.3 | 930.4 | 904.9 | 794.2 | 830.3 |
| 38 | 3 | 0.25 | 0.6 | 0.70 | 836.9 | 922.3 | 914.7 | 794.2 | 830.3 |
| 39 | 3 | 0.25 | 0.6 | 0.85 | 842.1 | 917.9 | 917.9 | 794.3 | 830.3 |
| 40 | 3 | 0.25 | 0.6 | 1.00 | 844.0 | 911.5 | 919.0 | 794.3 | 830.3 |
| 41 | 3 | 0.25 | 0.4 | 0.00 | 701.4 | 862.0 | 796.6 | 704.7 | 751.1 |
| 42 | 3 | 0.25 | 0.4 | 0.40 | 731.8 | 859.8 | 816.9 | 704.7 | 751.1 |
| 43 | 3 | 0.25 | 0.4 | 0.70 | 767.0 | 860.7 | 840.1 | 704.7 | 751.1 |
| 44 | 3 | 0.25 | 0.4 | 0.85 | 778.0 | 851.5 | 847.6 | 704.7 | 751.1 |
| 45 | 3 | 0.25 | 0.4 | 1.00 | 781.9 | 838.2 | 850.6 | 704.7 | 751.1 |
| 46 | 3 | 0.25 | 0.2 | 0.00 | 616.8 | 828.1 | 703.5 | 623.4 | 688.2 |
| 47 | 3 | 0.25 | 0.2 | 0.40 | 662.4 | 798.2 | 749.2 | 623.4 | 688.2 |
| 48 | 3 | 0.25 | 0.2 | 0.70 | 719.5 | 811.2 | 788.9 | 623.4 | 688.2 |
| 49 | 3 | 0.25 | 0.2 | 0.85 | 736.4 | 814.5 | 801.2 | 623.4 | 688.2 |
| 50 | 3 | 0.25 | 0.2 | 1.00 | 742.2 | 799.4 | 806.2 | 623.4 | 688.2 |
| 51 | 3 | 0.50 | 1.0 | 0.00 | 1063.1 | 1140.3 | 1184.3 | 1026.5 | 1061.8 |

| TP | SS | Bias | Ell | Corr | Exact | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|---|
| 52 | 3 | 0.50 | 1.0 | 0.40 | 1065.1 | 1147.5 | 1184.6 | 1026.5 | 1061.8 |
| 53 | 3 | 0.50 | 1.0 | 0.70 | 1065.0 | 1152.1 | 1184.2 | 1026.5 | 1061.8 |
| 54 | 3 | 0.50 | 1.0 | 0.85 | 1065.0 | 1149.7 | 1183.9 | 1026.5 | 1061.8 |
| 55 | 3 | 0.50 | 1.0 | 1.00 | 1065.0 | 1154.6 | 1183.6 | 1026.5 | 1061.8 |
| 56 | 3 | 0.50 | 0.8 | 0.00 | 960.1 | 1058.8 | 1080.0 | 932.0 | 967.5 |
| 57 | 3 | 0.50 | 0.8 | 0.40 | 966.5 | 1065.8 | 1083.0 | 932.0 | 967.5 |
| 58 | 3 | 0.50 | 0.8 | 0.70 | 973.1 | 1063.0 | 1086.8 | 932.0 | 967.5 |
| 59 | 3 | 0.50 | 0.8 | 0.85 | 975.4 | 1060.4 | 1088.1 | 932.0 | 967.5 |
| 60 | 3 | 0.50 | 0.8 | 1.00 | 976.4 | 1059.1 | 1088.4 | 932.0 | 967.5 |
| 61 | 3 | 0.50 | 0.6 | 0.00 | 853.9 | 981.6 | 978.7 | 839.9 | 880.6 |
| 62 | 3 | 0.50 | 0.6 | 0.40 | 871.4 | 984.7 | 988.6 | 839.9 | 880.6 |
| 63 | 3 | 0.50 | 0.6 | 0.70 | 892.2 | 982.1 | 1001.4 | 839.9 | 880.6 |
| 64 | 3 | 0.50 | 0.6 | 0.85 | 899.0 | 979.9 | 1005.6 | 839.9 | 880.6 |
| 65 | 3 | 0.50 | 0.6 | 1.00 | 901.6 | 973.5 | 1007.2 | 839.9 | 880.6 |
| 66 | 3 | 0.50 | 0.4 | 0.00 | 748.9 | 921.7 | 882.3 | 752.1 | 804.3 |
| 67 | 3 | 0.50 | 0.4 | 0.40 | 784.6 | 916.4 | 905.7 | 752.1 | 804.3 |
| 68 | 3 | 0.50 | 0.4 | 0.70 | 826.6 | 917.4 | 932.2 | 752.1 | 804.3 |
| 69 | 3 | 0.50 | 0.4 | 0.85 | 839.7 | 917.0 | 940.7 | 752.1 | 804.3 |
| 70 | 3 | 0.50 | 0.4 | 1.00 | 844.4 | 906.4 | 944.1 | 752.1 | 804.3 |
| 71 | 3 | 0.50 | 0.2 | 0.00 | 670.7 | 892.9 | 793.8 | 672.8 | 744.2 |
| 72 | 3 | 0.50 | 0.2 | 0.40 | 719.2 | 860.6 | 843.1 | 672.8 | 744.2 |
| 73 | 3 | 0.50 | 0.2 | 0.70 | 782.8 | 877.2 | 885.3 | 672.8 | 744.2 |
| 74 | 3 | 0.50 | 0.2 | 0.85 | 801.7 | 877.4 | 898.3 | 672.8 | 744.2 |
| 75 | 3 | 0.50 | 0.2 | 1.00 | 808.3 | 865.2 | 903.8 | 672.8 | 744.2 |
| 76 | 3 | 0.75 | 1.0 | 0.00 | 1142.6 | 1216.3 | 1302.7 | 1100.0 | 1135.6 |
| 77 | 3 | 0.75 | 1.0 | 0.40 | 1144.6 | 1231.1 | 1303.6 | 1100.0 | 1135.6 |
| 78 | 3 | 0.75 | 1.0 | 0.70 | 1144.4 | 1234.7 | 1304.5 | 1100.0 | 1135.6 |
| 79 | 3 | 0.75 | 1.0 | 0.85 | 1144.4 | 1243.5 | 1304.6 | 1100.0 | 1135.5 |
| 80 | 3 | 0.75 | 1.0 | 1.00 | 1144.4 | 1242.9 | 1304.6 | 1100.0 | 1135.6 |
| 81 | 3 | 0.75 | 0.8 | 0.00 | 1039.4 | 1138.9 | 1202.5 | 1007.2 | 1045.0 |
| 82 | 3 | 0.75 | 0.8 | 0.40 | 1048.7 | 1149.3 | 1207.7 | 1007.2 | 1045.0 |
| 83 | 3 | 0.75 | 0.8 | 0.70 | 1059.1 | 1148.2 | 1214.7 | 1007.2 | 1045.0 |
| 84 | 3 | 0.75 | 0.8 | 0.85 | 1062.7 | 1154.2 | 1217.1 | 1007.2 | 1045.0 |
| 85 | 3 | 0.75 | 0.8 | 1.00 | 1064.1 | 1150.6 | 1217.9 | 1007.2 | 1045.0 |
| 86 | 3 | 0.75 | 0.6 | 0.00 | 934.2 | 1069.2 | 1106.1 | 917.2 | 962.2 |
| 87 | 3 | 0.75 | 0.6 | 0.40 | 957.4 | 1071.0 | 1119.7 | 917.2 | 962.2 |
| 88 | 3 | 0.75 | 0.6 | 0.70 | 985.3 | 1078.2 | 1137.1 | 917.2 | 962.2 |
| 89 | 3 | 0.75 | 0.6 | 0.85 | 994.5 | 1073.6 | 1143.0 | 917.2 | 962.2 |
| 90 | 3 | 0.75 | 0.6 | 1.00 | 998.0 | 1070.4 | 1145.2 | 917.2 | 962.2 |
| 91 | 3 | 0.75 | 0.4 | 0.00 | 834.2 | 1016.5 | 1015.2 | 832.2 | 890.3 |

| TP | SS | Bias | Ell | Corr | Exact | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|---|
| 92 | 3 | 0.75 | 0.4 | 0.40 | 876.1 | 1006.2 | 1043.7 | 832.2 | 890.3 |
| 93 | 3 | 0.75 | 0.4 | 0.70 | 926.8 | 1010.6 | 1075.4 | 832.2 | 890.3 |
| 94 | 3 | 0.75 | 0.4 | 0.85 | 942.7 | 1013.0 | 1085.6 | 832.2 | 890.3 |
| 95 | 3 | 0.75 | 0.4 | 1.00 | 948.5 | 1003.9 | 1089.6 | 832.2 | 890.3 |
| 96 | 3 | 0.75 | 0.2 | 0.00 | 767.1 | 990.0 | 933.1 | 756.3 | 834.5 |
| 97 | 3 | 0.75 | 0.2 | 0.40 | 816.5 | 954.8 | 988.3 | 756.3 | 834.5 |
| 98 | 3 | 0.75 | 0.2 | 0.70 | 888.5 | 976.9 | 1034.4 | 756.3 | 834.5 |
| 99 | 3 | 0.75 | 0.2 | 0.85 | 910.3 | 977.4 | 1048.7 | 756.3 | 834.5 |
| 100 | 3 | 0.75 | 0.2 | 1.00 | 918.0 | 962.1 | 1054.8 | 756.3 | 834.5 |
| 101 | 3 | 1.00 | 1.0 | 0.00 | 1253.4 | 1315.4 | 1454.6 | 1202.6 | 1235.0 |
| 102 | 3 | 1.00 | 1.0 | 0.40 | 1255.3 | 1336.3 | 1457.2 | 1202.6 | 1235.0 |
| 103 | 3 | 1.00 | 1.0 | 0.70 | 1255.0 | 1350.1 | 1460.8 | 1202.6 | 1235.0 |
| 104 | 3 | 1.00 | 1.0 | 0.85 | 1254.9 | 1354.8 | 1462.1 | 1202.6 | 1235.0 |
| 105 | 3 | 1.00 | 1.0 | 1.00 | 1254.9 | 1354.8 | 1462.5 | 1202.6 | 1235.0 |
| 106 | 3 | 1.00 | 0.8 | 0.00 | 1152.2 | 1243.4 | 1359.3 | 1112.4 | 1149.2 |
| 107 | 3 | 1.00 | 0.8 | 0.40 | 1164.6 | 1256.7 | 1367.9 | 1112.4 | 1149.2 |
| 108 | 3 | 1.00 | 0.8 | 0.70 | 1178.5 | 1266.8 | 1379.8 | 1112.4 | 1149.2 |
| 109 | 3 | 1.00 | 0.8 | 0.85 | 1183.4 | 1268.4 | 1383.9 | 1112.4 | 1149.2 |
| 110 | 3 | 1.00 | 0.8 | 1.00 | 1185.3 | 1269.9 | 1385.6 | 1112.4 | 1149.2 |
| 111 | 3 | 1.00 | 0.6 | 0.00 | 1051.7 | 1183.0 | 1268.3 | 1025.6 | 1071.5 |
| 112 | 3 | 1.00 | 0.6 | 0.40 | 1079.7 | 1185.5 | 1287.2 | 1025.6 | 1071.5 |
| 113 | 3 | 1.00 | 0.6 | 0.70 | 1113.9 | 1183.9 | 1311.0 | 1025.6 | 1071.5 |
| 114 | 3 | 1.00 | 0.6 | 0.85 | 1125.2 | 1189.8 | 1319.0 | 1025.6 | 1071.5 |
| 115 | 3 | 1.00 | 0.6 | 1.00 | 1129.4 | [illegible]92.7 | 1322.2 | 1025.6 | 1071.5 |
| 116 | 3 | 1.00 | 0.4 | 0.00 | 962.5 | 1136.4 | 1183.8 | 944.4 | 1004.9 |
| 117 | 3 | 1.00 | 0.4 | 0.40 | 1006.4 | 1120.6 | 1219.3 | 944.4 | 1004.9 |
| 118 | 3 | 1.00 | 0.4 | 0.70 | 1063.5 | 1127.8 | 1257.5 | 944.4 | 1004.9 |
| 119 | 3 | 1.00 | 0.4 | 0.85 | 1082.1 | 1130.3 | 1269.7 | 944.4 | 1004.9 |
| 120 | 3 | 1.00 | 0.4 | 1.00 | 1088.8 | 1124.4 | 1274.7 | 944.4 | 1004.9 |
| 121 | 3 | 1.00 | 0.2 | 0.00 | 909.0 | 1112.9 | 1108.4 | 873.1 | 954.2 |
| 122 | 3 | 1.00 | 0.2 | 0.40 | 954.2 | 1079.1 | 1171.5 | 873.1 | 954.2 |
| 123 | 3 | 1.00 | 0.2 | 0.70 | 1030.8 | 1101.4 | 1222.7 | 873.1 | 954.2 |
| 124 | 3 | 1.00 | 0.2 | 0.85 | 1055.5 | 1100.4 | 1238.6 | 873.1 | 954.2 |
| 125 | 3 | 1.00 | 0.2 | 1.00 | 1064.2 | 1072.6 | 1245.5 | 873.1 | 954.2 |
| 126 | 3 | 1.50 | 1.0 | 0.00 | 1550.8 | 1581.8 | 1824.2 | 1478.5 | 1495.5 |
| 127 | 3 | 1.50 | 1.0 | 0.40 | 1552.5 | 1595.7 | 1834.3 | 1478.5 | 1495.5 |
| 128 | 3 | 1.50 | 1.0 | 0.70 | 1552.0 | 1612.4 | 1848.8 | 1478.5 | 1495.5 |
| 129 | 3 | 1.50 | 1.0 | 0.85 | 1551.8 | 1615.2 | 1854.1 | 1478.5 | 1495.5 |
| 130 | 3 | 1.50 | 1.0 | 1.00 | 1551.8 | 1622.5 | 1856.2 | 1478.5 | 1495.5 |
| 131 | 3 | 1.50 | 0.8 | 0.00 | 1462.9 | 1517.5 | 1738.6 | 1396.5 | 1420.7 |

| TP | SS | Bias | Ell | Corr | Exact | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|---|
| ---- | -- | ---- | --- | ---- | ------ | ------ | ------ | ------ | ------ |
| 132 | 3 | 1.50 | 0.8 | 0.40 | 1477.4 | 1523.3 | 1758.4 | 1396.5 | 1420.7 |
| 133 | 3 | 1.50 | 0.8 | 0.70 | 1494.1 | 1525.6 | 1784.8 | 1396.5 | 1420.7 |
| 134 | 3 | 1.50 | 0.8 | 0.85 | 1499.8 | 1530.4 | 1793.9 | 1396.5 | 1420.7 |
| 135 | 3 | 1.50 | 0.8 | 1.00 | 1502.0 | 1538.6 | 1797.6 | 1396.5 | 1420.7 |
| 136 | 3 | 1.50 | 0.6 | 0.00 | 1383.2 | 1468.4 | 1658.5 | 1319.3 | 1354.6 |
| 137 | 3 | 1.50 | 0.6 | 0.40 | 1409.9 | 1469.1 | 1692.3 | 1319.3 | 1354.6 |
| 138 | 3 | 1.50 | 0.6 | 0.70 | 1446.0 | 1456.4 | 1732.4 | 1319.3 | 1354.6 |
| 139 | 3 | 1.50 | 0.6 | 0.85 | 1458.6 | 1454.8 | 1745.6 | 1319.3 | 1354.6 |
| 140 | 3 | 1.50 | 0.6 | 1.00 | 1463.3 | 1457.2 | 1750.9 | 1319.3 | 1354.6 |
| 141 | 3 | 1.50 | 0.4 | 0.00 | 1323.3 | 1431.5 | 1585.5 | 1249.3 | 1299.7 |
| 142 | 3 | 1.50 | 0.4 | 0.40 | 1355.1 | 1409.2 | 1639.5 | 1249.3 | 1299.7 |
| 143 | 3 | 1.50 | 0.4 | 0.70 | 1408.8 | 1411.6 | 1693.2 | 1249.3 | 1299 7 |
| 144 | 3 | 1.50 | 0.4 | 0.85 | 1428.3 | 1402.5 | 1710.2 | 1249.3 | 1299.7 |
| 145 | 3 | 1.50 | 0.4 | 1.00 | 1435.5 | 1380.5 | 1717.2 | 1249.3 | 1299.7 |
| 146 | 3 | 1.50 | 0.2 | 0.00 | 1288.5 | 1409.1 | 1521.8 | 1191.0 | 1260.0 |
| 147 | 3 | 1.50 | 0.2 | 0.40 | 1319.5 | 1386.0 | 1605.1 | 1191.0 | 1260.0 |
| 148 | 3 | 1.50 | 0.2 | 0.70 | 1384.3 | 1406.6 | 1668.7 | 1191.0 | 1260.0 |
| 149 | 3 | 1.50 | 0.2 | 0.85 | 1409.6 | 1386.9 | 1688.4 | 1191.0 | 1260.0 |
| 150 | 3 | 1.50 | 0.2 | 1.00 | 1418.8 | 1329.7 | 1697.3 | 1191.0 | 1260.0 |
| 151 | 3 | 2.00 | 1.0 | 0.00 | 1907.6 | 1898.7 | 2240.7 | 1825.1 | 1813.2 |
| 152 | 3 | 2.00 | 1.0 | 0.40 | 1909.1 | 1895.4 | 2263.7 | 1825.1 | 1813.2 |
| 153 | 3 | 2.00 | 1.0 | 0.70 | 1908.8 | 1884.7 | 2295.1 | 1825.1 | 1813.2 |
| 154 | 3 | 2.00 | 1.0 | 0.85 | 1908.6 | 1902.8 | 2306.1 | 1825.1 | 1813.2 |
| 155 | 3 | 2.00 | 1.0 | 1.00 | 1908.6 | 1899.5 | 2310.6 | 1825.1 | 1813.2 |
| 156 | 3 | 2.00 | 0.8 | 0.00 | 1836.5 | 1847.9 | 2163.4 | 1753.8 | 1749.4 |
| 157 | 3 | 2.00 | 0.8 | 0.40 | 1848.6 | 1830.7 | 2199.5 | 1753.8 | 1749.4 |
| 158 | 3 | 2.00 | 0.8 | 0.70 | 1863.7 | 1811.7 | 2244.5 | 1753.8 | 1749.4 |
| 159 | 3 | 2.00 | 0.8 | 0.85 | 1868.9 | 1811.5 | 2259.6 | 1753.8 | 1749.4 |
| 160 | 3 | 2.00 | 0.8 | 1.00 | 1871.2 | 1810.9 | 2265.7 | 1753.8 | 1749.4 |
| 161 | 3 | 2.00 | 0.6 | 0.00 | 1776.8 | 1804.7 | 2091.9 | 1688.7 | 1694.5 |
| 162 | 3 | 2.00 | 0.6 | 0.40 | 1796.3 | 1768.8 | 2145.4 | 1688.7 | 1694.5 |
| 163 | 3 | 2.00 | 0.6 | 0.70 | 1826.2 | 1758.0 | 2204.0 | 1688.7 | 1694.5 |
| 164 | 3 | 2.00 | 0.6 | 0.85 | 1837.4 | 1737.0 | 2223.0 | 1688.7 | 1694.5 |
| 165 | 3 | 2.00 | 0.6 | 1.00 | 1841.8 | 1718.5 | 2230.7 | 1688.7 | 1694.5 |
| 166 | 3 | 2.00 | 0.4 | 0.00 | 1733.2 | 1775.8 | 2027.5 | 1632.6 | 1650.6 |
| 167 | 3 | 2.00 | 0.4 | 0.40 | 1755.4 | 1736.0 | 2104.1 | 1632.6 | 1650.6 |
| 168 | 3 | 2.00 | 0.4 | 0.70 | 1797.0 | 1716.2 | 2174.4 | 1632.6 | 1650.6 |
| 169 | 3 | 2.00 | 0.4 | 0.85 | 1814.3 | 1686.0 | 2196.6 | 1632.6 | 1650.6 |
| 170 | 3 | 2.00 | 0.4 | 1.00 | 1820.8 | 1641.4 | 2206.0 | 1632.6 | 1650.6 |
| 171 | 3 | 2.00 | 0.2 | 0.00 | 1707.1 | 1755.5 | 1971.3 | 1588.6 | 1620.5 |

| TP | SS | Bias | Ell | Corr | Exact | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|---|
| 172 | 3 | 2.00 | 0.2 | 0.40 | 1730.6 | 1741.7 | 2078.5 | 1588.6 | 1620.5 |
| 173 | 3 | 2.00 | 0.2 | 0.70 | 1778.3 | 1742.5 | 2156.3 | 1588.6 | 1620.5 |
| 174 | 3 | 2.00 | 0.2 | 0.85 | 1800.3 | 1691.8 | 2180.4 | 1588.6 | 1620.5 |
| 175 | 3 | 2.00 | 0.2 | 1.00 | 1808.1 | 1585.7 | 2191.8 | 1588.6 | 1620.5 |
| 176 | 5 | 0.00 | 1.0 | 0.00 | 1000.0 | 1017.9 | 1047.9 | 942.7 | 1002.2 |
| 177 | 5 | 0.00 | 1.0 | 0.40 | 1002.0 | 1011.2 | 1048.0 | 942.7 | 1002.2 |
| 178 | 5 | 0.00 | 1.0 | 0.70 | 1002.0 | 1012.3 | 1047.1 | 942.7 | 1002.2 |
| 179 | 5 | 0.00 | 1.0 | 0.85 | 1002.0 | 1011.7 | 1046.7 | 942.7 | 1002.2 |
| 180 | 5 | 0.00 | 1.0 | 1.00 | 1002.0 | 1009.4 | 1046.4 | 942.7 | 1002.2 |
| 181 | 5 | 0.00 | 0.8 | 0.00 | 898.4 | 939.3 | 942.5 | 849.0 | 904.5 |
| 182 | 5 | 0.00 | 0.8 | 0.40 | 902.2 | 940.2 | 944.2 | 849.0 | 904.5 |
| 183 | 5 | 0.00 | 0.8 | 0.70 | 905.3 | 932.3 | 945.9 | 849.0 | 904.5 |
| 184 | 5 | 0.00 | 0.8 | 0.85 | 906.3 | 926.1 | 946.4 | 849.0 | 904.5 |
| 185 | 5 | 0.00 | 0.8 | 1.00 | 906.7 | 921.1 | 946.4 | 849.0 | 904.5 |
| 186 | 5 | 0.00 | 0.6 | 0.00 | 793.1 | 869.7 | 838.1 | 756.7 | 813.9 |
| 187 | 5 | 0.00 | 0.6 | 0.40 | 805.1 | 872.0 | 846.0 | 756.7 | 813.9 |
| 188 | 5 | 0.00 | 0.6 | 0.70 | 818.8 | 861.2 | 856.1 | 756.7 | 813.9 |
| 189 | 5 | 0.00 | 0.6 | 0.85 | 823.4 | 855.3 | 859.4 | 756.7 | 813.9 |
| 190 | 5 | 0.00 | 0.6 | 1.00 | 825.0 | 844.3 | 860.6 | 756.7 | 813.9 |
| 191 | 5 | 0.00 | 0.4 | 0.00 | 686.3 | 804.8 | 735.8 | 666.3 | 733.5 |
| 192 | 5 | 0.00 | 0.4 | 0.40 | 714.7 | 803.0 | 757.5 | 666.3 | 733.5 |
| 193 | 5 | 0.00 | 0.4 | 0.70 | 747.4 | 809.5 | 782.5 | 666.3 | 733.5 |
| 194 | 5 | 0.00 | 0.4 | 0.85 | 757.7 | 799.5 | 790.5 | 666.3 | 733.5 |
| 195 | 5 | 0.00 | 0.4 | 1.00 | 761.3 | 781.1 | 793.7 | 666.3 | 733.5 |
| 196 | 5 | 0.00 | 0.2 | 0.00 | 599.6 | 779.4 | 638.3 | 580.8 | 669.6 |
| 197 | 5 | 0.00 | 0.2 | 0.40 | 643.0 | 743.0 | 688.6 | 580.8 | 669.6 |
| 198 | 5 | 0.00 | 0.2 | 0.70 | 698.7 | 762.8 | 732.1 | 580.8 | 669.6 |
| 199 | 5 | 0.00 | 0.2 | 0.85 | 714.8 | 770.3 | 745.6 | 580.8 | 669.6 |
| 200 | 5 | 0.00 | 0.2 | 1.00 | 720.3 | 752.3 | 751.4 | 580.8 | 669.6 |
| 201 | 5 | 0.25 | 1.0 | 0.00 | 1015.8 | 1035.2 | 1075.5 | 954.4 | 1016.7 |
| 202 | 5 | 0.25 | 1.0 | 0.40 | 1017.8 | 1031.1 | 1075.6 | 954.4 | 1016.7 |
| 203 | 5 | 0.25 | 1.0 | 0.70 | 1017.7 | 1033.7 | 1075.0 | 954.4 | 1016.7 |
| 204 | 5 | 0.25 | 1.0 | 0.85 | 1017.7 | 1037.9 | 1074.7 | 954.4 | 1016.7 |
| 205 | 5 | 0.25 | 1.0 | 1.00 | 1017.7 | 1034.8 | 1074.3 | 954.4 | 1016.7 |
| 206 | 5 | 0.25 | 0.8 | 0.00 | 913.7 | 955.6 | 971.3 | 861.5 | 919.9 |
| 207 | 5 | 0.25 | 0.8 | 0.40 | 918.1 | 959.4 | 973.4 | 861.5 | 919.9 |
| 208 | 5 | 0.25 | 0.8 | 0.70 | 922.0 | 955.4 | 975.9 | 861.5 | 919.9 |
| 209 | 5 | 0.25 | 0.8 | 0.85 | 923.5 | 956.6 | 976.6 | 861.5 | 919.9 |
| 210 | 5 | 0.25 | 0.8 | 1.00 | 924.0 | 945.9 | 976.8 | 861.5 | 919.9 |
| 211 | 5 | 0.25 | 0.6 | 0.00 | 808.0 | 889.5 | 868.3 | 770.1 | 830.3 |

| TP | SS | Bias | Ell | Corr | Exact | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|---|
| 212 | 5 | 0.25 | 0.6 | 0.40 | 821.3 | 893.6 | 877.0 | 770.1 | 830.3 |
| 213 | 5 | 0.25 | 0.6 | 0.70 | 836.9 | 892.5 | 888.3 | 770.1 | 830.3 |
| 214 | 5 | 0.25 | 0.6 | 0.85 | 842.1 | 882.2 | 892.0 | 770.1 | 830.3 |
| 215 | 5 | 0.25 | 0.6 | 1.00 | 844.0 | 868.4 | 893.4 | 770.1 | 830.3 |
| 216 | 5 | 0.25 | 0.4 | 0.00 | 701.4 | 829.1 | 767.8 | 681.2 | 751.1 |
| 217 | 5 | 0.25 | 0.4 | 0.40 | 731.8 | 826.5 | 790.6 | 681.2 | 751.1 |
| 218 | 5 | 0.25 | 0.4 | 0.70 | 767.0 | 832.9 | 816.8 | 681.2 | 751.1 |
| 219 | 5 | 0.25 | 0.4 | 0.85 | 778.0 | 826.9 | 825.3 | 681.2 | 751.1 |
| 220 | 5 | 0.25 | 0.4 | 1.00 | 781.9 | 810.1 | 828.7 | 681.2 | 751.1 |
| 221 | 5 | 0.25 | 0.2 | 0.00 | 616.8 | 806.2 | 672.6 | 596.8 | 688.2 |
| 222 | 5 | 0.25 | 0.2 | 0.40 | 662.4 | 765.6 | 723.9 | 596.8 | 688.2 |
| 223 | 5 | 0.25 | 0.2 | 0.70 | 719.5 | 790.3 | 768.2 | 596.8 | 688.2 |
| 224 | 5 | 0.25 | 0.2 | 0.85 | 736.4 | 796.3 | 781.9 | 596.8 | 688.2 |
| 225 | 5 | 0.25 | 0.2 | 1.00 | 742.2 | 782.8 | 787.8 | 596.8 | 688.2 |
| 226 | 5 | 0.50 | 1.0 | 0.00 | 1063.1 | 1085.2 | 1156.1 | 996.8 | 1061.8 |
| 227 | 5 | 0.50 | 1.0 | 0.40 | 1065.1 | 1096.5 | 1156.4 | 996.8 | 1061.8 |
| 228 | 5 | 0.50 | 1.0 | 0.70 | 1065.0 | 1097.3 | 1156.3 | 996.8 | 1061.8 |
| 229 | 5 | 0.50 | 1.0 | 0.85 | 1065.0 | 1100.7 | 1156.1 | 996.8 | 1061.8 |
| 230 | 5 | 0.50 | 1.0 | 1.00 | 1065.0 | 1101.8 | 1155.8 | 996.8 | 1061.8 |
| 231 | 5 | 0.50 | 0.8 | 0.00 | 960.1 | 1011.0 | 1055.0 | 904.6 | 967.5 |
| 232 | 5 | 0.50 | 0.8 | 0.40 | 966.5 | 1023.0 | 1058.6 | 904.6 | 967.5 |
| 233 | 5 | 0.50 | 0.8 | 0.70 | 973.1 | 1029.0 | 1063.1 | 904.6 | 967.5 |
| 234 | 5 | 0.50 | 0.8 | 0.85 | 975.4 | 1022.7 | 1064.6 | 904.6 | 967.5 |
| 235 | 5 | 0.50 | 0.8 | 1.00 | 976.4 | 1017.6 | 1065.0 | 904.6 | 967.5 |
| 236 | 5 | 0.50 | 0.6 | 0.00 | 853.9 | 946.9 | 956.0 | 813.8 | 880.6 |
| 237 | 5 | 0.50 | 0.6 | 0.40 | 871.4 | 953.8 | 967.2 | 813.8 | 880.6 |
| 238 | 5 | 0.50 | 0.6 | 0.70 | 892.2 | 958.9 | 981.7 | 813.8 | 880.6 |
| 239 | 5 | 0.50 | 0.6 | 0.85 | 899.0 | 956.4 | 986.5 | 813.8 | 880.6 |
| 240 | 5 | 0.50 | 0.6 | 1.00 | 901.6 | 942.7 | 988.4 | 813.8 | 880.6 |
| 241 | 5 | 0.50 | 0.4 | 0.00 | 748.9 | 894.9 | 860.5 | 725.8 | 804.3 |
| 242 | 5 | 0.50 | 0.4 | 0.40 | 784.6 | 888.7 | 886.6 | 725.8 | 804.3 |
| 243 | 5 | 0.50 | 0.4 | 0.70 | 826.6 | 898.6 | 916.2 | 725.8 | 804.3 |
| 244 | 5 | 0.50 | 0.4 | 0.85 | 839.7 | 906.1 | 925.9 | 725.8 | 804.3 |
| 245 | 5 | 0.50 | 0.4 | 1.00 | 844.4 | 887.0 | 929.8 | 725.8 | 804.3 |
| 246 | 5 | 0.50 | 0.2 | 0.00 | 670.7 | 877.5 | 771.3 | 642.6 | 744.2 |
| 247 | 5 | 0.50 | 0.2 | 0.40 | 719.2 | 829.9 | 826.0 | 642.6 | 744.2 |
| 248 | 5 | 0.50 | 0.2 | 0.70 | 782.8 | 864.2 | 872.4 | 642.6 | 744.2 |
| 249 | 5 | 0.50 | 0.2 | 0.85 | 801.7 | 872.5 | 886.8 | 642.6 | 744.2 |
| 250 | 5 | 0.50 | 0.2 | 1.00 | 808.3 | 859.8 | 893.1 | 642.6 | 744.2 |
| 251 | 5 | 0.75 | 1.0 | 0.00 | 1142.6 | 1165.4 | 1280.6 | 1066.8 | 1135.6 |

| TP | SS | Bias | Ell | Corr | Exact | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|---|
| 252 | 5 | 0.75 | 1.0 | 0.40 | 1144.6 | 1195.2 | 1281.9 | 1066.8 | 1135.6 |
| 253 | 5 | 0.75 | 1.0 | 0.70 | 1144.4 | 1203.5 | 1283.2 | 1066.8 | 1135.6 |
| 254 | 5 | 0.75 | 1.0 | 0.85 | 1144.4 | 1202.6 | 1283.6 | 1066.8 | 1135.5 |
| 255 | 5 | 0.75 | 1.0 | 1.00 | 1144.4 | 1209.5 | 1283.6 | 1066.8 | 1135.6 |
| 256 | 5 | 0.75 | 0.8 | 0.00 | 1039.4 | 1097.1 | 1184.1 | 975.6 | 1045.0 |
| 257 | 5 | 0.75 | 0.8 | 0.40 | 1048.7 | 1121.3 | 1190.2 | 975.6 | 1045.0 |
| 258 | 5 | 0.75 | 0.8 | 0.70 | 1059.1 | 1134.6 | 1198.4 | 975.6 | 1045.0 |
| 259 | 5 | 0.75 | 0.8 | 0.85 | 1062.7 | 1125.8 | 1201.1 | 975.6 | 1045.0 |
| 260 | 5 | 0.75 | 0.8 | 1.00 | 1064.1 | 1125.6 | 1202.2 | 975.6 | 1045.0 |
| 261 | 5 | 0.75 | 0.6 | 0.00 | 934.2 | 1042.2 | 1090.5 | 886.4 | 962.2 |
| 262 | 5 | 0.75 | 0.6 | 0.40 | 957.4 | 1050.1 | 1105.9 | 886.4 | 962.2 |
| 263 | 5 | 0.75 | 0.6 | 0.70 | 985.3 | 1065.0 | 1125.4 | 886.4 | 962.2 |
| 264 | 5 | 0.75 | 0.6 | 0.85 | 994.5 | 1066.6 | 1132.0 | 886.4 | 962.2 |
| 265 | 5 | 0.75 | 0.6 | 1.00 | 998.0 | 1058.5 | 1134.6 | 886.4 | 962.2 |
| 266 | 5 | 0.75 | 0.4 | 0.00 | 834.2 | 990.6 | 1001.7 | 800.5 | 890.3 |
| 267 | 5 | 0.75 | 0.4 | 0.40 | 876.1 | 984.1 | 1033.1 | 800.5 | 890.3 |
| 268 | 5 | 0.75 | 0.4 | 0.70 | 926.8 | 1010.6 | 1067.9 | 800.5 | 890.3 |
| 269 | 5 | 0.75 | 0.4 | 0.85 | 942.7 | 1012.2 | 1079.2 | 800.5 | 890.3 |
| 270 | 5 | 0.75 | 0.4 | 1.00 | 948.5 | 1005.2 | 1083.9 | 800.5 | 890.3 |
| 271 | 5 | 0.75 | 0.2 | 0.00 | 767.1 | 977.5 | 920.2 | 720.6 | 834.5 |
| 272 | 5 | 0.75 | 0.2 | 0.40 | 816.5 | 929.6 | 980.3 | 720.6 | 834.5 |
| 273 | 5 | 0.75 | 0.2 | 0.70 | 888.5 | 976.3 | 1030.2 | 720.6 | 834.5 |
| 274 | 5 | 0.75 | 0.2 | 0.85 | 810.3 | 984.6 | 1045.7 | 720.6 | 834.5 |
| 275 | 5 | 0.75 | 0.2 | 1.00 | 918.0 | 972.3 | 1052.6 | 720.6 | 834.5 |
| 276 | 5 | 1.00 | 1.0 | 0.00 | 1253.4 | 1272.3 | 1438.1 | 1166.7 | 1235.0 |
| 277 | 5 | 1.00 | 1.0 | 0.40 | 1255.3 | 1308.4 | 1441.5 | 1166.7 | 1235.0 |
| 278 | 5 | 1.00 | 1.0 | 0.70 | 1255.0 | 1333.2 | 1446.0 | 1166.7 | 1235.0 |
| 279 | 5 | 1.00 | 1.0 | 0.85 | 1254.9 | 1338.8 | 1447.6 | 1166.7 | 1235.0 |
| 280 | 5 | 1.00 | 1.0 | 1.00 | 1254.9 | 1339.4 | 1448.2 | 1166.7 | 1235.0 |
| 281 | 5 | 1.00 | 0.8 | 0.00 | 1152.2 | 1213.4 | 1346.7 | 1077.6 | 1149.2 |
| 282 | 5 | 1.00 | 0.8 | 0.40 | 1164.6 | 1244.1 | 1356.8 | 1077.6 | 1149.2 |
| 283 | 5 | 1.00 | 0.8 | 0.70 | 1178.5 | 1258.6 | 1370.3 | 1077.6 | 1149.2 |
| 284 | 5 | 1.00 | 0.8 | 0.85 | 1183.4 | 1264.5 | 1374.9 | 1077.6 | 1149.2 |
| 285 | 5 | 1.00 | 0.8 | 1.00 | 1185.3 | 1264.1 | 1376.8 | 1077.6 | 1149.2 |
| 286 | 5 | 1.00 | 0.6 | 0.00 | 1051.7 | 1154.8 | 1259.2 | 990.9 | 1071.5 |
| 287 | 5 | 1.00 | 0.6 | 0.40 | 1079.7 | 1174.3 | 1280.2 | 990.9 | 1071.5 |
| 288 | 5 | 1.00 | 0.6 | 0.70 | 1113.9 | 1192.8 | 1306.4 | 990.9 | 1071.5 |
| 289 | 5 | 1.00 | 0.6 | 0.85 | 1125.2 | 1194.3 | 1315.2 | 990.9 | 1071.5 |
| 290 | 5 | 1.00 | 0.6 | 1.00 | 1129.4 | 1194.6 | 1318.8 | 990.9 | 1071.5 |
| 291 | 5 | 1.00 | 0.4 | 0.00 | 962.5 | 1110.5 | 1177.4 | 907.8 | 1004.9 |

| TP | SS | Bias | Ell | Corr | Exact | Grubbs | Rand | Eth | CEP3 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 292 | 5 | 1.00 | 0.4 | 0.40 | 1006.4 | 1109.3 | 1216.0 | 907.8 | 1004.9 |
| 293 | 5 | 1.00 | 0.4 | 0.70 | 1063.5 | 1142.1 | 1257.1 | 907.8 | 1004.9 |
| 294 | 5 | 1.00 | 0.4 | 0.85 | 1082.1 | 1147.5 | 1270.5 | 907.8 | 1004.9 |
| 295 | 5 | 1.00 | 0.4 | 1.00 | 1088.8 | 1140.1 | 1276.0 | 907.8 | 1004.9 |
| 296 | 5 | 1.00 | 0.2 | 0.00 | 909.0 | 1095.4 | 1103.6 | 831.7 | 954.2 |
| 297 | 5 | 1.00 | 0.2 | 0.40 | 954.2 | 1059.1 | 1171.1 | 831.7 | 954.2 |
| 298 | 5 | 1.00 | 0.2 | 0.70 | 1030.8 | 1111.8 | 1225.5 | 831.7 | 954.2 |
| 299 | 5 | 1.00 | 0.2 | 0.85 | 1055.5 | 1122.0 | 1242.5 | 831.7 | 954.2 |
| 300 | 5 | 1.00 | 0.2 | 1.00 | 1064.2 | 1108.3 | 1250.2 | 831.7 | 954.2 |
| 301 | 5 | 1.50 | 1.0 | 0.00 | 1550.8 | 1556.9 | 1814.5 | 1439.6 | 1495.5 |
| 302 | 5 | 1.50 | 1.0 | 0.40 | 1552.5 | 1606.3 | 1826.5 | 1439.6 | 1495.5 |
| 303 | 5 | 1.50 | 1.0 | 0.70 | 1552.0 | 1622.5 | 1843.2 | 1439.6 | 1495.5 |
| 304 | 5 | 1.50 | 1.0 | 0.85 | 1551.8 | 1629.4 | 1849.1 | 1439.6 | 1495.5 |
| 305 | 5 | 1.50 | 1.0 | 1.00 | 1551.8 | 1627.3 | 1851.5 | 1439.6 | 1495.5 |
| 306 | 5 | 1.50 | 0.8 | 0.00 | 1462.9 | 1496.1 | 1733.1 | 1357.7 | 1420.7 |
| 307 | 5 | 1.50 | 0.8 | 0.40 | 1477.4 | 1534.8 | 1755.2 | 1357.7 | 1420.7 |
| 308 | 5 | 1.50 | 0.8 | 0.70 | 1494.1 | 1555.8 | 1784.0 | 1357.7 | 1420.7 |
| 309 | 5 | 1.50 | 0.8 | 0.85 | 1499.8 | 1551.6 | 1793.9 | 1357.7 | 1420.7 |
| 310 | 5 | 1.50 | 0.8 | 1.00 | 1502.0 | 1551.0 | 1798.0 | 1357.7 | 1420.7 |
| 311 | 5 | 1.50 | 0.6 | 0.00 | 1383.2 | 1450.5 | 1656.7 | 1279.1 | 1354.6 |
| 312 | 5 | 1.50 | 0.6 | 0.40 | 1409.9 | 1467.1 | 1693.1 | 1279.1 | 1354.6 |
| 313 | 5 | 1.50 | 0.6 | 0.70 | 1446.0 | 1485.5 | 1735.7 | 1279.1 | 1354.6 |
| 314 | 5 | 1.50 | 0.6 | 0.85 | 1458.6 | 1486.8 | 1749.9 | 1279.1 | 1354.6 |
| 315 | 5 | 1.50 | 0.6 | 1.00 | 1463.3 | 1474.2 | 1755.8 | 1279.1 | 1354.6 |
| 316 | 5 | 1.50 | 0.4 | 0.00 | 1323.3 | 1402.0 | 1586.8 | 1206.1 | 1299.7 |
| 317 | 5 | 1.50 | 0.4 | 0.40 | 1355.1 | 1414.1 | 1643.8 | 1206.1 | 1299.7 |
| 318 | 5 | 1.50 | 0.4 | 0.70 | 1408.8 | 1446.4 | 1699.8 | 1206.1 | 1299.7 |
| 319 | 5 | 1.50 | 0.4 | 0.85 | 1428.3 | 1445.2 | 1717.8 | 1206.1 | 1299.7 |
| 320 | 5 | 1.50 | 0.4 | 1.00 | 1435.5 | 1422.3 | 1725.5 | 1206.1 | 1299.7 |
| 321 | 5 | 1.50 | 0.2 | 0.00 | 1288.5 | 1382.4 | 1524.8 | 1141.1 | 1260.0 |
| 322 | 5 | 1.50 | 0.2 | 0.40 | 1319.5 | 1382.0 | 1611.6 | 1141.1 | 1260.0 |
| 323 | 5 | 1.50 | 0.2 | 0.70 | 1384.3 | 1438.3 | 1677.6 | 1141.1 | 1260.0 |
| 324 | 5 | 1.50 | 0.2 | 0.85 | 1409.6 | 1439.6 | 1698.1 | 1141.1 | 1260.0 |
| 325 | 5 | 1.50 | 0.2 | 1.00 | 1418.8 | 1394.3 | 1707.8 | 1141.1 | 1260.0 |
| 326 | 5 | 2.00 | 1.0 | 0.00 | 1907.6 | 1892.5 | 2234.0 | 1787.3 | 1813.2 |
| 327 | 5 | 2.00 | 1.0 | 0.40 | 1909.1 | 1919.5 | 2259.7 | 1787.3 | 1813.2 |
| 328 | 5 | 2.00 | 1.0 | 0.70 | 1908.8 | 1904.6 | 2293.9 | 1787.3 | 1813.2 |
| 329 | 5 | 2.00 | 1.0 | 0.85 | 1908.6 | 1899.9 | 2305.7 | 1787.3 | 1813.2 |
| 330 | 5 | 2.00 | 1.0 | 1.00 | 1908.6 | 1915.7 | 2310.6 | 1787.3 | 1813.2 |
| 331 | 5 | 2.00 | 0.8 | 0.00 | 1836.5 | 1842.0 | 2160.6 | 1715.5 | 1749.4 |

| TP | SS | Bias | Ell | Corr | Exact | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|---|
| 332 | 5 | 2.00 | 0.8 | 0.40 | 1848.6 | 1844.8 | 2199.4 | 1715.5 | 1749.4 |
| 333 | 5 | 2.00 | 0.8 | 0.70 | 1863.7 | 1829.8 | 2246.9 | 1715.5 | 1749.4 |
| 334 | 5 | 2.00 | 0.8 | 0.85 | 1868.9 | 1811.3 | 2262.9 | 1715.5 | 1749.4 |
| 335 | 5 | 2.00 | 0.8 | 1.00 | 1871.2 | 1810.8 | 2269.5 | 1715.5 | 1749.4 |
| 336 | 5 | 2.00 | 0.6 | 0.00 | 1776.8 | 1792.7 | 2092.5 | 1648.7 | 1694.5 |
| 337 | 5 | 2.00 | 0.6 | 0.40 | 1796.3 | 1801.4 | 2148.7 | 1648.7 | 1694.5 |
| 338 | 5 | 2.00 | 0.6 | 0.70 | 1826.2 | 1784.5 | 2209.3 | 1648.7 | 1694.5 |
| 339 | 5 | 2.00 | 0.6 | 0.85 | 1837.4 | 1750.8 | 2229.2 | 1648.7 | 1694.5 |
| 340 | 5 | 2.00 | 0.6 | 1.00 | 1841.8 | 1722.9 | 2237.6 | 1648.7 | 1694.5 |
| 341 | 5 | 2.00 | 0.4 | 0.00 | 1733.2 | 1749.6 | 2030.5 | 1588.9 | 1650.6 |
| 342 | 5 | 2.00 | 0.4 | 0.40 | 1755.4 | 1769.7 | 2109.9 | 1588.9 | 1650.6 |
| 343 | 5 | 2.00 | 0.4 | 0.70 | 1797.0 | 1778.9 | 2181.9 | 1588.9 | 1650.6 |
| 344 | 5 | 2.00 | 0.4 | 0.85 | 1814.3 | 1732.6 | 2204.9 | 1588.9 | 1650.6 |
| 345 | 5 | 2.00 | 0.4 | 1.00 | 1820.8 | 1648.9 | 2215.1 | 1588.9 | 1650.6 |
| 346 | 5 | 2.00 | 0.2 | 0.00 | 1707.1 | 1722.2 | 1975.6 | 1538.7 | 1620.5 |
| 347 | 5 | 2.00 | 0.2 | 0.40 | 1730.6 | 1756.8 | 2085.7 | 1538.7 | 1620.5 |
| 348 | 5 | 2.00 | 0.2 | 0.70 | 1778.3 | 1801.9 | 2165.4 | 1538.7 | 1620.5 |
| 349 | 5 | 2.00 | 0.2 | 0.85 | 1800.3 | 1770.0 | 2190.1 | 1538.7 | 1620.5 |
| 350 | 5 | 2.00 | 0.2 | 1.00 | 1808.1 | 1629.8 | 2202.1 | 1538.7 | 1620.5 |
| 351 | 7 | 0.00 | 1.0 | 0.00 | 1000.0 | 986.9 | 1034.0 | 915.2 | 1002.2 |
| 352 | 7 | 0.00 | 1.0 | 0.40 | 1002.0 | 977.3 | 1033.7 | 915.2 | 1002.2 |
| 353 | 7 | 0.00 | 1.0 | 0.70 | 1002.0 | 980.1 | 1032.3 | 915.2 | 1002.2 |
| 354 | 7 | 0.00 | 1.0 | 0.85 | 1002.0 | 976.1 | 1031.6 | 915.2 | 1002.2 |
| 355 | 7 | 0.00 | 1.0 | 1.00 | 1002.0 | 984.3 | 1031.1 | 915.2 | 1002.2 |
| 356 | 7 | 0.00 | 0.8 | 0.00 | 898.4 | 924.2 | 929.7 | 823.9 | 904.5 |
| 357 | 7 | 0.00 | 0.8 | 0.40 | 902.2 | 923.7 | 931.2 | 823.9 | 904.5 |
| 358 | 7 | 0.00 | 0.8 | 0.70 | 905.3 | 915.1 | 932.6 | 823.9 | 904.5 |
| 359 | 7 | 0.00 | 0.8 | 0.85 | 906.3 | 905.0 | 932.9 | 823.9 | 904.5 |
| 360 | 7 | 0.00 | 0.8 | 1.00 | 906.7 | 897.5 | 932.8 | 823.9 | 904.5 |
| 361 | 7 | 0.00 | 0.6 | 0.00 | 793.1 | 854.2 | 825.3 | 733.1 | 813.9 |
| 362 | 7 | 0.00 | 0.6 | 0.40 | 805.1 | 856.0 | 833.7 | 733.1 | 813.9 |
| 363 | 7 | 0.00 | 0.6 | 0.70 | 818.8 | 850.9 | 844.1 | 733.1 | 813.9 |
| 364 | 7 | 0.00 | 0.6 | 0.85 | 823.4 | 839.3 | 847.6 | 733.1 | 813.9 |
| 365 | 7 | 0.00 | 0.6 | 1.00 | 825.0 | 821.1 | 848.8 | 733.1 | 813.9 |
| 366 | 7 | 0.00 | 0.4 | 0.00 | 686.3 | 787.4 | 722.5 | 647.0 | 733.5 |
| 367 | 7 | 0.00 | 0.4 | 0.40 | 714.7 | 785.6 | 745.3 | 647.0 | 733.5 |
| 368 | 7 | 0.00 | 0.4 | 0.70 | 747.4 | 795.0 | 771.7 | 647.0 | 733.5 |
| 369 | 7 | 0.00 | 0.4 | 0.85 | 757.7 | 786.5 | 780.3 | 647.0 | 733.5 |
| 370 | 7 | 0.00 | 0.4 | 1.00 | 761.3 | 766.0 | 783.8 | 647.0 | 733.5 |
| 371 | 7 | 0.00 | 0.2 | 0.00 | 599.6 | 765.0 | 623.5 | 562.9 | 669.6 |

| TP | SS | Bias | Ell | Corr | Exact | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|---|
| 372 | 7 | 0.00 | 0.2 | 0.40 | 643.8 | 726.8 | 676.5 | 562.9 | 669.6 |
| 373 | 7 | 0.00 | 0.2 | 0.70 | 698.7 | 745.6 | 722.3 | 562.9 | 669.6 |
| 374 | 7 | 0.00 | 0.2 | 0.85 | 714.8 | 755.7 | 736.5 | 562.9 | 669.6 |
| 375 | 7 | 0.00 | 0.2 | 1.00 | 720.3 | 743.5 | 742.7 | 562.9 | 669.6 |
| 376 | 7 | 0.25 | 1.0 | 0.00 | 1015.8 | 1000.8 | 1062.0 | 926.9 | 1016.7 |
| 377 | 7 | 0.25 | 1.0 | 0.40 | 1017.8 | 1006.0 | 1061.7 | 926.9 | 1016.7 |
| 378 | 7 | 0.25 | 1.0 | 0.70 | 1017.7 | 1014.8 | 1060.6 | 926.9 | 1016.7 |
| 379 | 7 | 0.25 | 1.0 | 0.85 | 1017.7 | 1010.8 | 1060.0 | 926.9 | 1016.7 |
| 380 | 7 | 0.25 | 1.0 | 1.00 | 1017.7 | 1015.5 | 1059.7 | 926.9 | 1016.7 |
| 381 | 7 | 0.25 | 0.8 | 0.00 | 913.7 | 939.5 | 958.8 | 836.9 | 919.9 |
| 382 | 7 | 0.25 | 0.8 | 0.40 | 918.1 | 938.8 | 960.8 | 836.9 | 919.9 |
| 383 | 7 | 0.25 | 0.8 | 0.70 | 922.0 | 940.0 | 963.1 | 836.9 | 919.9 |
| 384 | 7 | 0.25 | 0.8 | 0.85 | 923.5 | 931.8 | 963.8 | 836.9 | 919.9 |
| 385 | 7 | 0.25 | 0.8 | 1.00 | 924.0 | 926.1 | 963.9 | 836.9 | 919.9 |
| 386 | 7 | 0.25 | 0.6 | 0.00 | 808.0 | 874.4 | 856.1 | 747.3 | 830.3 |
| 387 | 7 | 0.25 | 0.6 | 0.40 | 821.3 | 877.2 | 865.3 | 747.3 | 830.3 |
| 388 | 7 | 0.25 | 0.6 | 0.70 | 836.9 | 869.9 | 877.0 | 747.3 | 830.3 |
| 389 | 7 | 0.25 | 0.6 | 0.85 | 842.1 | 863.4 | 881.0 | 747.3 | 830.3 |
| 390 | 7 | 0.25 | 0.6 | 1.00 | 844.0 | 847.3 | 882.4 | 747.3 | 830.3 |
| 391 | 7 | 0.25 | 0.4 | 0.00 | 701.4 | 810.5 | 755.3 | 662.5 | 751.1 |
| 392 | 7 | 0.25 | 0.4 | 0.40 | 731.8 | 810.7 | 779.3 | 662.5 | 751.1 |
| 393 | 7 | 0.25 | 0.4 | 0.70 | 767.0 | 819.6 | 806.9 | 662.5 | 751.1 |
| 394 | 7 | 0.25 | 0.4 | 0.85 | 778.0 | 816.3 | 815.9 | 662.5 | 751.1 |
| 395 | 7 | 0.25 | 0.4 | 1.00 | 781.9 | 790.1 | 819.6 | 662.5 | 751.1 |
| 396 | 7 | 0.25 | 0.2 | 0.00 | 661.8 | 794.7 | 658.9 | 579.5 | 688.2 |
| 397 | 7 | 0.25 | 0.2 | 0.40 | 662.4 | 749.8 | 712.9 | 579.5 | 688.2 |
| 398 | 7 | 0.25 | 0.2 | 0.70 | 719.5 | 777.9 | 759.3 | 579.5 | 688.2 |
| 399 | 7 | 0.25 | 0.2 | 0.85 | 736.4 | 785.0 | 773.7 | 579.5 | 688.2 |
| 400 | 7 | 0.25 | 0.2 | 1.00 | 742.2 | 769.6 | 780.0 | 579.5 | 688.2 |
| 401 | 7 | 0.50 | 1.0 | 0.00 | 1063.1 | 1054.9 | 1144.1 | 967.5 | 1061.8 |
| 402 | 7 | 0.50 | 1.0 | 0.40 | 1065.1 | 1073.6 | 1144.2 | 967.5 | 1061.8 |
| 403 | 7 | 0.50 | 1.0 | 0.70 | 1065.0 | 1080.9 | 1143.7 | 967.5 | 1061.8 |
| 404 | 7 | 0.50 | 1.0 | 0.85 | 1065.0 | 1073.5 | 1143.5 | 967.5 | 1061.8 |
| 405 | 7 | 0.50 | 1.0 | 1.00 | 1065.0 | 1079.0 | 1143.3 | 967.5 | 1061.8 |
| 406 | 7 | 0.50 | 0.8 | 0.00 | 960.1 | 994.7 | 1044.3 | 879.3 | 967.5 |
| 407 | 7 | 0.50 | 0.8 | 0.40 | 966.5 | 1001.4 | 1047.9 | 879.3 | 967.5 |
| 408 | 7 | 0.50 | 0.8 | 0.70 | 973.1 | 1006.2 | 1052.5 | 879.3 | 967.5 |
| 409 | 7 | 0.50 | 0.8 | 0.85 | 975.4 | 1006.0 | 1054.0 | 879.3 | 967.5 |
| 410 | 7 | 0.50 | 0.8 | 1.00 | 976.4 | 1000.0 | 1054.5 | 879.3 | 967.5 |
| 411 | 7 | 0.50 | 0.6 | 0.00 | 853.9 | 933.4 | 946.0 | 793.9 | 880.6 |

| TP | SS | Bias | Ell | Corr | Exact | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|---|
| 412 | 7 | 0.50 | 0.6 | 0.40 | 871.4 | 940.9 | 957.7 | 793.9 | 880.6 |
| 413 | 7 | 0.50 | 0.6 | 0.70 | 892.2 | 941.1 | 972.9 | 793.9 | 880.6 |
| 414 | 7 | 0.50 | 0.6 | 0.85 | 899.0 | 943.6 | 978.0 | 793.9 | 880.6 |
| 415 | 7 | 0.50 | 0.6 | 1.00 | 901.6 | 927.4 | 980.0 | 793.9 | 880.6 |
| 416 | 7 | 0.50 | 0.4 | 0.00 | 748.9 | 878.6 | 850.7 | 708.8 | 804.3 |
| 417 | 7 | 0.50 | 0.4 | 0.40 | 784.6 | 872.0 | 878.0 | 708.8 | 804.3 |
| 418 | 7 | 0.50 | 0.4 | 0.70 | 826.6 | 890.3 | 909.0 | 708.8 | 804.3 |
| 419 | 7 | 0.50 | 0.4 | 0.85 | 839.7 | 895.4 | 919.1 | 708.8 | 804.3 |
| 420 | 7 | 0.50 | 0.4 | 1.00 | 844.4 | 877.2 | 923.3 | 708.8 | 804.3 |
| 421 | 7 | 0.50 | 0.2 | 0.00 | 670.7 | 871.3 | 760.9 | 627.4 | 744.2 |
| 422 | 7 | 0.50 | 0.2 | 0.40 | 719.2 | 816.5 | 818.0 | 627.4 | 744.2 |
| 423 | 7 | 0.50 | 0.2 | 0.70 | 782.8 | 855.2 | 866.3 | 627.4 | 744.2 |
| 424 | 7 | 0.50 | 0.2 | 0.85 | 801.7 | 867.2 | 881.3 | 627.4 | 744.2 |
| 425 | 7 | 0.50 | 0.2 | 1.00 | 808.3 | 859.0 | 888.0 | 627.4 | 744.2 |
| 426 | 7 | 0.75 | 1.0 | 0.00 | 1142.6 | 1141.6 | 1271.1 | 1035.2 | 1135.6 |
| 427 | 7 | 0.75 | 1.0 | 0.40 | 1144.6 | 1170.5 | 1272.3 | 1035.2 | 1135.6 |
| 428 | 7 | 0.75 | 1.0 | 0.70 | 1144.4 | 1185.3 | 1273.7 | 1035.2 | 1135.6 |
| 429 | 7 | 0.75 | 1.0 | 0.85 | 1144.4 | 1194.8 | 1274.1 | 1035.2 | 1135.5 |
| 430 | 7 | 0.75 | 1.0 | 1.00 | 1144.4 | 1188.7 | 1274.2 | 1035.2 | 1135.6 |
| 431 | 7 | 0.75 | 0.8 | 0.00 | 1039.4 | 1085.7 | 1176.1 | 949.5 | 1045.0 |
| 432 | 7 | 0.75 | 0.8 | 0.40 | 1048.7 | 1099.1 | 1182.4 | 949.5 | 1045.0 |
| 433 | 7 | 0.75 | 0.8 | 0.70 | 1059.1 | 1110.7 | 1191.0 | 949.5 | 1045.0 |
| 434 | 7 | 0.75 | 0.8 | 0.85 | 1062.7 | 1119.9 | 1194.0 | 949.5 | 1045.0 |
| 435 | 7 | 0.75 | 0.8 | 1.00 | 1064.1 | 1118.6 | 1195.1 | 949.5 | 1045.0 |
| 436 | 7 | 0.75 | 0.6 | 0.00 | 934.2 | 1023.2 | 1083.7 | 864.5 | 962.2 |
| 437 | 7 | 0.75 | 0.6 | 0.40 | 957.4 | 1033.9 | 1099.7 | 864.5 | 962.2 |
| 438 | 7 | 0.75 | 0.6 | 0.70 | 985.3 | 1053.1 | 1120.2 | 864.5 | 962.2 |
| 439 | 7 | 0.75 | 0.6 | 0.85 | 994.5 | 1060.8 | 1127.1 | 864.5 | 962.2 |
| 440 | 7 | 0.75 | 0.6 | 1.00 | 998.0 | 1058.9 | 1130.0 | 864.5 | 962.2 |
| 441 | 7 | 0.75 | 0.4 | 0.00 | 834.2 | 980.1 | 995.8 | 780.6 | 890.3 |
| 442 | 7 | 0.75 | 0.4 | 0.40 | 876.1 | 968.9 | 1028.4 | 780.6 | 890.3 |
| 443 | 7 | 0.75 | 0.4 | 0.70 | 926.8 | 1003.7 | 1064.5 | 780.6 | 890.3 |
| 444 | 7 | 0.75 | 0.4 | 0.85 | 942.7 | 1012.8 | 1076.3 | 780.6 | 890.3 |
| 445 | 7 | 0.75 | 0.4 | 1.00 | 948.5 | 1001.4 | 1081.3 | 780.6 | 890.3 |
| 446 | 7 | 0.75 | 0.2 | 0.00 | 767.1 | 974.9 | 914.5 | 703.4 | 834.5 |
| 447 | 7 | 0.75 | 0.2 | 0.40 | 816.5 | 916.9 | 976.8 | 703.4 | 834.5 |
| 448 | 7 | 0.75 | 0.2 | 0.70 | 888.5 | 972.9 | 1028.2 | 703.4 | 834.5 |
| 449 | 7 | 0.75 | 0.2 | 0.85 | 910.3 | 986.0 | 1044.2 | 703.4 | 834.5 |
| 450 | 7 | 0.75 | 0.2 | 1.00 | 918.0 | 977.7 | 1051.5 | 703.4 | 834.5 |
| 451 | 7 | 1.00 | 1.0 | 0.00 | 1253.4 | 1254.0 | 1431.0 | 1129.1 | 1235.0 |

| TP | SS | Bias | Ell | Corr | Exact | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|---|
| 452 | 7 | 1.00 | 1.0 | 0.40 | 1255.3 | 1298.3 | 1434.7 | 1129.1 | 1235.0 |
| 453 | 7 | 1.00 | 1.0 | 0.70 | 1255.0 | 1322.2 | 1439.7 | 1129.1 | 1235.0 |
| 454 | 7 | 1.00 | 1.0 | 0.85 | 1254.9 | 1329.2 | 1441.5 | 1129.1 | 1235.0 |
| 455 | 7 | 1.00 | 1.0 | 1.00 | 1254.9 | 1335.4 | 1442.2 | 1129.1 | 1235.0 |
| 456 | 7 | 1.00 | 0.8 | 0.00 | 1152.2 | 1201.5 | 1341.4 | 1045.0 | 1149.2 |
| 457 | 7 | 1.00 | 0.8 | 0.40 | 1164.6 | 1231.3 | 1351.9 | 1045.0 | 1149.2 |
| 458 | 7 | 1.00 | 0.8 | 0.70 | 1178.5 | 1259.6 | 1366.3 | 1045.0 | 1149.2 |
| 459 | 7 | 1.00 | 0.8 | 0.85 | 1183.4 | 1258.3 | 1371.3 | 1045.0 | 1149.2 |
| 460 | 7 | 1.00 | 0.8 | 1.00 | 1185.3 | 1261.8 | 1373.4 | 1045.0 | 1149.2 |
| 461 | 7 | 1.00 | 0.6 | 0.00 | 1051.7 | 1140.0 | 1255.5 | 962.3 | 1071.5 |
| 462 | 7 | 1.00 | 0.6 | 0.40 | 1079.7 | 1163.8 | 1277.3 | 962.3 | 1071.5 |
| 463 | 7 | 1.00 | 0.6 | 0.70 | 1113.9 | 1193.2 | 1304.6 | 962.3 | 1071.5 |
| 464 | 7 | 1.00 | 0.6 | 0.85 | 1125.2 | 1195.5 | 1313.9 | 962.3 | 1071.5 |
| 465 | 7 | 1.00 | 0.6 | 1.00 | 1129.4 | 1201.4 | 1317.7 | 962.3 | 1071.5 |
| 466 | 7 | 1.00 | 0.4 | 0.00 | 962.5 | 1099.9 | 1175.0 | 883.5 | 1004.9 |
| 467 | 7 | 1.00 | 0.4 | 0.40 | 1006.4 | 1097.9 | 1214.8 | 883.5 | 1004.9 |
| 468 | 7 | 1.00 | 0.4 | 0.70 | 1063.5 | 1142.3 | 1257.1 | 883.5 | 1004.9 |
| 469 | 7 | 1.00 | 0.4 | 0.85 | 1082.1 | 1157.1 | 1271.0 | 883.5 | 1004.9 |
| 470 | 7 | 1.00 | 0.4 | 1.00 | 1088.8 | 1151.8 | 1276.9 | 883.5 | 1004.9 |
| 471 | 7 | 1.00 | 0.2 | 0.00 | 909.0 | 1093.4 | 1101.9 | 804.9 | 954.2 |
| 472 | 7 | 1.00 | 0.2 | 0.40 | 954.2 | 1045.5 | 1171.3 | 804.9 | 954.2 |
| 473 | 7 | 1.00 | 0.2 | 0.70 | 1030.8 | 1117.0 | 1227.0 | 804.9 | 954.2 |
| 474 | 7 | 1.00 | 0.2 | 0.85 | 1055.5 | 1133.2 | 1244.3 | 804.9 | 954.2 |
| 475 | 7 | 1.00 | 0.2 | 1.00 | 1064.2 | 1129.8 | 1252.4 | 804.9 | 954.2 |
| 476 | 7 | 1.50 | 1.0 | 0.00 | 1550.8 | 1547.0 | 1810.6 | 1393.2 | 1495.5 |
| 477 | 7 | 1.50 | 1.0 | 0.40 | 1552.5 | 1598.1 | 1823.4 | 1393.2 | 1495.5 |
| 478 | 7 | 1.50 | 1.0 | 0.70 | 1552.0 | 1629.0 | 1841.4 | 1393.2 | 1495.5 |
| 479 | 7 | 1.50 | 1.0 | 0.85 | 1551.8 | 1635.5 | 1847.8 | 1393.2 | 1495.5 |
| 480 | 7 | 1.50 | 1.0 | 1.00 | 1551.8 | 1651.0 | 1850.5 | 1393.2 | 1495.5 |
| 481 | 7 | 1.50 | 0.8 | 0.00 | 1462.9 | 1481.2 | 1731.1 | 1316.3 | 1420.7 |
| 482 | 7 | 1.50 | 0.8 | 0.40 | 1477.4 | 1537.3 | 1754.1 | 1316.3 | 1420.7 |
| 483 | 7 | 1.50 | 0.8 | 0.70 | 1494.1 | 1561.4 | 1784.2 | 1316.3 | 1420.7 |
| 484 | 7 | 1.50 | 0.8 | 0.85 | 1499.8 | 1569.9 | 1794.7 | 1316.3 | 1420.7 |
| 485 | 7 | 1.50 | 0.8 | 1.00 | 1502.0 | 1570.3 | 1799.1 | 1316.3 | 1420.7 |
| 486 | 7 | 1.50 | 0.6 | 0.00 | 1383.2 | 1429.9 | 1656.4 | 1242.9 | 1354.6 |
| 487 | 7 | 1.50 | 0.6 | 0.40 | 1409.9 | 1469.1 | 1694.0 | 1242.9 | 1354.6 |
| 488 | 7 | 1.50 | 0.6 | 0.70 | 1446.0 | 1505.1 | 1737.7 | 1242.9 | 1354.6 |
| 489 | 7 | 1.50 | 0.6 | 0.85 | 1458.6 | 1502.7 | 1752.4 | 1242.9 | 1354.6 |
| 490 | 7 | 1.50 | 0.6 | 1.00 | 1463.3 | 1500.1 | 1758.6 | 1242.9 | 1354.6 |
| 491 | 7 | 1.50 | 0.4 | 0.00 | 1323.3 | 1379.8 | 1587.9 | 1171.9 | 1299.7 |

| TP | SS | Bias | Ell | Corr | Exact | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|---|
| 492 | 7 | 1.50 | 0.4 | 0.40 | 1355.1 | 1417.0 | 1646.2 | 1171.9 | 1299.7 |
| 493 | 7 | 1.50 | 0.4 | 0.70 | 1408.8 | 1464.5 | 1703.1 | 1171.9 | 1299.7 |
| 494 | 7 | 1.50 | 0.4 | 0.85 | 1428.3 | 1469.8 | 1721.6 | 1171.9 | 1299.7 |
| 495 | 7 | 1.50 | 0.4 | 1.00 | 1435.5 | 1448.2 | 1729.7 | 1171.9 | 1299.7 |
| 496 | 7 | 1.50 | 0.2 | 0.00 | 1288.5 | 1361.0 | 1526.7 | 1101.8 | 1260.0 |
| 497 | 7 | 1.50 | 0.2 | 0.40 | 1319.5 | 1371.8 | 1615.0 | 1101.8 | 1260.0 |
| 498 | 7 | 1.50 | 0.2 | 0.70 | 1384.3 | 1449.7 | 1681.9 | 1101.8 | 1260.0 |
| 499 | 7 | 1.50 | 0.2 | 0.85 | 1409.6 | 1463.2 | 1702.7 | 1101.8 | 1260.0 |
| 500 | 7 | 1.50 | 0.2 | 1.00 | 1418.8 | 1432.7 | 1712.7 | 1101.8 | 1260.0 |
| 501 | 7 | 2.00 | 1.0 | 0.00 | 1907.6 | 1892.5 | 2231.6 | 1740.4 | 1813.2 |
| 502 | 7 | 2.00 | 1.0 | 0.40 | 1909.1 | 1935.8 | 2258.4 | 1740.4 | 1813.2 |
| 503 | 7 | 2.00 | 1.0 | 0.70 | 1908.8 | 1911.4 | 2294.0 | 1740.4 | 1813.2 |
| 504 | 7 | 2.00 | 1.0 | 0.85 | 1908.6 | 1924.2 | 2306.5 | 1740.4 | 1813.2 |
| 505 | 7 | 2.00 | 1.0 | 1.00 | 1908.6 | 1932.3 | 2311.7 | 1740.4 | 1813.2 |
| 506 | 7 | 2.00 | 0.8 | 0.00 | 1836.5 | 1839.8 | 2160.1 | 1669.0 | 1749.4 |
| 507 | 7 | 2.00 | 0.8 | 0.40 | 1848.6 | 1874.1 | 2200.0 | 1669.0 | 1749.4 |
| 508 | 7 | 2.00 | 0.8 | 0.70 | 1863.7 | 1846.1 | 2248.6 | 1669.0 | 1749.4 |
| 509 | 7 | 2.00 | 0.8 | 0.85 | 1868.9 | 1853.4 | 2265.1 | 1669.0 | 1749.4 |
| 510 | 7 | 2.00 | 0.8 | 1.00 | 1871.2 | 1840.8 | 2272.1 | 1669.0 | 1749.4 |
| 511 | 7 | 2.00 | 0.6 | 0.00 | 1776.8 | 1786.2 | 2093.5 | 1600.8 | 1694.5 |
| 512 | 7 | 2.00 | 0.6 | 0.40 | 1796.3 | 1829.5 | 2150.8 | 1600.8 | 1694.5 |
| 513 | 7 | 2.00 | 0.6 | 0.70 | 1826.2 | 1821.1 | 2212.3 | 1600.8 | 1694.5 |
| 514 | 7 | 2.00 | 0.6 | 0.85 | 1837.4 | 1777.3 | 2232.6 | 1600.8 | 1694.5 |
| 515 | 7 | 2.00 | 0.6 | 1.00 | 1841.8 | 1755.6 | 2241.4 | 1600.8 | 1694.5 |
| 516 | 7 | 2.00 | 0.4 | 0.00 | 1733.2 | 1737.7 | 2032.6 | 1536.4 | 1650.6 |
| 517 | 7 | 2.00 | 0.4 | 0.40 | 1755.4 | 1784.1 | 2113.1 | 1536.4 | 1650.6 |
| 518 | 7 | 2.00 | 0.4 | 0.70 | 1797.0 | 1814.9 | 2185.8 | 1536.4 | 1650.6 |
| 519 | 7 | 2.00 | 0.4 | 0.85 | 1814.3 | 1771.5 | 2209.1 | 1536.4 | 1650.6 |
| 520 | 7 | 2.00 | 0.4 | 1.00 | 1820.8 | 1691.0 | 2219.7 | 1536.4 | 1650.6 |
| 521 | 7 | 2.00 | 0.2 | 0.00 | 1707.1 | 1710.9 | 1978.2 | 1472.2 | 1620.5 |
| 522 | 7 | 2.00 | 0.2 | 0.40 | 1730.6 | 1752.4 | 2089.4 | 1472.2 | 1620.5 |
| 523 | 7 | 2.00 | 0.2 | 0.70 | 1778.3 | 1823.7 | 2169.9 | 1472.2 | 1620.5 |
| 524 | 7 | 2.00 | 0.2 | 0.85 | 1800.3 | 1825.6 | 2194.8 | 1472.2 | 1620.5 |
| 525 | 7 | 2.00 | 0.2 | 1.00 | 1808.1 | 1693.1 | 2207.1 | 1472.2 | 1620.5 |
| 526 | 10 | 0.00 | 1.0 | 0.00 | 1000.0 | 961.2 | 1021.6 | 855.1 | 1002.2 |
| 527 | 10 | 0.00 | 1.0 | 0.40 | 1002.0 | 958.1 | 1021.9 | 855.1 | 1002.2 |
| 528 | 10 | 0.00 | 1.0 | 0.70 | 1002.0 | 963.7 | 1021.4 | 855.1 | 1002.2 |
| 529 | 10 | 0.00 | 1.0 | 0.85 | 1002.0 | 968.7 | 1021.1 | 855.1 | 1002.2 |
| 530 | 10 | 0.00 | 1.0 | 1.00 | 1002.0 | 967.9 | 1020.7 | 855.1 | 1002.2 |
| 531 | 10 | 0.00 | 0.8 | 0.00 | 898.4 | 907.5 | 918.6 | 772.8 | 904.5 |

| TP | SS | Bias | Ell | Corr | Exact | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|---|
| 532 | 10 | 0.00 | 0.8 | 0.40 | 902.2 | 908.1 | 920.7 | 772.8 | 904.5 |
| 533 | 10 | 0.00 | 0.8 | 0.70 | 905.3 | 901.2 | 923.0 | 772.8 | 904.5 |
| 534 | 10 | 0.00 | 0.8 | 0.85 | 906.3 | 891.1 | 923.7 | 772.8 | 904.5 |
| 535 | 10 | 0.00 | 0.8 | 1.00 | 906.7 | 879.4 | 923.8 | 772.8 | 904.5 |
| 536 | 10 | 0.00 | 0.6 | 0.00 | 793.1 | 841.6 | 814.8 | 693.0 | 813.9 |
| 537 | 10 | 0.00 | 0.6 | 0.40 | 805.1 | 842.1 | 823.9 | 693.0 | 813.9 |
| 538 | 10 | 0.00 | 0.6 | 0.70 | 818.8 | 833.6 | 835.5 | 693.0 | 813.9 |
| 539 | 10 | 0.00 | 0.6 | 0.85 | 823.4 | 827.0 | 839.5 | 693.0 | 813.9 |
| 540 | 10 | 0.00 | 0.6 | 1.00 | 825.0 | 806.7 | 841.0 | 693.0 | 813.9 |
| 541 | 10 | 0.00 | 0.4 | 0.00 | 686.3 | 768.3 | 712.0 | 618.0 | 733.5 |
| 542 | 10 | 0.00 | 0.4 | 0.40 | 714.7 | 765.9 | 736.0 | 618.0 | 733.5 |
| 543 | 10 | 0.00 | 0.4 | 0.70 | 747.4 | 781.7 | 763.7 | 618.0 | 733.5 |
| 544 | 10 | 0.00 | 0.4 | 0.85 | 757.7 | 775.3 | 772.9 | 618.0 | 733.5 |
| 545 | 10 | 0.00 | 0.4 | 1.00 | 761.3 | 756.7 | 776.8 | 618.0 | 733.5 |
| 546 | 10 | 0.00 | 0.2 | 0.00 | 599.6 | 753.3 | 612.0 | 540.6 | 669.6 |
| 547 | 10 | 0.00 | 0.2 | 0.40 | 643.8 | 708.7 | 667.3 | 540.6 | 669.6 |
| 548 | 10 | 0.00 | 0.2 | 0.70 | 698.7 | 732.6 | 714.7 | 540.6 | 669.6 |
| 549 | 10 | 0.00 | 0.2 | 0.85 | 714.8 | 741.8 | 729.5 | 540.6 | 669.6 |
| 550 | 10 | 0.00 | 0.2 | 1.00 | 720.3 | 736.8 | 736.1 | 540.6 | 669.6 |
| 551 | 10 | 0.25 | 1.0 | 0.00 | 1015.8 | 981.6 | 1051.5 | 876.4 | 1016.7 |
| 552 | 10 | 0.25 | 1.0 | 0.40 | 1017.8 | 986.9 | 1051.5 | 876.4 | 1016.7 |
| 553 | 10 | 0.25 | 1.0 | 0.70 | 1017.7 | 982.7 | 1051.1 | 876.4 | 1016.7 |
| 554 | 10 | 0.25 | 1.0 | 0.85 | 1017.7 | 986.0 | 1050.8 | 876.4 | 1016.7 |
| 555 | 10 | 0.25 | 1.0 | 1.00 | 1017.7 | 991.9 | 1050.6 | 876.4 | 1016.7 |
| 556 | 10 | 0.25 | 0.8 | 0.00 | 913.7 | 928.7 | 949.7 | 792.8 | 919.9 |
| 557 | 10 | 0.25 | 0.8 | 0.40 | 913.7 | 930.3 | 952.2 | 792.8 | 919.9 |
| 558 | 10 | 0.25 | 0.8 | 0.70 | 922.0 | 921.0 | 955.2 | 792.8 | 919.9 |
| 559 | 10 | 0.25 | 0.8 | 0.85 | 923.5 | 922.7 | 956.2 | 792.8 | 919.9 |
| 560 | 10 | 0.25 | 0.8 | 1.00 | 924.0 | 910.0 | 956.6 | 792.8 | 919.9 |
| 561 | 10 | 0.25 | 0.6 | 0.00 | 808.0 | 857.0 | 847.8 | 713.6 | 830.3 |
| 562 | 10 | 0.25 | 0.6 | 0.40 | 821.3 | 863.1 | 857.7 | 713.6 | 830.3 |
| 563 | 10 | 0.25 | 0.6 | 0.70 | 836.9 | 866.4 | 870.5 | 713.6 | 830.3 |
| 564 | 10 | 0.25 | 0.6 | 0.85 | 842.1 | 851.1 | 874.9 | 713.6 | 830.3 |
| 565 | 10 | 0.25 | 0.6 | 1.00 | 844.0 | 832.4 | 876.7 | 713.6 | 830.3 |
| 566 | 10 | 0.25 | 0.4 | 0.00 | 701.4 | 795.1 | 747.4 | 634.5 | 751.1 |
| 567 | 10 | 0.25 | 0.4 | 0.40 | 731.8 | 791.1 | 772.5 | 634.5 | 751.1 |
| 568 | 10 | 0.25 | 0.4 | 0.70 | 767.0 | 808.3 | 801.4 | 634.5 | 751.1 |
| 569 | 10 | 0.25 | 0.4 | 0.85 | 778.0 | 807.5 | 811.1 | 634.5 | 751.1 |
| 570 | 10 | 0.25 | 0.4 | 1.00 | 781.9 | 785.8 | 815.1 | 634.5 | 751.1 |
| 571 | 10 | 0.25 | 0.2 | 0.00 | 616.8 | 786.5 | 650.4 | 559.0 | 688.2 |

| TP | SS | Bias | Ell | Corr | Exact | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|---|
| 572 | 10 | 0.25 | 0.2 | 0.40 | 662.4 | 734.5 | 706.7 | 559.0 | 688.2 |
| 573 | 10 | 0.25 | 0.2 | 0.70 | 719.5 | 767.1 | 754.6 | 559.0 | 688.2 |
| 574 | 10 | 0.25 | 0.2 | 0.85 | 736.4 | 774.9 | 769.6 | 559.0 | 688.2 |
| 575 | 10 | 0.25 | 0.2 | 1.00 | 742.2 | 764.6 | 776.4 | 559.0 | 688.2 |
| 576 | 10 | 0.50 | 1.0 | 0.00 | 1063.1 | 1039.2 | 1135.9 | 921.8 | 1061.8 |
| 577 | 10 | 0.50 | 1.0 | 0.40 | 1065.0 | 1058.0 | 1136.1 | 921.8 | 1061.8 |
| 578 | 10 | 0.50 | 1.0 | 0.70 | 1065.0 | 1060.5 | 1136.4 | 921.8 | 1061.8 |
| 579 | 10 | 0.50 | 1.0 | 0.85 | 1065.0 | 1058.1 | 1136.4 | 921.8 | 1061.8 |
| 580 | 10 | 0.50 | 1.0 | 1.00 | 1065.0 | 1066.3 | 1136.4 | 921.8 | 1061.8 |
| 581 | 10 | 0.50 | 0.8 | 0.00 | 960.1 | 991.9 | 1037.7 | 835.8 | 967.5 |
| 582 | 10 | 0.50 | 0.8 | 0.40 | 966.5 | 997.8 | 1041.7 | 835.8 | 967.5 |
| 583 | 10 | 0.50 | 0.8 | 0.70 | 973.1 | 1005.3 | 1047.1 | 835.8 | 967.5 |
| 584 | 10 | 0.50 | 0.8 | 0.85 | 975.4 | 997.4 | 1049.0 | 835.8 | 967.5 |
| 585 | 10 | 0.50 | 0.8 | 1.00 | 976.4 | 984.9 | 1049.8 | 835.8 | 967.5 |
| 586 | 10 | 0.50 | 0.6 | 0.00 | 853.9 | 921.6 | 940.5 | 752.4 | 880.6 |
| 587 | 10 | 0.50 | 0.6 | 0.40 | 871.4 | 929.6 | 953.0 | 752.4 | 880.6 |
| 588 | 10 | 0.50 | 0.6 | 0.70 | 892.2 | 939.3 | 969.2 | 752.4 | 880.6 |
| 589 | 10 | 0.50 | 0.6 | 0.85 | 899.0 | 936.8 | 974.9 | 752.4 | 880.6 |
| 590 | 10 | 0.50 | 0.6 | 1.00 | 901.6 | 920.3 | 977.2 | 752.4 | 880.6 |
| 591 | 10 | 0.50 | 0.4 | 0.00 | 748.9 | 870.9 | 846.1 | 676.9 | 804.3 |
| 592 | 10 | 0.50 | 0.4 | 0.40 | 784.6 | 859.1 | 874.6 | 676.9 | 804.3 |
| 593 | 10 | 0.50 | 0.4 | 0.70 | 826.6 | 884.1 | 906.8 | 676.9 | 804.3 |
| 594 | 10 | 0.50 | 0.4 | 0.85 | 839.7 | 896.0 | 917.6 | 676.9 | 804.3 |
| 595 | 10 | 0.50 | 0.4 | 1.00 | 844.4 | 873.8 | 922.2 | 676.9 | 804.3 |
| 596 | 10 | 0.50 | 0.2 | 0.00 | 670.7 | 869.5 | 756.5 | 591.6 | 744.2 |
| 597 | 10 | 0.50 | 0.2 | 0.40 | 719.2 | 804.7 | 815.7 | 591.6 | 744.2 |
| 598 | 10 | 0.50 | 0.2 | 0.70 | 782.8 | 845.8 | 865.4 | 591.6 | 744.2 |
| 599 | 10 | 0.50 | 0.2 | 0.85 | 801.7 | 857.7 | 880.8 | 591.6 | 744.2 |
| 600 | 10 | 0.50 | 0.2 | 1.00 | 808.3 | 860.1 | 888.0 | 591.6 | 744.2 |
| 601 | 10 | 0.75 | 1.0 | 0.00 | 1142.6 | 1138.1 | 1264.9 | 975.5 | 1135.6 |
| 602 | 10 | 0.75 | 1.0 | 0.40 | 1144.6 | 1162.3 | 1266.4 | 975.5 | 1135.6 |
| 603 | 10 | 0.75 | 1.0 | 0.70 | 1144.4 | 1179.9 | 1268.6 | 975.5 | 1135.6 |
| 604 | 10 | 0.75 | 1.0 | 0.85 | 1144.4 | 1183.8 | 1269.4 | 975.5 | 1135.5 |
| 605 | 10 | 0.75 | 1.0 | 1.00 | 1144.4 | 1185.8 | 1269.8 | 975.5 | 1135.6 |
| 606 | 10 | 0.75 | 0.8 | 0.00 | 1039.4 | 1077.0 | 1171.6 | 893.2 | 1045.0 |
| 607 | 10 | 0.75 | 0.8 | 0.40 | 1048.7 | 1095.9 | 1178.5 | 893.2 | 1045.0 |
| 608 | 10 | 0.75 | 0.8 | 0.70 | 1059.1 | 1116.4 | 1188.1 | 893.2 | 1045.0 |
| 609 | 10 | 0.75 | 0.8 | 0.85 | 1062.7 | 1125.5 | 1191.5 | 893.2 | 1045.0 |
| 610 | 10 | 0.75 | 0.8 | 1.00 | 1064.1 | 1115.7 | 1193.0 | 893.2 | 1045.0 |
| 611 | 10 | 0.75 | 0.6 | 0.00 | 934.2 | 1015.0 | 1080.7 | 810.5 | 962.2 |

| TP | SS | Bias | Ell | Corr | Exact | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|---|
| 612 | 10 | 0.75 | 0.6 | 0.40 | 957.4 | 1032.5 | 1097.5 | 810.5 | 962.2 |
| 613 | 10 | 0.75 | 0.6 | 0.70 | 985.3 | 1048.8 | 1119.2 | 810.5 | 962.2 |
| 614 | 10 | 0.75 | 0.6 | 0.85 | 994.5 | 1061.6 | 1126.7 | 810.5 | 962.2 |
| 615 | 10 | 0.75 | 0.6 | 1.00 | 998.0 | 1058.7 | 1129.9 | 810.5 | 962.2 |
| 616 | 10 | 0.75 | 0.4 | 0.00 | 834.2 | 973.4 | 993.9 | 738.0 | 890.3 |
| 617 | 10 | 0.75 | 0.4 | 0.40 | 876.1 | 957.9 | 1027.8 | 738.0 | 890.3 |
| 618 | 10 | 0.75 | 0.4 | 0.70 | 926.8 | 1005.1 | 1065.1 | 738.0 | 890.3 |
| 619 | 10 | 0.75 | 0.4 | 0.85 | 942.7 | 1018.8 | 1077.5 | 738.0 | 890.3 |
| 620 | 10 | 0.75 | 0.4 | 1.00 | 948.5 | 1015.7 | 1082.9 | 738.0 | 890.3 |
| 621 | 10 | 0.75 | 0.2 | 0.00 | 767.1 | 975.9 | 913.4 | 657.3 | 834.5 |
| 622 | 10 | 0.75 | 0.2 | 0.40 | 816.5 | 909.6 | 977.5 | 657.3 | 834.5 |
| 623 | 10 | 0.75 | 0.2 | 0.70 | 888.5 | 970.2 | 1030.0 | 657.3 | 834.5 |
| 624 | 10 | 0.75 | 0.2 | 0.85 | 910.3 | 986.5 | 1046.4 | 657.3 | 834.5 |
| 625 | 10 | 0.75 | 0.2 | 1.00 | 918.0 | 987.1 | 1054.1 | 657.3 | 834.5 |
| 626 | 10 | 1.00 | 1.0 | 0.00 | 1253.4 | 1247.4 | 1426.2 | 1057.8 | 1235.0 |
| 627 | 10 | 1.00 | 1.0 | 0.40 | 1255.3 | 1295.2 | 1430.3 | 1057.8 | 1235.0 |
| 628 | 10 | 1.00 | 1.0 | 0.70 | 1255.0 | 1324.2 | 1436.5 | 1057.8 | 1235.0 |
| 629 | 10 | 1.00 | 1.0 | 0.85 | 1254.9 | 1333.8 | 1438.7 | 1057.8 | 1235.0 |
| 630 | 10 | 1.00 | 1.0 | 1.00 | 1254.9 | 1340.9 | 1439.8 | 1057.8 | 1235.0 |
| 631 | 10 | 1.00 | 0.8 | 0.00 | 1152.2 | 1189.5 | 1338.3 | 982.8 | 1149.2 |
| 632 | 10 | 1.00 | 0.8 | 0.40 | 1164.6 | 1228.0 | 1349.6 | 982.8 | 1149.2 |
| 633 | 10 | 1.00 | 0.8 | 0.70 | 1178.5 | 1258.8 | 1365.2 | 982.8 | 1149.2 |
| 634 | 10 | 1.00 | 0.8 | 0.85 | 1183.4 | 1265.7 | 1370.8 | 982.8 | 1149.2 |
| 635 | 10 | 1.00 | 0.8 | 1.00 | 1185.3 | 1271.4 | 1373.2 | 982.8 | 1149.2 |
| 636 | 10 | 1.00 | 0.6 | 0.00 | 1051.7 | 1126.7 | 1253.9 | 908.2 | 1071.5 |
| 637 | 10 | 1.00 | 0.6 | 0.40 | 1079.7 | 1158.6 | 1276.7 | 908.2 | 1071.5 |
| 638 | 10 | 1.00 | 0.6 | 0.70 | 1113.9 | 1198.1 | 1305.3 | 908.2 | 1071.5 |
| 639 | 10 | 1.00 | 0.6 | 0.85 | 1125.2 | 1210.8 | 1315.2 | 908.2 | 1071.5 |
| 640 | 10 | 1.00 | 0.6 | 1.00 | 1129.4 | 1208.5 | 1319.4 | 908.2 | 1071.5 |
| 641 | 10 | 1.00 | 0.4 | 0.00 | 962.5 | 1088.9 | 1174.8 | 832.1 | 1004.9 |
| 642 | 10 | 1.00 | 0.4 | 0.40 | 1006.4 | 1085.2 | 1215.9 | 832.0 | 1004.9 |
| 643 | 10 | 1.00 | 0.4 | 0.70 | 1063.5 | 1149.3 | 1259.3 | 832.0 | 1004.9 |
| 644 | 10 | 1.00 | 0.4 | 0.85 | 1082.1 | 1166.3 | 1273.7 | 832.1 | 1004.9 |
| 645 | 10 | 1.00 | 0.4 | 1.00 | 1088.8 | 1167.8 | 1280.0 | 832.0 | 1004.9 |
| 646 | 10 | 1.00 | 0.2 | 0.00 | 909.0 | 1089.9 | 1102.5 | 749.7 | 954.2 |
| 647 | 10 | 1.00 | 0.2 | 0.40 | 954.2 | 1035.8 | 1173.5 | 749.7 | 954.2 |
| 648 | 10 | 1.00 | 0.2 | 0.70 | 1030.8 | 1115.3 | 1230.2 | 749.7 | 954.2 |
| 649 | 10 | 1.00 | 0.2 | 0.85 | 1055.5 | 1134.4 | 1247.9 | 749.7 | 954.2 |
| 650 | 10 | 1.00 | 0.2 | 1.00 | 1064.2 | 1144.9 | 1256.3 | 749.7 | 954.2 |
| 651 | 10 | 1.50 | 1.0 | 0.00 | 1550.8 | 1547.0 | 1806.9 | 1298.8 | 1495.5 |

| TP | SS | Bias | Ell | Corr | Exact | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|---|
| 652 | 10 | 1.50 | 1.0 | 0.40 | 1552.5 | 1615.4 | 1820.6 | 1298.8 | 1495.5 |
| 653 | 10 | 1.50 | 1.0 | 0.70 | 1552.0 | 1637.1 | 1840.2 | 1298.8 | 1495.5 |
| 654 | 10 | 1.50 | 1.0 | 0.85 | 1551.8 | 1660.2 | 1847.2 | 1298.8 | 1495.5 |
| 655 | 10 | 1.50 | 1.0 | 1.00 | 1551.8 | 1662.2 | 1850.3 | 1298.8 | 1495.5 |
| 656 | 10 | 1.50 | 0.8 | 0.00 | 1462.9 | 1476.7 | 1729.1 | 1223.3 | 1420.7 |
| 657 | 10 | 1.50 | 0.8 | 0.40 | 1477.4 | 1540.9 | 1753.2 | 1223.3 | 1420.7 |
| 658 | 10 | 1.50 | 0.8 | 0.70 | 1494.1 | 1574.5 | 1784.7 | 1223.3 | 1420.7 |
| 659 | 10 | 1.50 | 0.8 | 0.85 | 1499.8 | 1583.8 | 1795.7 | 1223.3 | 1420.7 |
| 660 | 10 | 1.50 | 0.8 | 1.00 | 1502.0 | 1585.2 | 1800.5 | 1223.3 | 1420.7 |
| 661 | 10 | 1.50 | 0.6 | 0.00 | 1383.2 | 1411.7 | 1656.0 | 1155.4 | 1354.6 |
| 662 | 10 | 1.50 | 0.6 | 0.40 | 1409.9 | 1468.5 | 1694.7 | 1155.4 | 1354.6 |
| 663 | 10 | 1.50 | 0.6 | 0.70 | 1446.0 | 1516.8 | 1739.4 | 1155.4 | 1354.6 |
| 664 | 10 | 1.50 | 0.6 | 0.85 | 1458.6 | 1517.3 | 1754.6 | 1155.4 | 1354.6 |
| 665 | 10 | 1.50 | 0.6 | 1.00 | 1463.3 | 1520.7 | 1761.3 | 1155.4 | 1354.6 |
| 666 | 10 | 1.50 | 0.4 | 0.00 | 1323.3 | 1368.4 | 1588.7 | 1090.9 | 1299.7 |
| 667 | 10 | 1.50 | 0.4 | 0.40 | 1355.1 | 1412.5 | 1648.2 | 1090.9 | 1299.7 |
| 668 | 10 | 1.50 | 0.4 | 0.70 | 1408.8 | 1479.2 | 1705.8 | 1090.9 | 1299.7 |
| 669 | 10 | 1.50 | 0.4 | 0.85 | 1428.3 | 1488.0 | 1724.7 | 1090.9 | 1299.7 |
| 670 | 10 | 1.50 | 0.4 | 1.00 | 1435.5 | 1470.0 | 1733.2 | 1090.9 | 1299.7 |
| 671 | 10 | 1.50 | 0.2 | 0.00 | 1288.5 | 1346.8 | 1528.1 | 1009.8 | 1260.0 |
| 672 | 10 | 1.50 | 0.2 | 0.40 | 1319.5 | 1362.4 | 1617.6 | 1009.8 | 1260.0 |
| 673 | 10 | 1.50 | 0.2 | 0.70 | 1384.3 | 1446.9 | 1685.3 | 1009.8 | 1260.0 |
| 674 | 10 | 1.50 | 0.2 | 0.85 | 1409.6 | 1479.8 | 1706.3 | 1009.8 | 1260.0 |
| 675 | 10 | 1.50 | 0.2 | 1.00 | 1418.8 | 1462.0 | 1716.7 | 1009.8 | 1260.0 |
| 676 | 10 | 2.00 | 1.0 | 0.00 | 1907.6 | 1889.6 | 2228.5 | 1629.5 | 1813.2 |
| 677 | 10 | 2.00 | 1.0 | 0.40 | 1909.1 | 1948.4 | 2256.5 | 1629.5 | 1813.2 |
| 678 | 10 | 2.00 | 1.0 | 0.70 | 1908.8 | 1948.4 | 2293.5 | 1629.5 | 1813.2 |
| 679 | 10 | 2.00 | 1.0 | 0.85 | 1908.6 | 1944.4 | 2306.7 | 1629.5 | 1813.2 |
| 680 | 10 | 2.00 | 1.0 | 1.00 | 1908.6 | 1954.5 | 2312.3 | 1629.5 | 1813.2 |
| 681 | 10 | 2.00 | 0.8 | 0.00 | 1836.5 | 1831.5 | 2158.6 | 1566.1 | 1749.4 |
| 682 | 10 | 2.00 | 0.8 | 0.40 | 1848.6 | 1890.1 | 2199.7 | 1566.1 | 1749.4 |
| 683 | 10 | 2.00 | 0.8 | 0.70 | 1863.7 | 1874.3 | 2249.3 | 1566.1 | 1749.4 |
| 684 | 10 | 2.00 | 0.8 | 0.85 | 1868.9 | 1861.1 | 2266.4 | 1566.1 | 1749.4 |
| 685 | 10 | 2.00 | 0.8 | 1.00 | 1871.2 | 1862.5 | 2273.8 | 1566.1 | 1749.4 |
| 686 | 10 | 2.00 | 0.6 | 0.00 | 1776.8 | 1782.3 | 2093.3 | 1493.9 | 1694.5 |
| 687 | 10 | 2.00 | 0.6 | 0.40 | 1796.3 | 1836.3 | 2151.9 | 1493.9 | 1694.5 |
| 688 | 10 | 2.00 | 0.6 | 0.70 | 1826.2 | 1848.8 | 2213.9 | 1493.9 | 1694.5 |
| 689 | 10 | 2.00 | 0.6 | 0.85 | 1837.4 | 1812.2 | 2234.7 | 1493.9 | 1694.5 |
| 690 | 10 | 2.00 | 0.6 | 1.00 | 1814.8 | 1770.2 | 2243.9 | 1493.9 | 1694.5 |
| 691 | 10 | 2.00 | 0.4 | 0.00 | 1733.2 | 1729.2 | 2033.4 | 1426.6 | 1650.6 |

| TP | SS | Bias | Ell | Corr | Exact | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|---|
| 692 | 10 | 2.00 | 0.4 | 0.40 | 1755.4 | 1792.6 | 2115.0 | 1426.6 | 1650.6 |
| 693 | 10 | 2.00 | 0.4 | 0.70 | 1797.0 | 1837.3 | 2188.2 | 1426.6 | 1650.6 |
| 694 | 10 | 2.00 | 0.4 | 0.85 | 1814.3 | 1809.7 | 2211.7 | 1426.6 | 1650.6 |
| 695 | 10 | 2.00 | 0.4 | 1.00 | 1820.8 | 1709.4 | 2222.7 | 1426.6 | 1650.6 |
| 696 | 10 | 2.00 | 0.2 | 0.00 | 1707.1 | 1701.4 | 1979.4 | 1330.7 | 1620.5 |
| 697 | 10 | 2.00 | 0.2 | 0.40 | 1730.6 | 1748.1 | 2091.6 | 1330.7 | 1620.5 |
| 698 | 10 | 2.00 | 0.2 | 0.70 | 1778.3 | 1827.2 | 2172.7 | 1330.7 | 1620.5 |
| 699 | 10 | 2.00 | 0.2 | 0.85 | 1800.3 | 1853.4 | 2197.8 | 1330.7 | 1620.5 |
| 700 | 10 | 2.00 | 0.2 | 1.00 | 1808.1 | 1744.5 | 2210.4 | 1330.7 | 1620.5 |
| 701 | 15 | 0.00 | 1.0 | 0.00 | 1000.0 | 931.9 | 1012.1 | 828.2 | 1002.2 |
| 702 | 15 | 0.00 | 1.0 | 0.40 | 1002.0 | 953.5 | 1012.4 | 828.2 | 1002.2 |
| 703 | 15 | 0.00 | 1.0 | 0.70 | 1002.0 | 947.2 | 1011.7 | 828.2 | 1002.2 |
| 704 | 15 | 0.00 | 1.0 | 0.85 | 1002.0 | 953.3 | 1011.3 | 828.2 | 1002.2 |
| 705 | 15 | 0.00 | 1.0 | 1.00 | 1002.0 | 951.3 | 1011.0 | 828.2 | 1002.2 |
| 706 | 15 | 0.00 | 0.8 | 0.00 | 898.4 | 908.9 | 910.2 | 749.1 | 904.5 |
| 707 | 15 | 0.00 | 0.8 | 0.40 | 902.2 | 904.5 | 912.4 | 749.1 | 904.5 |
| 708 | 15 | 0.00 | 0.8 | 0.70 | 905.3 | 890.2 | 914.7 | 749.1 | 904.5 |
| 709 | 15 | 0.00 | 0.8 | 0.85 | 906.3 | 878.4 | 915.4 | 749.1 | 904.5 |
| 710 | 15 | 0.00 | 0.8 | 1.00 | 906.7 | 864.9 | 915.6 | 749.1 | 904.5 |
| 711 | 15 | 0.00 | 0.6 | 0.00 | 793.1 | 823.1 | 806.8 | 674.4 | 813.9 |
| 712 | 15 | 0.00 | 0.6 | 0.40 | 805.1 | 828.2 | 816.2 | 674.4 | 813.9 |
| 713 | 15 | 0.00 | 0.6 | 0.70 | 818.8 | 827.1 | 828.2 | 674.4 | 813.9 |
| 714 | 15 | 0.00 | 0.6 | 0.85 | 823.4 | 818.3 | 832.5 | 674.4 | 813.9 |
| 715 | 15 | 0.00 | 0.6 | 1.00 | 825.0 | 789.6 | 834.2 | 674.4 | 813.9 |
| 716 | 15 | 0.00 | 0.4 | 0.00 | 686.3 | 747.9 | 703.9 | 598.4 | 733.5 |
| 717 | 15 | 0.00 | 0.4 | 0.40 | 714.7 | 751.3 | 728.7 | 598.4 | 733.5 |
| 718 | 15 | 0.00 | 0.4 | 0.70 | 747.4 | 765.9 | 757.2 | 598.4 | 733.5 |
| 719 | 15 | 0.00 | 0.4 | 0.85 | 757.7 | 769.3 | 767.0 | 598.4 | 733.5 |
| 720 | 15 | 0.00 | 0.4 | 1.00 | 761.3 | 744.5 | 771.2 | 598.4 | 733.5 |
| 721 | 15 | 0.00 | 0.2 | 0.00 | 599.6 | 740.0 | 603.2 | 527.9 | 669.6 |
| 722 | 15 | 0.00 | 0.2 | 0.40 | 643.8 | 694.2 | 660.3 | 527.9 | 669.6 |
| 723 | 15 | 0.00 | 0.2 | 0.70 | 698.7 | 713.8 | 709.1 | 527.9 | 669.6 |
| 724 | 15 | 0.00 | 0.2 | 0.85 | 714.8 | 732.6 | 724.3 | 527.9 | 669.6 |
| 725 | 15 | 0.00 | 0.2 | 1.00 | 720.3 | 736.6 | 731.4 | 527.9 | 669.6 |
| 726 | 15 | 0.25 | 1.0 | 0.00 | 1015.8 | 954.5 | 1042.0 | 836.7 | 1016.7 |
| 727 | 15 | 0.25 | 1.0 | 0.40 | 1017.8 | 973.2 | 1042.4 | 836.7 | 1016.7 |
| 728 | 15 | 0.25 | 1.0 | 0.70 | 1017.7 | 984.1 | 1041.9 | 836.7 | 1016.7 |
| 729 | 15 | 0.25 | 1.0 | 0.85 | 1017.7 | 990.2 | 1041.6 | 836.7 | 1016.7 |
| 730 | 15 | 0.25 | 1.0 | 1.00 | 1017.7 | 987.6 | 1041.3 | 836.7 | 1016.7 |
| 731 | 15 | 0.25 | 0.8 | 0.00 | 913.7 | 927.0 | 941.4 | 753.5 | 919.9 |

| TP | SS | Bias | Ell | Corr | Exact | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|---|
| 732 | 15 | 0.25 | 0.8 | 0.40 | 918.1 | 925.1 | 944.1 | 753.5 | 919.9 |
| 733 | 15 | 0.25 | 0.8 | 0.70 | 922.0 | 925.1 | 947.3 | 753.5 | 919.9 |
| 734 | 15 | 0.25 | 0.8 | 0.85 | 923.5 | 916.8 | 948.4 | 753.5 | 919.9 |
| 735 | 15 | 0.25 | 0.8 | 1.00 | 924.0 | 901.6 | 948.7 | 753.5 | 919.9 |
| 736 | 15 | 0.25 | 0.6 | 0.00 | 808.0 | 842.3 | 839.9 | 682.1 | 830.3 |
| 737 | 15 | 0.25 | 0.6 | 0.40 | 821.3 | 851.6 | 850.2 | 682.1 | 830.3 |
| 738 | 15 | 0.25 | 0.6 | 0.70 | 836.9 | 859.1 | 863.5 | 682.1 | 830.3 |
| 739 | 15 | 0.25 | 0.6 | 0.85 | 842.1 | 857.8 | 868.2 | 682.1 | 830.3 |
| 740 | 15 | 0.25 | 0.6 | 1.00 | 844.0 | 832.0 | 870.2 | 682.1 | 830.3 |
| 741 | 15 | 0.25 | 0.4 | 0.00 | 701.4 | 781.7 | 739.6 | 608.4 | 751.1 |
| 742 | 15 | 0.25 | 0.4 | 0.40 | 731.8 | 772.6 | 765.5 | 608.4 | 751.1 |
| 743 | 15 | 0.25 | 0.4 | 0.70 | 767.0 | 797.1 | 795.1 | 608.4 | 751.1 |
| 744 | 15 | 0.25 | 0.4 | 0.85 | 778.0 | 801.3 | 805.3 | 608.4 | 751.1 |
| 745 | 15 | 0.25 | 0.4 | 1.00 | 781.9 | 786.2 | 809.8 | 608.4 | 751.1 |
| 746 | 15 | 0.25 | 0.2 | 0.00 | 616.8 | 777.6 | 642.0 | 536.7 | 688.2 |
| 747 | 15 | 0.25 | 0.2 | 0.40 | 662.4 | 725.2 | 699.9 | 536.7 | 688.2 |
| 748 | 15 | 0.25 | 0.2 | 0.70 | 719.5 | 752.9 | 749.1 | 536.7 | 688.2 |
| 749 | 15 | 0.25 | 0.2 | 0.85 | 736.4 | 765.1 | 764.5 | 536.7 | 688.2 |
| 750 | 15 | 0.25 | 0.2 | 1.00 | 742.2 | 768.1 | 771.7 | 536.7 | 688.2 |
| 751 | 15 | 0.50 | 1.0 | 0.00 | 1063.1 | 1028.6 | 1127.6 | 889.0 | 1061.8 |
| 752 | 15 | 0.50 | 1.0 | 0.40 | 1065.1 | 1045.7 | 1128.4 | 889.0 | 1061.8 |
| 753 | 15 | 0.50 | 1.0 | 0.70 | 1065.0 | 1068.7 | 1128.8 | 889.0 | 1061.8 |
| 754 | 15 | 0.50 | 1.0 | 0.85 | 1065.0 | 1074.0 | 1128.8 | 889.0 | 1061.8 |
| 755 | 15 | 0.50 | 1.0 | 1.00 | 1065.0 | 1072.6 | 1128.8 | 889.0 | 1061.8 |
| 756 | 15 | 0.50 | 0.8 | 0.00 | 960.1 | 981.3 | 1030.5 | 800.4 | 967.5 |
| 757 | 15 | 0.50 | 0.8 | 0.40 | 965.5 | 990.5 | 1035.0 | 800.4 | 967.5 |
| 758 | 15 | 0.50 | 0.8 | 0.70 | 973.1 | 997.9 | 1040.8 | 800.4 | 967.5 |
| 759 | 15 | 0.50 | 0.8 | 0.85 | 975.4 | 999.1 | 1042.9 | 800.4 | 967.5 |
| 760 | 15 | 0.50 | 0.8 | 1.00 | 976.4 | 993.1 | 1043.8 | 800.4 | 967.5 |
| 761 | 15 | 0.50 | 0.6 | 0.00 | 853.9 | 910.2 | 934.1 | 721.5 | 880.6 |
| 762 | 15 | 0.50 | 0.6 | 0.40 | 871.4 | 915.6 | 947.2 | 721.5 | 880.6 |
| 763 | 15 | 0.50 | 0.6 | 0.70 | 892.2 | 936.5 | 964.1 | 721.5 | 880.6 |
| 764 | 15 | 0.50 | 0.6 | 0.85 | 899.0 | 937.3 | 970.1 | 721.5 | 880.6 |
| 765 | 15 | 0.50 | 0.6 | 1.00 | 901.6 | 931.6 | 972.7 | 721.5 | 880.6 |
| 766 | 15 | 0.50 | 0.4 | 0.00 | 748.9 | 864.7 | 840.2 | 657.6 | 804.3 |
| 767 | 15 | 0.50 | 0.4 | 0.40 | 784.6 | 839.4 | 869.6 | 657.6 | 804.3 |
| 768 | 15 | 0.50 | 0.4 | 0.70 | 826.6 | 877.7 | 902.5 | 657.6 | 804.3 |
| 769 | 15 | 0.50 | 0.4 | 0.85 | 839.7 | 883.9 | 913.7 | 657.6 | 804.3 |
| 770 | 15 | 0.50 | 0.4 | 1.00 | 844.4 | 878.7 | 918.7 | 657.6 | 804.3 |
| 771 | 15 | 0.50 | 0.2 | 0.00 | 670.7 | 870.9 | 750.6 | 578.7 | 744.2 |

| TP | SS | Bias | Ell | Corr | Exact | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|---|
| 772 | 15 | 0.50 | 0.2 | 0.40 | 719.2 | 798.9 | 811.2 | 578.7 | 744.2 |
| 773 | 15 | 0.50 | 0.2 | 0.70 | 782.8 | 849.5 | 861.8 | 578.7 | 744.2 |
| 774 | 15 | 0.50 | 0.2 | 0.85 | 801.7 | 850.9 | 877.6 | 578.7 | 744.2 |
| 775 | 15 | 0.50 | 0.2 | 1.00 | 808.3 | 851.9 | 885.2 | 578.7 | 744.2 |
| 776 | 15 | 0.75 | 1.0 | 0.00 | 1142.6 | 1136.4 | 1258.0 | 935.0 | 1135.6 |
| 777 | 15 | 0.75 | 1.0 | 0.40 | 1144.6 | 1167.4 | 1260.3 | 935.0 | 1135.6 |
| 778 | 15 | 0.75 | 1.0 | 0.70 | 1144.4 | 1183.3 | 1263.1 | 935.0 | 1135.6 |
| 779 | 15 | 0.75 | 1.0 | 0.85 | 1144.4 | 1191.8 | 1264.1 | 935.0 | 1135.5 |
| 780 | 15 | 0.75 | 1.0 | 1.00 | 1144.4 | 1193.9 | 1264.4 | 935.0 | 1135.6 |
| 781 | 15 | 0.75 | 0.8 | 0.00 | 1039.4 | 1071.5 | 1165.9 | 853.6 | 1045.0 |
| 782 | 15 | 0.75 | 0.8 | 0.40 | 1048.7 | 1089.5 | 1173.7 | 853.6 | 1045.0 |
| 783 | 15 | 0.75 | 0.8 | 0.70 | 1059.1 | 1111.7 | 1184.1 | 853.6 | 1045.0 |
| 784 | 15 | 0.75 | 0.8 | 0.85 | 1062.7 | 1109.8 | 1187.8 | 853.6 | 1045.0 |
| 785 | 15 | 0.75 | 0.8 | 1.00 | 1064.1 | 1118.1 | 1189.4 | 853.6 | 1045.0 |
| 786 | 15 | 0.75 | 0.6 | 0.00 | 934.2 | 1002.0 | 1076.2 | 778.9 | 962.2 |
| 787 | 15 | 0.75 | 0.6 | 0.40 | 957.4 | 1013.2 | 1093.9 | 778.9 | 962.2 |
| 788 | 15 | 0.75 | 0.6 | 0.70 | 985.3 | 1053.5 | 1116.3 | 778.9 | 962.2 |
| 789 | 15 | 0.75 | 0.6 | 0.85 | 994.5 | 1059.7 | 1124.3 | 778.9 | 962.2 |
| 790 | 15 | 0.75 | 0.6 | 1.00 | 998.0 | 1058.6 | 1127.8 | 778.9 | 962.2 |
| 791 | 15 | 0.75 | 0.4 | 0.00 | 834.2 | 969.6 | 990.5 | 710.9 | 890.3 |
| 792 | 15 | 0.75 | 0.4 | 0.40 | 876.1 | 936.6 | 1025.4 | 710.9 | 890.3 |
| 793 | 15 | 0.75 | 0.4 | 0.70 | 926.8 | 1001.3 | 1063.3 | 710.9 | 890.3 |
| 794 | 15 | 0.75 | 0.4 | 0.85 | 942.7 | 1010.8 | 1076.1 | 710.9 | 890.3 |
| 795 | 15 | 0.75 | 0.4 | 1.00 | 948.5 | 1015.1 | 1081.9 | 710.9 | 890.3 |
| 796 | 15 | 0.75 | 0.2 | 0.00 | 767.1 | 982.4 | 910.5 | 636.9 | 834.5 |
| 797 | 15 | 0.75 | 0.2 | 0.40 | 816.5 | 900.7 | 975.7 | 636.9 | 834.5 |
| 798 | 15 | 0.75 | 0.2 | 0.70 | 888.5 | 972.1 | 1029.0 | 636.9 | 834.5 |
| 799 | 15 | 0.75 | 0.2 | 0.85 | 910.3 | 980.8 | 1045.7 | 636.9 | 834.5 |
| 800 | 15 | 0.75 | 0.2 | 1.00 | 918.0 | 982.0 | 1053.8 | 636.9 | 834.5 |
| 801 | 15 | 1.00 | 1.0 | 0.00 | 1253.4 | 1245.9 | 1420.6 | 1022.7 | 1235.0 |
| 802 | 15 | 1.00 | 1.0 | 0.40 | 1255.3 | 1290.4 | 1425.8 | 1022.7 | 1235.0 |
| 803 | 15 | 1.00 | 1.0 | 0.70 | 1255.0 | 1320.8 | 1433.0 | 1022.7 | 1235.0 |
| 804 | 15 | 1.00 | 1.0 | 0.85 | 1254.9 | 1333.2 | 1435.6 | 1022.7 | 1235.0 |
| 805 | 15 | 1.00 | 1.0 | 1.00 | 1254.9 | 1338.9 | 1436.7 | 1022.7 | 1235.0 |
| 806 | 15 | 1.00 | 0.8 | 0.00 | 1152.2 | 1180.7 | 1334.2 | 952.4 | 1149.2 |
| 807 | 15 | 1.00 | 0.8 | 0.40 | 1164.6 | 1225.4 | 1346.6 | 952.4 | 1149.2 |
| 808 | 15 | 1.00 | 0.8 | 0.70 | 1178.5 | 1254.8 | 1363.2 | 952.4 | 1149.2 |
| 809 | 15 | 1.00 | 0.8 | 0.85 | 1183.4 | 1266.3 | 1369.2 | 952.4 | 1149.2 |
| 810 | 15 | 1.00 | 0.8 | 1.00 | 1185.3 | 1273.3 | 1371.8 | 952.4 | 1149.2 |
| 811 | 15 | 1.00 | 0.6 | 0.00 | 1051.7 | 1117.2 | 1251.3 | 880.1 | 1071.5 |

| TP | SS | Bias | Ell | Corr | Exact | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|---|
| 812 | 15 | 1.00 | 0.6 | 0.40 | 1079.7 | 1144.7 | 1275.2 | 880.1 | 1071.5 |
| 813 | 15 | 1.00 | 0.6 | 0.70 | 1113.9 | 1203.1 | 1304.4 | 880.1 | 1071.5 |
| 814 | 15 | 1.00 | 0.6 | 0.85 | 1125.2 | 1210.8 | 1314.8 | 880.1 | 1071.5 |
| 815 | 15 | 1.00 | 0.6 | 1.00 | 1129.4 | 1214.2 | 1319.3 | 880.1 | 1071.5 |
| 816 | 15 | 1.00 | 0.4 | 0.00 | 962.5 | 1084.2 | 1173.4 | 813.4 | 1004.9 |
| 817 | 15 | 1.00 | 0.4 | 0.40 | 1006.4 | 1068.2 | 1215.6 | 813.4 | 1004.9 |
| 818 | 15 | 1.00 | 0.4 | 0.70 | 1063.5 | 1150.6 | 1259.5 | 813.4 | 1004.9 |
| 819 | 15 | 1.00 | 0.4 | 0.85 | 1082.1 | 1163.4 | 1274.2 | 813.4 | 1004.9 |
| 820 | 15 | 1.00 | 0.4 | 1.00 | 1088.8 | 1168.2 | 1281.0 | 813.4 | 1004.9 |
| 821 | 15 | 1.00 | 0.2 | 0.00 | 909.0 | 1089.4 | 1101.9 | 740.0 | 954.2 |
| 822 | 15 | 1.00 | 0.2 | 0.40 | 954.2 | 1017.7 | 1173.9 | 740.0 | 954.2 |
| 823 | 15 | 1.00 | 0.2 | 0.70 | 1030.8 | 1111.4 | 1231.1 | 740.0 | 954.2 |
| 824 | 15 | 1.00 | 0.2 | 0.85 | 1055.5 | 1135.7 | 1249.0 | 740.0 | 954.2 |
| 825 | 15 | 1.00 | 0.2 | 1.00 | 1064.2 | 1144.8 | 1257.8 | 740.0 | 954.2 |
| 826 | 15 | 1.50 | 1.0 | 0.00 | 1550.8 | 1530.2 | 1803.2 | 1243.7 | 1495.5 |
| 827 | 15 | 1.50 | 1.0 | 0.40 | 1552.5 | 1621.0 | 1818.5 | 1243.7 | 1495.5 |
| 828 | 15 | 1.50 | 1.0 | 0.70 | 1552.0 | 1655.6 | 1839.3 | 1243.7 | 1495.5 |
| 829 | 15 | 1.50 | 1.0 | 0.85 | 1551.8 | 1667.1 | 1846.9 | 1243.7 | 1495.5 |
| 830 | 15 | 1.50 | 1.0 | 1.00 | 1551.8 | 1673.9 | 1850.2 | 1243.7 | 1495.5 |
| 831 | 15 | 1.50 | 0.8 | 0.00 | 1462.9 | 1464.0 | 1727.2 | 1182.3 | 1420.7 |
| 832 | 15 | 1.50 | 0.8 | 0.40 | 1477.4 | 1544.8 | 1752.6 | 1182.3 | 1420.7 |
| 833 | 15 | 1.50 | 0.8 | 0.70 | 1494.1 | 1585.1 | 1784.9 | 1182.3 | 1420.7 |
| 834 | 15 | 1.50 | 0.8 | 0.85 | 1499.8 | 1601.9 | 1796.5 | 1182.3 | 1420.7 |
| 835 | 15 | 1.50 | 0.8 | 1.00 | 1502.0 | 1604.7 | 1801.7 | 1182.3 | 1420.7 |
| 836 | 15 | 1.50 | 0.6 | 0.00 | 1383.2 | 1401.9 | 1655.6 | 1112.1 | 1354.6 |
| 837 | 15 | 1.50 | 0.6 | 0.40 | 1409.9 | 1472.2 | 1695.5 | 1112.1 | 1354.6 |
| 838 | 15 | 1.50 | 0.6 | 0.70 | 1446.0 | 1526.0 | 1740.6 | 1112.1 | 1354.6 |
| 839 | 15 | 1.50 | 0.6 | 0.85 | 1458.6 | 1544.1 | 1756.3 | 1112.1 | 1354.6 |
| 840 | 15 | 1.50 | 0.6 | 1.00 | 1463.3 | 1555.3 | 1763.4 | 1112.1 | 1354.6 |
| 841 | 15 | 1.50 | 0.4 | 0.00 | 1323.3 | 1349.9 | 1589.3 | 1042.5 | 1299.7 |
| 842 | 15 | 1.50 | 0.4 | 0.40 | 1355.1 | 1408.5 | 1649.8 | 1042.5 | 1299.7 |
| 843 | 15 | 1.50 | 0.4 | 0.70 | 1408.8 | 1482.9 | 1707.8 | 1042.5 | 1299.7 |
| 844 | 15 | 1.50 | 0.4 | 0.85 | 1428.3 | 1503.7 | 1726.8 | 1042.5 | 1299.7 |
| 845 | 15 | 1.50 | 0.4 | 1.00 | 1435.5 | 1505.2 | 1735.9 | 1042.5 | 1299.7 |
| 846 | 15 | 1.50 | 0.2 | 0.00 | 1288.5 | 1329.6 | 1529.4 | 959.5 | 1260.0 |
| 847 | 15 | 1.50 | 0.2 | 0.40 | 1319.5 | 1360.2 | 1619.7 | 959.5 | 1260.0 |
| 848 | 15 | 1.50 | 0.2 | 0.70 | 1384.3 | 1447.0 | 1687.8 | 959.5 | 1260.0 |
| 849 | 15 | 1.50 | 0.2 | 0.85 | 1409.6 | 1481.7 | 1709.0 | 959.5 | 1260.0 |
| 850 | 15 | 1.50 | 0.2 | 1.00 | 1418.8 | 1492.3 | 1719.6 | 959.5 | 1260.0 |
| 851 | 15 | 2.00 | 1.0 | 0.00 | 1907.6 | 1882.8 | 2226.1 | 1560.4 | 1813.2 |

| TP | SS | Bias | Ell | Corr | Exact | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|---|
| 852 | 15 | 2.00 | 1.0 | 0.40 | 1909.1 | 1967.6 | 2255.6 | 1560.4 | 1813.2 |
| 853 | 15 | 2.00 | 1.0 | 0.70 | 1908.8 | 1975.7 | 2293.7 | 1560.4 | 1813.2 |
| 854 | 15 | 2.00 | 1.0 | 0.85 | 1908.6 | 1984.6 | 2307.4 | 1560.4 | 1813.2 |
| 855 | 15 | 2.00 | 1.0 | 1.00 | 1908.6 | 1993.5 | 2313.6 | 1560.4 | 1813.2 |
| 856 | 15 | 2.00 | 0.8 | 0.00 | 1836.5 | 1830.5 | 2157.7 | 1497.4 | 1749.4 |
| 857 | 15 | 2.00 | 0.8 | 0.40 | 1848.6 | 1907.3 | 2200.3 | 1497.4 | 1749.4 |
| 858 | 15 | 2.00 | 0.8 | 0.70 | 1863.7 | 1921.4 | 2250.3 | 1497.4 | 1749.4 |
| 859 | 15 | 2.00 | 0.8 | 0.85 | 1868.9 | 1906.4 | 2267.9 | 1497.4 | 1749.4 |
| 860 | 15 | 2.00 | 0.8 | 1.00 | 1871.2 | 1898.4 | 2275.9 | 1497.4 | 1749.4 |
| 861 | 15 | 2.00 | 0.6 | 0.00 | 1776.8 | 1781.1 | 2093.7 | 1435.7 | 1694.5 |
| 862 | 15 | 2.00 | 0.6 | 0.40 | 1796.3 | 1838.9 | 2153.4 | 1435.7 | 1694.5 |
| 863 | 15 | 2.00 | 0.6 | 0.70 | 1826.2 | 1878.4 | 2215.7 | 1435.7 | 1694.5 |
| 864 | 15 | 2.00 | 0.6 | 0.85 | 1837.4 | 1855.6 | 2236.7 | 1435.7 | 1694.5 |
| 865 | 15 | 2.00 | 0.6 | 1.00 | 1841.8 | 1800.4 | 2246.6 | 1435.7 | 1694.5 |
| 866 | 15 | 2.00 | 0.4 | 0.00 | 1733.2 | 1726.9 | 2034.6 | 1371.5 | 1650.6 |
| 867 | 15 | 2.00 | 0.4 | 0.40 | 1755.4 | 1779.4 | 2117.1 | 1371.5 | 1650.6 |
| 868 | 15 | 2.00 | 0.4 | 0.70 | 1797.0 | 1854.0 | 2190.5 | 1371.5 | 1650.6 |
| 869 | 15 | 2.00 | 0.4 | 0.85 | 1814.3 | 1848.5 | 2214.2 | 1371.5 | 1650.6 |
| 870 | 15 | 2.00 | 0.4 | 1.00 | 1820.8 | 1757.1 | 2225.8 | 1371.5 | 1650.6 |
| 871 | 15 | 2.00 | 0.2 | 0.00 | 1707.1 | 1695.1 | 1981.1 | 1268.4 | 1620.5 |
| 872 | 15 | 2.00 | 0.2 | 0.40 | 1730.6 | 1748.6 | 2093.9 | 1268.4 | 1620.5 |
| 873 | 15 | 2.00 | 0.2 | 0.70 | 1778.3 | 1825.5 | 2175.3 | 1268.4 | 1620.5 |
| 874 | 15 | 2.00 | 0.2 | 0.85 | 1800.3 | 1861.3 | 2200.6 | 1268.4 | 1620.5 |
| 875 | 15 | 2.00 | 0.2 | 1.00 | 1808.1 | 1821.6 | 2213.5 | 1268.4 | 1620.5 |

# Appendix F. *Relative Errors*

This Appendix lists the Relative Errors of the CEP estimates made by the quick methods for the 875 test design points. The names of the four parameters and the names of the CEP estimation methods for this experiment are abbreviated in the table headings as follows:

Index

Test Point - TP

Parameters

Sample Size - SS

Bias - Bias

Ellipticity - Ell

Correlation - Corr

Estimation Methods

Grubbs-Patnaik/chi-square method - Grubbs

Modified RAND-234 method - Rand

Ethridge method - Eth

CEP3 method - CEP3

| TP | SS | Bias | Ell | Corr | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 0.00 | 1.0 | 0.00 | 0.080 | 0.083 | -0.031 | 0.002 |
| 2 | 3 | 0.00 | 1.0 | 0.40 | 0.074 | 0.081 | -0.032 | 0.000 |
| 3 | 3 | 0.00 | 1.0 | 0.70 | 0.074 | 0.080 | -0.032 | 0.000 |
| 4 | 3 | 0.00 | 1.0 | 0.85 | 0.076 | 0.080 | -0.032 | 0.000 |
| 5 | 3 | 0.00 | 1.0 | 1.00 | 0.074 | 0.079 | -0.032 | 0.000 |
| 6 | 3 | 0.00 | 0.8 | 0.00 | 0.100 | 0.085 | -0.028 | 0.007 |
| 7 | 3 | 0.00 | 0.8 | 0.40 | 0.096 | 0.082 | -0.032 | 0.003 |
| 8 | 3 | 0.00 | 0.8 | 0.70 | 0.086 | 0.080 | -0.036 | -0.001 |
| 9 | 3 | 0.00 | 0.8 | 0.85 | 0.084 | 0.079 | -0.037 | -0.002 |
| 10 | 3 | 0.00 | 0.8 | 1.00 | 0.077 | 0.079 | -0.037 | -0.002 |
| 11 | 3 | 0.00 | 0.6 | 0.00 | 0.141 | 0.096 | -0.018 | 0.026 |

| TP | SS | Bias | Ell | Corr | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|
| 12 | 3 | 0.00 | 0.6 | 0.40 | 0.133 | 0.088 | -0.032 | 0.011 |
| 13 | 3 | 0.00 | 0.6 | 0.70 | 0.102 | 0.081 | -0.049 | -0.006 |
| 14 | 3 | 0.00 | 0.6 | 0.85 | 0.091 | 0.078 | -0.054 | -0.012 |
| 15 | 3 | 0.00 | 0.6 | 1.00 | 0.076 | 0.077 | -0.056 | -0.013 |
| 16 | 3 | 0.00 | 0.4 | 0.00 | 0.226 | 0.118 | 0.004 | 0.069 |
| 17 | 3 | 0.00 | 0.4 | 0.40 | 0.175 | 0.101 | -0.036 | 0.026 |
| 18 | 3 | 0.00 | 0.4 | 0.70 | 0.118 | 0.082 | -0.078 | -0.019 |
| 19 | 3 | 0.00 | 0.4 | 0.85 | 0.097 | 0.076 | -0.091 | -0.032 |
| 20 | 3 | 0.00 | 0.4 | 1.00 | 0.077 | 0.075 | -0.095 | -0.037 |
| 21 | 3 | 0.00 | 0.2 | 0.00 | 0.346 | 0.122 | 0.012 | 0.117 |
| 22 | 3 | 0.00 | 0.2 | 0.40 | 0.205 | 0.114 | -0.057 | 0.040 |
| 23 | 3 | 0.00 | 0.2 | 0.70 | 0.133 | 0.082 | -0.132 | -0.042 |
| 24 | 3 | 0.00 | 0.2 | 0.85 | 0.111 | 0.074 | -0.151 | -0.063 |
| 25 | 3 | 0.00 | 0.2 | 1.00 | 0.079 | 0.073 | -0.158 | -0.070 |
| 26 | 3 | 0.25 | 1.0 | 0.00 | 0.077 | 0.091 | -0.032 | 0.001 |
| 27 | 3 | 0.25 | 1.0 | 0.40 | 0.073 | 0.090 | -0.034 | -0.001 |
| 28 | 3 | 0.25 | 1.0 | 0.70 | 0.078 | 0.089 | -0.034 | -0.001 |
| 29 | 3 | 0.25 | 1.0 | 0.85 | 0.076 | 0.089 | -0.034 | -0.001 |
| 30 | 3 | 0.25 | 1.0 | 1.00 | 0.073 | 0.088 | -0.034 | -0.001 |
| 31 | 3 | 0.25 | 0.8 | 0.00 | 0.104 | 0.096 | -0.029 | 0.007 |
| 32 | 3 | 0.25 | 0.8 | 0.40 | 0.099 | 0.093 | -0.033 | 0.002 |
| 33 | 3 | 0.25 | 0.8 | 0.70 | 0.087 | 0.089 | -0.039 | -0.004 |
| 34 | 3 | 0.25 | 0.8 | 0.85 | 0.085 | 0.089 | -0.040 | -0.004 |
| 35 | 3 | 0.25 | 0.8 | 1.00 | 0.079 | 0.089 | -0.040 | -0.004 |
| 36 | 3 | 0.25 | 0.6 | 0.00 | 0.146 | 0.110 | -0.017 | 0.028 |
| 37 | 3 | 0.25 | 0.6 | 0.40 | 0.133 | 0.102 | -0.033 | 0.011 |
| 38 | 3 | 0.25 | 0.6 | 0.70 | 0.102 | 0.093 | -0.051 | -0.008 |
| 39 | 3 | 0.25 | 0.6 | 0.85 | 0.090 | 0.090 | -0.057 | -0.014 |
| 40 | 3 | 0.25 | 0.6 | 1.00 | 0.080 | 0.089 | -0.059 | -0.016 |
| 41 | 3 | 0.25 | 0.4 | 0.00 | 0.229 | 0.136 | 0.005 | 0.071 |
| 42 | 3 | 0.25 | 0.4 | 0.40 | 0.175 | 0.116 | -0.037 | 0.026 |
| 43 | 3 | 0.25 | 0.4 | 0.70 | 0.122 | 0.095 | -0.081 | -0.021 |
| 44 | 3 | 0.25 | 0.4 | 0.85 | 0.094 | 0.089 | -0.094 | -0.035 |
| 45 | 3 | 0.25 | 0.4 | 1.00 | 0.072 | 0.088 | -0.099 | -0.039 |
| 46 | 3 | 0.25 | 0.2 | 0.00 | 0.343 | 0.141 | 0.011 | 0.116 |
| 47 | 3 | 0.25 | 0.2 | 0.40 | 0.205 | 0.131 | -0.059 | 0.039 |
| 48 | 3 | 0.25 | 0.2 | 0.70 | 0.127 | 0.096 | -0.134 | -0.044 |
| 49 | 3 | 0.25 | 0.2 | 0.85 | 0.106 | 0.088 | -0.153 | -0.065 |
| 50 | 3 | 0.25 | 0.2 | 1.00 | 0.077 | 0.086 | -0.160 | -0.073 |
| 51 | 3 | 0.50 | 1.0 | 0.00 | 0.073 | 0.114 | -0.034 | -0.001 |

| TP | SS | Bias | Ell | Corr | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|
| 52 | 3 | 0.50 | 1.0 | 0.40 | 0.077 | 0.112 | -0.036 | -0.003 |
| 53 | 3 | 0.50 | 1.0 | 0.70 | 0.082 | 0.112 | -0.036 | -0.003 |
| 54 | 3 | 0.50 | 1.0 | 0.85 | 0.080 | 0.112 | -0.036 | -0.003 |
| 55 | 3 | 0.50 | 1.0 | 1.00 | 0.084 | 0.111 | -0.036 | -0.003 |
| 56 | 3 | 0.50 | 0.8 | 0.00 | 0.103 | 0.125 | -0.029 | 0.008 |
| 57 | 3 | 0.50 | 0.8 | 0.40 | 0.103 | 0.121 | -0.036 | 0.001 |
| 58 | 3 | 0.50 | 0.8 | 0.70 | 0.092 | 0.117 | -0.042 | -0.006 |
| 59 | 3 | 0.50 | 0.8 | 0.85 | 0.087 | 0.116 | -0.044 | -0.008 |
| 60 | 3 | 0.50 | 0.8 | 1.00 | 0.085 | 0.115 | -0.045 | -0.009 |
| 61 | 3 | 0.50 | 0.6 | 0.00 | 0.150 | 0.146 | -0.016 | 0.031 |
| 62 | 3 | 0.50 | 0.6 | 0.40 | 0.130 | 0.134 | -0.036 | 0.011 |
| 63 | 3 | 0.50 | 0.6 | 0.70 | 0.101 | 0.122 | -0.059 | -0.013 |
| 64 | 3 | 0.50 | 0.6 | 0.85 | 0.090 | 0.119 | -0.066 | -0.020 |
| 65 | 3 | 0.50 | 0.6 | 1.00 | 0.080 | 0.117 | -0.068 | -0.023 |
| 66 | 3 | 0.50 | 0.4 | 0.00 | 0.231 | 0.178 | 0.004 | 0.074 |
| 67 | 3 | 0.50 | 0.4 | 0.40 | 0.168 | 0.154 | -0.041 | 0.025 |
| 68 | 3 | 0.50 | 0.4 | 0.70 | 0.110 | 0.128 | -0.090 | -0.027 |
| 69 | 3 | 0.50 | 0.4 | 0.85 | 0.092 | 0.120 | -0.104 | -0.042 |
| 70 | 3 | 0.50 | 0.4 | 1.00 | 0.073 | 0.118 | -0.109 | -0.047 |
| 71 | 3 | 0.50 | 0.2 | 0.00 | 0.331 | 0.184 | 0.003 | 0.110 |
| 72 | 3 | 0.50 | 0.2 | 0.40 | 0.197 | 0.172 | -0.065 | 0.035 |
| 73 | 3 | 0.50 | 0.2 | 0.70 | 0.121 | 0.131 | -0.141 | -0.049 |
| 74 | 3 | 0.50 | 0.2 | 0.85 | 0.094 | 0.120 | -0.161 | -0.072 |
| 75 | 3 | 0.50 | 0.2 | 1.00 | 0.070 | 0.118 | -0.168 | -0.079 |
| 76 | 3 | 0.75 | 1.0 | 0.00 | 0.065 | 0.140 | -0.037 | -0.006 |
| 77 | 3 | 0.75 | 1.0 | 0.40 | 0.076 | 0.139 | -0.039 | -0.008 |
| 78 | 3 | 0.75 | 1.0 | 0.70 | 0.079 | 0.140 | -0.039 | -0.008 |
| 79 | 3 | 0.75 | 1.0 | 0.85 | 0.087 | 0.140 | -0.039 | -0.008 |
| 80 | 3 | 0.75 | 1.0 | 1.00 | 0.086 | 0.140 | -0.039 | -0.008 |
| 81 | 3 | 0.75 | 0.8 | 0.00 | 0.096 | 0.157 | -0.031 | 0.005 |
| 82 | 3 | 0.75 | 0.8 | 0.40 | 0.096 | 0.152 | -0.040 | -0.004 |
| 83 | 3 | 0.75 | 0.8 | 0.70 | 0.084 | 0.147 | -0.049 | -0.013 |
| 84 | 3 | 0.75 | 0.8 | 0.85 | 0.086 | 0.145 | -0.052 | -0.017 |
| 85 | 3 | 0.75 | 0.8 | 1.00 | 0.081 | 0.145 | -0.053 | -0.018 |
| 86 | 3 | 0.75 | 0.6 | 0.00 | 0.145 | 0.184 | -0.018 | 0.030 |
| 87 | 3 | 0.75 | 0.6 | 0.40 | 0.119 | 0.170 | -0.042 | 0.005 |
| 88 | 3 | 0.75 | 0.6 | 0.70 | 0.094 | 0.154 | -0.069 | -0.023 |
| 89 | 3 | 0.75 | 0.6 | 0.85 | 0.080 | 0.149 | -0.078 | -0.032 |
| 90 | 3 | 0.75 | 0.6 | 1.00 | 0.073 | 0.147 | -0.081 | -0.036 |
| 91 | 3 | 0.75 | 0.4 | 0.00 | 0.219 | 0.217 | -0.002 | 0.067 |

| TP | SS | Bias | Ell | Corr | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|
| 92 | 3 | 0.75 | 0.4 | 0.40 | 0.148 | 0.191 | -0.050 | 0.016 |
| 93 | 3 | 0.75 | 0.4 | 0.70 | 0.090 | 0.160 | -0.102 | -0.039 |
| 94 | 3 | 0.75 | 0.4 | 0.85 | 0.075 | 0.152 | -0.117 | -0.056 |
| 95 | 3 | 0.75 | 0.4 | 1.00 | 0.058 | 0.149 | -0.123 | -0.061 |
| 96 | 3 | 0.75 | 0.2 | 0.00 | 0.291 | 0.216 | -0.014 | 0.088 |
| 97 | 3 | 0.75 | 0.2 | 0.40 | 0.169 | 0.210 | -0.074 | 0.022 |
| 98 | 3 | 0.75 | 0.2 | 0.70 | 0.099 | 0.164 | -0.149 | -0.061 |
| 99 | 3 | 0.75 | 0.2 | 0.85 | 0.074 | 0.152 | -0.169 | -0.083 |
| 100 | 3 | 0.75 | 0.2 | 1.00 | 0.048 | 0.149 | -0.176 | -0.091 |
| 101 | 3 | 1.00 | 1.0 | 0.00 | 0.049 | 0.161 | -0.041 | -0.015 |
| 102 | 3 | 1.00 | 1.0 | 0.40 | 0.065 | 0.161 | -0.042 | -0.016 |
| 103 | 3 | 1.00 | 1.0 | 0.70 | 0.076 | 0.164 | -0.042 | -0.016 |
| 104 | 3 | 1.00 | 1.0 | 0.85 | 0.080 | 0.165 | -0.042 | -0.016 |
| 105 | 3 | 1.00 | 1.0 | 1.00 | 0.080 | 0.165 | -0.042 | -0.016 |
| 106 | 3 | 1.00 | 0.8 | 0.00 | 0.079 | 0.180 | -0.035 | -0.003 |
| 107 | 3 | 1.00 | 0.8 | 0.40 | 0.079 | 0.175 | -0.045 | -0.013 |
| 108 | 3 | 1.00 | 0.8 | 0.70 | 0.075 | 0.171 | -0.056 | -0.025 |
| 109 | 3 | 1.00 | 0.8 | 0.85 | 0.072 | 0.169 | -0.060 | -0.029 |
| 110 | 3 | 1.00 | 0.8 | 1.00 | 0.071 | 0.169 | -0.062 | -0.030 |
| 111 | 3 | 1.00 | 0.6 | 0.00 | 0.125 | 0.206 | -0.025 | 0.019 |
| 112 | 3 | 1.00 | 0.6 | 0.40 | 0.098 | 0.192 | -0.050 | -0.008 |
| 113 | 3 | 1.00 | 0.6 | 0.70 | 0.063 | 0.177 | -0.079 | -0.038 |
| 114 | 3 | 1.00 | 0.6 | 0.85 | 0.057 | 0.172 | -0.089 | -0.048 |
| 115 | 3 | 1.00 | 0.6 | 1.00 | 0.056 | 0.171 | -0.092 | -0.051 |
| 116 | 3 | 1.00 | 0.4 | 0.00 | 0.181 | 0.230 | -0.019 | 0.044 |
| 117 | 3 | 1.00 | 0.4 | 0.40 | 0.113 | 0.212 | -0.062 | -0.001 |
| 118 | 3 | 1.00 | 0.4 | 0.70 | 0.060 | 0.182 | -0.112 | -0.055 |
| 119 | 3 | 1.00 | 0.4 | 0.85 | 0.045 | 0.173 | -0.127 | -0.071 |
| 120 | 3 | 1.00 | 0.4 | 1.00 | 0.033 | 0.171 | -0.133 | -0.077 |
| 121 | 3 | 1.00 | 0.2 | 0.00 | 0.224 | 0.219 | -0.039 | 0.050 |
| 122 | 3 | 1.00 | 0.2 | 0.40 | 0.131 | 0.228 | -0.085 | 0.000 |
| 123 | 3 | 1.00 | 0.2 | 0.70 | 0.068 | 0.186 | -0.153 | -0.074 |
| 124 | 3 | 1.00 | 0.2 | 0.85 | 0.043 | 0.173 | -0.173 | -0.096 |
| 125 | 3 | 1.00 | 0.2 | 1.00 | 0.008 | 0.170 | -0.180 | -0.103 |
| 126 | 3 | 1.50 | 1.0 | 0.00 | 0.020 | 0.176 | -0.047 | -0.036 |
| 127 | 3 | 1.50 | 1.0 | 0.40 | 0.028 | 0.182 | -0.048 | -0.037 |
| 128 | 3 | 1.50 | 1.0 | 0.70 | 0.039 | 0.191 | -0.047 | -0.036 |
| 129 | 3 | 1.50 | 1.0 | 0.85 | 0.041 | 0.195 | -0.047 | -0.036 |
| 130 | 3 | 1.50 | 1.0 | 1.00 | 0.046 | 0.196 | -0.047 | -0.036 |
| 131 | 3 | 1.50 | 0.8 | 0.00 | 0.037 | 0.188 | -0.045 | -0.029 |

| TP | SS | Bias | Ell | Corr | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|
| 132 | 3 | 1.50 | 0.8 | 0.40 | 0.031 | 0.190 | -0.055 | -0.038 |
| 133 | 3 | 1.50 | 0.8 | 0.70 | 0.021 | 0.195 | -0.065 | -0.049 |
| 134 | 3 | 1.50 | 0.8 | 0.85 | 0.020 | 0.196 | -0.069 | -0.053 |
| 135 | 3 | 1.50 | 0.8 | 1.00 | 0.024 | 0.197 | -0.070 | -0.054 |
| 136 | 3 | 1.50 | 0.6 | 0.00 | 0.062 | 0.199 | -0.046 | -0.021 |
| 137 | 3 | 1.50 | 0.6 | 0.40 | 0.042 | 0.200 | -0.064 | -0.039 |
| 138 | 3 | 1.50 | 0.6 | 0.70 | 0.007 | 0.198 | -0.088 | -0.063 |
| 139 | 3 | 1.50 | 0.6 | 0.85 | -0.003 | 0.197 | -0.096 | -0.071 |
| 140 | 3 | 1.50 | 0.6 | 1.00 | -0.004 | 0.197 | -0.098 | -0.074 |
| 141 | 3 | 1.50 | 0.4 | 0.00 | 0.082 | 0.198 | -0.056 | -0.018 |
| 142 | 3 | 1.50 | 0.4 | 0.40 | 0.040 | 0.210 | -0.078 | -0.041 |
| 143 | 3 | 1.50 | 0.4 | 0.70 | 0.002 | 0.202 | -0.113 | -0.077 |
| 144 | 3 | 1.50 | 0.4 | 0.85 | -0.018 | 0.197 | -0.125 | -0.090 |
| 145 | 3 | 1.50 | 0.4 | 1.00 | -0.038 | 0.196 | -0.130 | -0.095 |
| 146 | 3 | 1.50 | 0.2 | 0.00 | 0.094 | 0.181 | -0.076 | -0.022 |
| 147 | 3 | 1.50 | 0.2 | 0.40 | 0.050 | 0.216 | -0.097 | -0.045 |
| 148 | 3 | 1.50 | 0.2 | 0.70 | 0.016 | 0.205 | -0.140 | -0.090 |
| 149 | 3 | 1.50 | 0.2 | 0.85 | -0.016 | 0.198 | -0.155 | -0.106 |
| 150 | 3 | 1.50 | 0.2 | 1.00 | -0.063 | 0.196 | -0.161 | -0.112 |
| 151 | 3 | 2.00 | 1.0 | 0.00 | -0.005 | 0.175 | -0.043 | -0.049 |
| 152 | 3 | 2.00 | 1.0 | 0.40 | -0.007 | 0.186 | -0.044 | -0.050 |
| 153 | 3 | 2.00 | 1.0 | 0.70 | -0.013 | 0.202 | -0.044 | -0.050 |
| 154 | 3 | 2.00 | 1.0 | 0.85 | -0.003 | 0.208 | -0.044 | -0.050 |
| 155 | 3 | 2.00 | 1.0 | 1.00 | -0.005 | 0.211 | -0.044 | -0.050 |
| 156 | 3 | 2.00 | 0.8 | 0.00 | 0.006 | 0.178 | -0.045 | -0.047 |
| 157 | 3 | 2.00 | 0.8 | 0.40 | -0.010 | 0.190 | -0.051 | -0.054 |
| 158 | 3 | 2.00 | 0.8 | 0.70 | -0.028 | 0.204 | -0.059 | -0.061 |
| 159 | 3 | 2.00 | 0.8 | 0.85 | -0.031 | 0.209 | -0.062 | -0.064 |
| 160 | 3 | 2.00 | 0.8 | 1.00 | -0.032 | 0.211 | -0.063 | -0.065 |
| 161 | 3 | 2.00 | 0.6 | 0.00 | 0.016 | 0.177 | -0.050 | -0.046 |
| 162 | 3 | 2.00 | 0.6 | 0.40 | -0.015 | 0.194 | -0.060 | -0.057 |
| 163 | 3 | 2.00 | 0.6 | 0.70 | -0.037 | 0.207 | -0.075 | -0.072 |
| 164 | 3 | 2.00 | 0.6 | 0.85 | -0.055 | 0.210 | -0.081 | -0.078 |
| 165 | 3 | 2.00 | 0.6 | 1.00 | -0.067 | 0.211 | -0.083 | -0.080 |
| 166 | 3 | 2.00 | 0.4 | 0.00 | 0.025 | 0.170 | -0.058 | -0.048 |
| 167 | 3 | 2.00 | 0.4 | 0.40 | -0.011 | 0.199 | -0.070 | -0.060 |
| 168 | 3 | 2.00 | 0.4 | 0.70 | -0.045 | 0.210 | -0.091 | -0.081 |
| 169 | 3 | 2.00 | 0.4 | 0.85 | -0.071 | 0.211 | -0.100 | -0.090 |
| 170 | 3 | 2.00 | 0.4 | 1.00 | -0.099 | 0.212 | -0.103 | -0.093 |
| 171 | 3 | 2.00 | 0.2 | 0.00 | 0.028 | 0.155 | -0.069 | -0.051 |

| TP | SS | Bias | Ell | Corr | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|
| 172 | 3 | 2.00 | 0.2 | 0.40 | 0.006 | 0.201 | -0.082 | -0.064 |
| 173 | 3 | 2.00 | 0.2 | 0.70 | -0.020 | 0.213 | -0.107 | -0.089 |
| 174 | 3 | 2.00 | 0.2 | 0.85 | -0.060 | 0.211 | -0.118 | -0.100 |
| 175 | 3 | 2.00 | 0.2 | 1.00 | -0.123 | 0.212 | -0.121 | -0.104 |
| 176 | 5 | 0.00 | 1.0 | 0.00 | 0.018 | 0.048 | -0.057 | 0.002 |
| 177 | 5 | 0.00 | 1.0 | 0.40 | 0.009 | 0.046 | -0.059 | 0.000 |
| 178 | 5 | 0.00 | 1.0 | 0.70 | 0.010 | 0.045 | -0.059 | 0.000 |
| 179 | 5 | 0.00 | 1.0 | 0.85 | 0.010 | 0.045 | -0.059 | 0.000 |
| 180 | 5 | 0.00 | 1.0 | 1.00 | 0.007 | 0.044 | -0.059 | 0.000 |
| 181 | 5 | 0.00 | 0.8 | 0.00 | 0.046 | 0.049 | -0.055 | 0.007 |
| 182 | 5 | 0.00 | 0.8 | 0.40 | 0.042 | 0.047 | -0.059 | 0.003 |
| 183 | 5 | 0.00 | 0.8 | 0.70 | 0.030 | 0.045 | -0.062 | -0.001 |
| 184 | 5 | 0.00 | 0.8 | 0.85 | 0.022 | 0.044 | -0.063 | -0.002 |
| 185 | 5 | 0.00 | 0.8 | 1.00 | 0.016 | 0.044 | -0.064 | -0.002 |
| 186 | 5 | 0.00 | 0.6 | 0.00 | 0.097 | 0.057 | [illegible] | 0.026 |
| 187 | 5 | 0.00 | 0.6 | 0.40 | 0.083 | 0.051 | [illegible] | 0.011 |
| 188 | 5 | 0.00 | 0.6 | 0.70 | 0.052 | 0.046 | -0.076 | -0.006 |
| 189 | 5 | 0.00 | 0.6 | 0.85 | 0.039 | 0.044 | -0.081 | -0.012 |
| 190 | 5 | 0.00 | 0.6 | 1.00 | 0.023 | 0.043 | -0.083 | -0.013 |
| 191 | 5 | 0.00 | 0.4 | 0.00 | 0.173 | 0.072 | -0.029 | 0.069 |
| 192 | 5 | 0.00 | 0.4 | 0.40 | 0.124 | 0.060 | -0.068 | 0.026 |
| 193 | 5 | 0.00 | 0.4 | 0.70 | 0.083 | 0.047 | -0.109 | -0.019 |
| 194 | 5 | 0.00 | 0.4 | 0.85 | 0.055 | 0.043 | -0.121 | -0.032 |
| 195 | 5 | 0.00 | 0.4 | 1.00 | 0.026 | 0.043 | -0.125 | -0.037 |
| 196 | 5 | 0.00 | 0.2 | 0.00 | 0.300 | 0.065 | -0.031 | 0.117 |
| 197 | 5 | 0.00 | 0.2 | 0.40 | 0.154 | 0.070 | -0.098 | 0.040 |
| 198 | 5 | 0.00 | 0.2 | 0.70 | 0.092 | 0.048 | -0.169 | -0.042 |
| 199 | 5 | 0.00 | 0.2 | 0.85 | 0.078 | 0.043 | -0.187 | -0.063 |
| 200 | 5 | 0.00 | 0.2 | 1.00 | 0.044 | 0.043 | -0.194 | -0.070 |
| 201 | 5 | 0.25 | 1.0 | 0.00 | 0.019 | 0.059 | -0.060 | 0.001 |
| 202 | 5 | 0.25 | 1.0 | 0.40 | 0.013 | 0.057 | -0.062 | -0.001 |
| 203 | 5 | 0.25 | 1.0 | 0.70 | 0.016 | 0.056 | -0.062 | -0.001 |
| 204 | 5 | 0.25 | 1.0 | 0.85 | 0.020 | 0.056 | -0.062 | -0.001 |
| 205 | 5 | 0.25 | 1.0 | 1.00 | 0.017 | 0.056 | -0.062 | -0.001 |
| 206 | 5 | 0.25 | 0.8 | 0.00 | 0.046 | 0.063 | -0.057 | 0.007 |
| 207 | 5 | 0.25 | 0.8 | 0.40 | 0.045 | 0.060 | -0.062 | 0.002 |
| 208 | 5 | 0.25 | 0.8 | 0.70 | 0.036 | 0.058 | -0.066 | -0.002 |
| 209 | 5 | 0.25 | 0.8 | 0.85 | 0.036 | 0.057 | -0.067 | -0.004 |
| 210 | 5 | 0.25 | 0.8 | 1.00 | 0.024 | 0.057 | -0.068 | -0.004 |
| 211 | 5 | 0.25 | 0.6 | 0.00 | 0.101 | 0.075 | -0.047 | 0.028 |

| TP | SS | Bias | Ell | Corr | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|
| 212 | 5 | 0.25 | 0.6 | 0.40 | 0.088 | 0.068 | -0.062 | 0.011 |
| 213 | 5 | 0.25 | 0.6 | 0.70 | 0.066 | 0.061 | -0.080 | -0.008 |
| 214 | 5 | 0.25 | 0.6 | 0.85 | 0.048 | 0.059 | -0.086 | -0.014 |
| 215 | 5 | 0.25 | 0.6 | 1.00 | 0.029 | 0.059 | -0.088 | -0.016 |
| 216 | 5 | 0.25 | 0.4 | 0.00 | 0.182 | 0.095 | -0.029 | 0.071 |
| 217 | 5 | 0.25 | 0.4 | 0.40 | 0.129 | 0.080 | -0.069 | 0.026 |
| 218 | 5 | 0.25 | 0.4 | 0.70 | 0.086 | 0.065 | -0.112 | -0.021 |
| 219 | 5 | 0.25 | 0.4 | 0.85 | 0.063 | 0.061 | -0.124 | -0.035 |
| 220 | 5 | 0.25 | 0.4 | 1.00 | 0.036 | 0.060 | -0.129 | -0.039 |
| 221 | 5 | 0.25 | 0.2 | 0.00 | 0.307 | 0.090 | -0.032 | 0.116 |
| 222 | 5 | 0.25 | 0.2 | 0.40 | 0.156 | 0.093 | -0.099 | 0.039 |
| 223 | 5 | 0.25 | 0.2 | 0.70 | 0.098 | 0.068 | -0.171 | -0.044 |
| 224 | 5 | 0.25 | 0.2 | 0.85 | 0.081 | 0.062 | -0.190 | -0.065 |
| 225 | 5 | 0.25 | 0.2 | 1.00 | 0.055 | 0.061 | -0.196 | -0.073 |
| 226 | 5 | 0.50 | 1.0 | 0.00 | 0.021 | 0.087 | -0.062 | -0.001 |
| 227 | 5 | 0.50 | 1.0 | 0.40 | 0.029 | 0.086 | -0.064 | -0.003 |
| 228 | 5 | 0.50 | 1.0 | 0.70 | 0.030 | 0.086 | -0.064 | -0.003 |
| 229 | 5 | 0.50 | 1.0 | 0.85 | 0.034 | 0.086 | -0.064 | -0.003 |
| 230 | 5 | 0.50 | 1.0 | 1.00 | 0.035 | 0.085 | -0.064 | -0.003 |
| 231 | 5 | 0.50 | 0.8 | 0.00 | 0.053 | 0.099 | -0.058 | 0.008 |
| 232 | 5 | 0.50 | 0.8 | 0.40 | 0.058 | 0.095 | -0.064 | 0.001 |
| 233 | 5 | 0.50 | 0.8 | 0.70 | 0.057 | 0.092 | -0.070 | -0.006 |
| 234 | 5 | 0.50 | 0.8 | 0.85 | 0.048 | 0.091 | -0.073 | -0.008 |
| 235 | 5 | 0.50 | 0.8 | 1.00 | 0.042 | 0.091 | -0.074 | -0.009 |
| 236 | 5 | 0.50 | 0.6 | 0.00 | 0.109 | 0.120 | -0.047 | 0.031 |
| 237 | 5 | 0.50 | 0.6 | 0.40 | 0.095 | 0.110 | -0.066 | 0.011 |
| 238 | 5 | 0.50 | 0.6 | 0.70 | 0.075 | 0.100 | -0.088 | -0.013 |
| 239 | 5 | 0.50 | 0.6 | 0.85 | 0.064 | 0.097 | -0.095 | -0.020 |
| 240 | 5 | 0.50 | 0.6 | 1.00 | 0.046 | 0.096 | -0.097 | -0.023 |
| 241 | 5 | 0.50 | 0.4 | 0.00 | 0.195 | 0.149 | -0.031 | 0.074 |
| 242 | 5 | 0.50 | 0.4 | 0.40 | 0.133 | 0.130 | -0.075 | 0.025 |
| 243 | 5 | 0.50 | 0.4 | 0.70 | 0.087 | 0.108 | -0.122 | -0.027 |
| 244 | 5 | 0.50 | 0.4 | 0.85 | 0.079 | 0.103 | -0.136 | -0.042 |
| 245 | 5 | 0.50 | 0.4 | 1.00 | 0.050 | 0.101 | -0.140 | -0.047 |
| 246 | 5 | 0.50 | 0.2 | 0.00 | 0.308 | 0.150 | -0.042 | 0.110 |
| 247 | 5 | 0.50 | 0.2 | 0.40 | 0.154 | 0.148 | -0.107 | 0.035 |
| 248 | 5 | 0.50 | 0.2 | 0.70 | 0.104 | 0.114 | -0.179 | -0.049 |
| 249 | 5 | 0.50 | 0.2 | 0.85 | 0.088 | 0.106 | -0.198 | -0.072 |
| 250 | 5 | 0.50 | 0.2 | 1.00 | 0.064 | 0.105 | -0.205 | -0.079 |
| 251 | 5 | 0.75 | 1.0 | 0.00 | 0.020 | 0.121 | -0.066 | -0.006 |

| TP | SS | Bias | Ell | Corr | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|
| 252 | 5 | 0.75 | 1.0 | 0.40 | 0.044 | 0.120 | -0.068 | -0.008 |
| 253 | 5 | 0.75 | 1.0 | 0.70 | 0.052 | 0.121 | -0.068 | -0.008 |
| 254 | 5 | 0.75 | 1.0 | 0.85 | 0.051 | 0.122 | -0.068 | -0.008 |
| 255 | 5 | 0.75 | 1.0 | 1.00 | 0.057 | 0.122 | -0.068 | -0.008 |
| 256 | 5 | 0.75 | 0.8 | 0.00 | 0.056 | 0.139 | -0.061 | 0.005 |
| 257 | 5 | 0.75 | 0.8 | 0.40 | 0.069 | 0.135 | -0.070 | -0.004 |
| 258 | 5 | 0.75 | 0.8 | 0.70 | 0.071 | 0.132 | -0.079 | -0.013 |
| 259 | 5 | 0.75 | 0.8 | 0.85 | 0.059 | 0.130 | -0.082 | -0.017 |
| 260 | 5 | 0.75 | 0.8 | 1.00 | 0.058 | 0.130 | -0.083 | -0.018 |
| 261 | 5 | 0.75 | 0.6 | 0.00 | 0.116 | 0.167 | -0.051 | 0.030 |
| 262 | 5 | 0.75 | 0.6 | 0.40 | 0.097 | 0.155 | -0.074 | 0.005 |
| 263 | 5 | 0.75 | 0.6 | 0.70 | 0.081 | 0.142 | -0.100 | -0.023 |
| 264 | 5 | 0.75 | 0.6 | 0.85 | 0.072 | 0.138 | -0.109 | -0.032 |
| 265 | 5 | 0.75 | 0.6 | 1.00 | 0.061 | 0.137 | -0.112 | -0.036 |
| 266 | 5 | 0.75 | 0.4 | 0.00 | 0.187 | 0.201 | -0.040 | 0.067 |
| 267 | 5 | 0.75 | 0.4 | 0.40 | 0.123 | 0.179 | -0.086 | 0.016 |
| 268 | 5 | 0.75 | 0.4 | 0.70 | 0.090 | 0.152 | -0.136 | -0.039 |
| 269 | 5 | 0.75 | 0.4 | 0.85 | 0.074 | 0.145 | -0.151 | -0.056 |
| 270 | 5 | 0.75 | 0.4 | 1.00 | 0.060 | 0.143 | -0.156 | -0.061 |
| 271 | 5 | 0.75 | 0.2 | 0.00 | 0.274 | 0.200 | -0.061 | 0.088 |
| 272 | 5 | 0.75 | 0.2 | 0.40 | 0.139 | 0.201 | -0.117 | 0.022 |
| 273 | 5 | 0.75 | 0.2 | 0.70 | 0.099 | 0.159 | -0.189 | -0.061 |
| 274 | 5 | 0.75 | 0.2 | 0.85 | 0.215 | 0.291 | -0.111 | 0.030 |
| 275 | 5 | 0.75 | 0.2 | 1.00 | 0.059 | 0.147 | -0.215 | -0.091 |
| 276 | 5 | 1.00 | 1.0 | 0.00 | 0.015 | 0.147 | -0.069 | -0.015 |
| 277 | 5 | 1.00 | 1.0 | 0.40 | 0.042 | 0.148 | -0.071 | -0.016 |
| 278 | 5 | 1.00 | 1.0 | 0.70 | 0.062 | 0.152 | -0.070 | -0.016 |
| 279 | 5 | 1.00 | 1.0 | 0.85 | 0.067 | 0.154 | -0.070 | -0.016 |
| 280 | 5 | 1.00 | 1.0 | 1.00 | 0.067 | 0.154 | -0.070 | -0.016 |
| 281 | 5 | 1.00 | 0.8 | 0.00 | 0.053 | 0.169 | -0.065 | -0.003 |
| 282 | 5 | 1.00 | 0.8 | 0.40 | 0.068 | 0.165 | -0.075 | -0.013 |
| 283 | 5 | 1.00 | 0.8 | 0.70 | 0.068 | 0.163 | -0.086 | -0.025 |
| 284 | 5 | 1.00 | 0.8 | 0.85 | 0.069 | 0.162 | -0.089 | -0.029 |
| 285 | 5 | 1.00 | 0.8 | 1.00 | 0.066 | 0.162 | -0.091 | -0.030 |
| 286 | 5 | 1.00 | 0.6 | 0.00 | 0.098 | 0.197 | -0.058 | 0.019 |
| 287 | 5 | 1.00 | 0.6 | 0.40 | 0.088 | 0.186 | -0.082 | -0.008 |
| 288 | 5 | 1.00 | 0.6 | 0.70 | 0.071 | 0.173 | -0.110 | -0.038 |
| 289 | 5 | 1.00 | 0.6 | 0.85 | 0.061 | 0.169 | -0.119 | -0.048 |
| 290 | 5 | 1.00 | 0.6 | 1.00 | 0.058 | 0.168 | -0.123 | -0.051 |
| 291 | 5 | 1.00 | 0.4 | 0.00 | 0.154 | 0.223 | -0.057 | 0.044 |

| TP | SS | Bias | Ell | Corr | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|
| 292 | 5 | 1.00 | 0.4 | 0.40 | 0.102 | 0.208 | -0.098 | -0.001 |
| 293 | 5 | 1.00 | 0.4 | 0.70 | 0.074 | 0.182 | -0.146 | -0.055 |
| 294 | 5 | 1.00 | 0.4 | 0.85 | 0.060 | 0.174 | -0.161 | -0.071 |
| 295 | 5 | 1.00 | 0.4 | 1.00 | 0.047 | 0.172 | -0.166 | -0.077 |
| 296 | 5 | 1.00 | 0.2 | 0.00 | 0.205 | 0.214 | -0.085 | 0.050 |
| 297 | 5 | 1.00 | 0.2 | 0.40 | 0.110 | 0.227 | -0.128 | 0.000 |
| 298 | 5 | 1.00 | 0.2 | 0.70 | 0.079 | 0.189 | -0.193 | -0.074 |
| 299 | 5 | 1.00 | 0.2 | 0.85 | 0.063 | 0.177 | -0.212 | -0.096 |
| 300 | 5 | 1.00 | 0.2 | 1.00 | 0.041 | 0.175 | -0.218 | -0.103 |
| 301 | 5 | 1.50 | 1.0 | 0.00 | 0.004 | 0.170 | -0.072 | -0.036 |
| 302 | 5 | 1.50 | 1.0 | 0.40 | 0.035 | 0.176 | -0.073 | -0.037 |
| 303 | 5 | 1.50 | 1.0 | 0.70 | 0.045 | 0.188 | -0.072 | -0.036 |
| 304 | 5 | 1.50 | 1.0 | 0.85 | 0.050 | 0.192 | -0.072 | -0.036 |
| 305 | 5 | 1.50 | 1.0 | 1.00 | 0.049 | 0.193 | -0.072 | -0.036 |
| 306 | 5 | 1.50 | 0.8 | 0.00 | 0.023 | 0.185 | -0.072 | -0.029 |
| 307 | 5 | 1.50 | 0.8 | 0.40 | 0.039 | 0.188 | -0.081 | -0.038 |
| 308 | 5 | 1.50 | 0.8 | 0.70 | 0.041 | 0.194 | -0.091 | -0.049 |
| 309 | 5 | 1.50 | 0.8 | 0.85 | 0.035 | 0.196 | -0.095 | -0.053 |
| 310 | 5 | 1.50 | 0.8 | 1.00 | 0.033 | 0.197 | -0.096 | -0.054 |
| 311 | 5 | 1.50 | 0.6 | 0.00 | 0.049 | 0.198 | -0.075 | -0.021 |
| 312 | 5 | 1.50 | 0.6 | 0.40 | 0.041 | 0.201 | -0.093 | -0.039 |
| 313 | 5 | 1.50 | 0.6 | 0.70 | 0.027 | 0.200 | -0.115 | -0.063 |
| 314 | 5 | 1.50 | 0.6 | 0.85 | 0.019 | 0.200 | -0.123 | -0.071 |
| 315 | 5 | 1.50 | 0.6 | 1.00 | 0.007 | 0.200 | -0.126 | -0.074 |
| 316 | 5 | 1.50 | 0.4 | 0.00 | 0.059 | 0.199 | -0.089 | -0.018 |
| 317 | 5 | 1.50 | 0.4 | 0.40 | 0.044 | 0.213 | -0.110 | -0.041 |
| 318 | 5 | 1.50 | 0.4 | 0.70 | 0.027 | 0.207 | -0.144 | -0.077 |
| 319 | 5 | 1.50 | 0.4 | 0.85 | 0.012 | 0.203 | -0.156 | -0.090 |
| 320 | 5 | 1.50 | 0.4 | 1.00 | -0.009 | 0.202 | -0.160 | -0.095 |
| 321 | 5 | 1.50 | 0.2 | 0.00 | 0.073 | 0.183 | -0.114 | -0.022 |
| 322 | 5 | 1.50 | 0.2 | 0.40 | 0.047 | 0.221 | -0.135 | -0.045 |
| 323 | 5 | 1.50 | 0.2 | 0.70 | 0.039 | 0.212 | -0.176 | -0.090 |
| 324 | 5 | 1.50 | 0.2 | 0.85 | 0.021 | 0.205 | -0.190 | -0.106 |
| 325 | 5 | 1.50 | 0.2 | 1.00 | -0.017 | 0.204 | -0.196 | -0.112 |
| 326 | 5 | 2.00 | 1.0 | 0.00 | -0.008 | 0.171 | -0.063 | -0.049 |
| 327 | 5 | 2.00 | 1.0 | 0.40 | 0.005 | 0.184 | -0.064 | -0.050 |
| 328 | 5 | 2.00 | 1.0 | 0.70 | -0.002 | 0.202 | -0.064 | -0.050 |
| 329 | 5 | 2.00 | 1.0 | 0.85 | -0.005 | 0.208 | -0.064 | -0.050 |
| 330 | 5 | 2.00 | 1.0 | 1.00 | 0.004 | 0.211 | -0.064 | -0.050 |
| 331 | 5 | 2.00 | 0.8 | 0.00 | 0.003 | 0.176 | -0.066 | -0.047 |

| TP | SS | Bias | Ell | Corr | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|
| 332 | 5 | 2.00 | 0.8 | 0.40 | -0.002 | 0.190 | -0.072 | -0.054 |
| 333 | 5 | 2.00 | 0.8 | 0.70 | -0.018 | 0.206 | -0.080 | -0.061 |
| 334 | 5 | 2.00 | 0.8 | 0.85 | -0.031 | 0.211 | -0.082 | -0.064 |
| 335 | 5 | 2.00 | 0.8 | 1.00 | -0.032 | 0.213 | -0.083 | -0.065 |
| 336 | 5 | 2.00 | 0.6 | 0.00 | 0.009 | 0.178 | -0.072 | -0.046 |
| 337 | 5 | 2.00 | 0.6 | 0.40 | 0.003 | 0.196 | -0.082 | -0.057 |
| 338 | 5 | 2.00 | 0.6 | 0.70 | -0.023 | 0.210 | -0.097 | -0.072 |
| 339 | 5 | 2.00 | 0.6 | 0.85 | -0.047 | 0.213 | -0.103 | -0.078 |
| 340 | 5 | 2.00 | 0.6 | 1.00 | -0.065 | 0.215 | -0.105 | -0.080 |
| 341 | 5 | 2.00 | 0.4 | 0.00 | 0.009 | 0.172 | -0.083 | -0.048 |
| 342 | 5 | 2.00 | 0.4 | 0.40 | 0.008 | 0.202 | -0.095 | -0.060 |
| 343 | 5 | 2.00 | 0.4 | 0.70 | -0.010 | 0.214 | -0.116 | -0.081 |
| 344 | 5 | 2.00 | 0.4 | 0.85 | -0.045 | 0.215 | -0.124 | -0.090 |
| 345 | 5 | 2.00 | 0.4 | 1.00 | -0.094 | 0.217 | -0.127 | -0.093 |
| 346 | 5 | 2.00 | 0.2 | 0.00 | 0.009 | 0.157 | -0.099 | -0.051 |
| 347 | 5 | 2.00 | 0.2 | 0.40 | 0.015 | 0.205 | -0.111 | -0.064 |
| 348 | 5 | 2.00 | 0.2 | 0.70 | 0.013 | 0.218 | -0.135 | -0.089 |
| 349 | 5 | 2.00 | 0.2 | 0.85 | -0.017 | 0.217 | -0.145 | -0.100 |
| 350 | 5 | 2.00 | 0.2 | 1.00 | -0.099 | 0.218 | -0.149 | -0.104 |
| 351 | 7 | 0.00 | 1.0 | 0.00 | -0.013 | 0.034 | -0.085 | 0.002 |
| 352 | 7 | 0.00 | 1.0 | 0.40 | -0.025 | 0.032 | -0.087 | 0.000 |
| 353 | 7 | 0.00 | 1.0 | 0.70 | -0.022 | 0.030 | -0.087 | 0.000 |
| 354 | 7 | 0.00 | 1.0 | 0.85 | -0.026 | 0.030 | -0.087 | 0.000 |
| 355 | 7 | 0.00 | 1.0 | 1.00 | -0.018 | 0.029 | -0.087 | 0.000 |
| 356 | 7 | 0.00 | 0.8 | 0.00 | 0.029 | 0.035 | -0.083 | 0.007 |
| 357 | 7 | 0.00 | 0.8 | 0.40 | 0.024 | 0.032 | -0.087 | 0.003 |
| 358 | 7 | 0.00 | 0.8 | 0.70 | 0.011 | 0.030 | -0.090 | -0.001 |
| 359 | 7 | 0.00 | 0.8 | 0.85 | -0.001 | 0.029 | -0.091 | -0.002 |
| 360 | 7 | 0.00 | 0.8 | 1.00 | -0.010 | 0.029 | -0.091 | -0.002 |
| 361 | 7 | 0.00 | 0.6 | 0.00 | 0.077 | 0.041 | -0.076 | 0.026 |
| 362 | 7 | 0.00 | 0.6 | 0.40 | 0.063 | 0.036 | -0.089 | 0.011 |
| 363 | 7 | 0.00 | 0.6 | 0.70 | 0.039 | 0.031 | -0.105 | -0.006 |
| 364 | 7 | 0.00 | 0.6 | 0.85 | 0.019 | 0.029 | -0.110 | -0.012 |
| 365 | 7 | 0.00 | 0.6 | 1.00 | -0.005 | 0.029 | -0.111 | -0.013 |
| 366 | 7 | 0.00 | 0.4 | 0.00 | 0.147 | 0.053 | -0.057 | 0.069 |
| 367 | 7 | 0.00 | 0.4 | 0.40 | 0.099 | 0.043 | -0.095 | 0.026 |
| 368 | 7 | 0.00 | 0.4 | 0.70 | 0.064 | 0.033 | -0.134 | -0.019 |
| 369 | 7 | 0.00 | 0.4 | 0.85 | 0.038 | 0.030 | -0.146 | -0.032 |
| 370 | 7 | 0.00 | 0.4 | 1.00 | 0.006 | 0.030 | -0.150 | -0.037 |
| 371 | 7 | 0.00 | 0.2 | 0.00 | 0.276 | 0.040 | -0.061 | 0.117 |

| TP | SS | Bias | Ell | Corr | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|
| 372 | 7 | 0.00 | 0.2 | 0.40 | 0.129 | 0.051 | -0.126 | 0.040 |
| 373 | 7 | 0.00 | 0.2 | 0.70 | 0.067 | 0.034 | -0.194 | -0.042 |
| 374 | 7 | 0.00 | 0.2 | 0.85 | 0.057 | 0.030 | -0.213 | -0.063 |
| 375 | 7 | 0.00 | 0.2 | 1.00 | 0.032 | 0.031 | -0.219 | -0.070 |
| 376 | 7 | 0.25 | 1.0 | 0.00 | -0.015 | 0.045 | -0.088 | 0.001 |
| 377 | 7 | 0.25 | 1.0 | 0.40 | -0.012 | 0.043 | -0.089 | -0.001 |
| 378 | 7 | 0.25 | 1.0 | 0.70 | -0.003 | 0.042 | -0.089 | -0.001 |
| 379 | 7 | 0.25 | 1.0 | 0.85 | -0.007 | 0.042 | -0.089 | -0.001 |
| 380 | 7 | 0.25 | 1.0 | 1.00 | -0.002 | 0.041 | -0.089 | -0.001 |
| 381 | 7 | 0.25 | 0.8 | 0.00 | 0.028 | 0.049 | -0.084 | 0.007 |
| 382 | 7 | 0.25 | 0.8 | 0.40 | 0.023 | 0.047 | -0.088 | 0.002 |
| 383 | 7 | 0.25 | 0.8 | 0.70 | 0.020 | 0.045 | -0.092 | -0.002 |
| 384 | 7 | 0.25 | 0.8 | 0.85 | 0.009 | 0.044 | -0.094 | -0.004 |
| 385 | 7 | 0.25 | 0.8 | 1.00 | 0.002 | 0.043 | -0.094 | -0.004 |
| 386 | 7 | 0.25 | 0.6 | 0.00 | 0.082 | 0.060 | -0.075 | 0.028 |
| 387 | 7 | 0.25 | 0.6 | 0.40 | 0.068 | 0.054 | -0.090 | 0.011 |
| 388 | 7 | 0.25 | 0.6 | 0.70 | 0.039 | 0.048 | -0.107 | -0.008 |
| 389 | 7 | 0.25 | 0.6 | 0.85 | 0.025 | 0.046 | -0.113 | -0.014 |
| 390 | 7 | 0.25 | 0.6 | 1.00 | 0.004 | 0.045 | -0.115 | -0.016 |
| 391 | 7 | 0.25 | 0.4 | 0.00 | 0.156 | 0.077 | -0.055 | 0.071 |
| 392 | 7 | 0.25 | 0.4 | 0.40 | 0.108 | 0.065 | -0.095 | 0.026 |
| 393 | 7 | 0.25 | 0.4 | 0.70 | 0.069 | 0.052 | -0.136 | -0.021 |
| 394 | 7 | 0.25 | 0.4 | 0.85 | 0.049 | 0.049 | -0.148 | -0.035 |
| 395 | 7 | 0.25 | 0.4 | 1.00 | 0.010 | 0.048 | -0.153 | -0.039 |
| 396 | 7 | 0.25 | 0.2 | 0.00 | 0.201 | -0.004 | -0.124 | 0.040 |
| 397 | 7 | 0.25 | 0.2 | 0.40 | 0.132 | 0.076 | -0.125 | 0.039 |
| 398 | 7 | 0.25 | 0.2 | 0.70 | 0.081 | 0.055 | -0.195 | -0.044 |
| 399 | 7 | 0.25 | 0.2 | 0.85 | 0.066 | 0.051 | -0.213 | -0.065 |
| 400 | 7 | 0.25 | 0.2 | 1.00 | 0.037 | 0.051 | -0.219 | -0.073 |
| 401 | 7 | 0.50 | 1.0 | 0.00 | -0.008 | 0.076 | -0.090 | -0.001 |
| 402 | 7 | 0.50 | 1.0 | 0.40 | 0.008 | 0.074 | -0.092 | -0.003 |
| 403 | 7 | 0.50 | 1.0 | 0.70 | 0.015 | 0.074 | -0.092 | -0.003 |
| 404 | 7 | 0.50 | 1.0 | 0.85 | 0.008 | 0.074 | -0.092 | -0.003 |
| 405 | 7 | 0.50 | 1.0 | 1.00 | 0.013 | 0.074 | -0.092 | -0.003 |
| 406 | 7 | 0.50 | 0.8 | 0.00 | 0.036 | 0.088 | -0.084 | 0.008 |
| 407 | 7 | 0.50 | 0.8 | 0.40 | 0.036 | 0.084 | -0.090 | 0.001 |
| 408 | 7 | 0.50 | 0.8 | 0.70 | 0.034 | 0.082 | -0.096 | -0.006 |
| 409 | 7 | 0.50 | 0.8 | 0.85 | 0.031 | 0.081 | -0.099 | -0.008 |
| 410 | 7 | 0.50 | 0.8 | 1.00 | 0.024 | 0.080 | -0.099 | -0.009 |
| 411 | 7 | 0.50 | 0.6 | 0.00 | 0.093 | 0.108 | -0.070 | 0.031 |

| TP | SS | Bias | Ell | Corr | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|
| 412 | 7 | 0.50 | 0.6 | 0.40 | 0.080 | 0.099 | -0.089 | 0.011 |
| 413 | 7 | 0.50 | 0.6 | 0.70 | 0.055 | 0.090 | -0.110 | -0.013 |
| 414 | 7 | 0.50 | 0.6 | 0.85 | 0.050 | 0.088 | -0.117 | -0.020 |
| 415 | 7 | 0.50 | 0.6 | 1.00 | 0.029 | 0.087 | -0.119 | -0.023 |
| 416 | 7 | 0.50 | 0.4 | 0.00 | 0.173 | 0.136 | -0.054 | 0.074 |
| 417 | 7 | 0.50 | 0.4 | 0.40 | 0.111 | 0.119 | -0.097 | 0.025 |
| 418 | 7 | 0.50 | 0.4 | 0.70 | 0.077 | 0.100 | -0.143 | -0.027 |
| 419 | 7 | 0.50 | 0.4 | 0.85 | 0.066 | 0.095 | -0.156 | -0.042 |
| 420 | 7 | 0.50 | 0.4 | 1.00 | 0.039 | 0.093 | -0.161 | -0.047 |
| 421 | 7 | 0.50 | 0.2 | 0.00 | 0.299 | 0.134 | -0.065 | 0.110 |
| 422 | 7 | 0.50 | 0.2 | 0.40 | 0.135 | 0.137 | -0.128 | 0.035 |
| 423 | 7 | 0.50 | 0.2 | 0.70 | 0.092 | 0.107 | -0.199 | -0.049 |
| 424 | 7 | 0.50 | 0.2 | 0.85 | 0.082 | 0.099 | -0.217 | -0.072 |
| 425 | 7 | 0.50 | 0.2 | 1.00 | 0.063 | 0.099 | -0.224 | -0.079 |
| 426 | 7 | 0.75 | 1.0 | 0.00 | -0.001 | 0.112 | -0.094 | -0.006 |
| 427 | 7 | 0.75 | 1.0 | 0.40 | 0.023 | 0.112 | -0.096 | -0.008 |
| 428 | 7 | 0.75 | 1.0 | 0.70 | 0.036 | 0.113 | -0.095 | -0.008 |
| 429 | 7 | 0.75 | 1.0 | 0.85 | 0.044 | 0.113 | -0.095 | -0.008 |
| 430 | 7 | 0.75 | 1.0 | 1.00 | 0.039 | 0.113 | -0.095 | -0.008 |
| 431 | 7 | 0.75 | 0.8 | 0.00 | 0.045 | 0.132 | -0.086 | 0.005 |
| 432 | 7 | 0.75 | 0.8 | 0.40 | 0.048 | 0.127 | -0.095 | -0.004 |
| 433 | 7 | 0.75 | 0.8 | 0.70 | 0.049 | 0.125 | -0.103 | -0.013 |
| 434 | 7 | 0.75 | 0.8 | 0.85 | 0.054 | 0.124 | -0.107 | -0.017 |
| 435 | 7 | 0.75 | 0.8 | 1.00 | 0.051 | 0.123 | -0.108 | -0.018 |
| 436 | 7 | 0.75 | 0.6 | 0.00 | 0.095 | 0.160 | -0.075 | 0.030 |
| 437 | 7 | 0.75 | 0.6 | 0.40 | 0.080 | 0.149 | -0.097 | 0.005 |
| 438 | 7 | 0.75 | 0.6 | 0.70 | 0.069 | 0.137 | -0.123 | -0.023 |
| 439 | 7 | 0.75 | 0.6 | 0.85 | 0.067 | 0.133 | -0.131 | -0.032 |
| 440 | 7 | 0.75 | 0.6 | 1.00 | 0.061 | 0.132 | -0.134 | -0.036 |
| 441 | 7 | 0.75 | 0.4 | 0.00 | 0.175 | 0.194 | -0.064 | 0.067 |
| 442 | 7 | 0.75 | 0.4 | 0.40 | 0.106 | 0.174 | -0.109 | 0.016 |
| 443 | 7 | 0.75 | 0.4 | 0.70 | 0.083 | 0.149 | -0.158 | -0.039 |
| 444 | 7 | 0.75 | 0.4 | 0.85 | 0.074 | 0.142 | -0.172 | -0.056 |
| 445 | 7 | 0.75 | 0.4 | 1.00 | 0.056 | 0.140 | -0.177 | -0.061 |
| 446 | 7 | 0.75 | 0.2 | 0.00 | 0.271 | 0.192 | -0.083 | 0.088 |
| 447 | 7 | 0.75 | 0.2 | 0.40 | 0.123 | 0.196 | -0.139 | 0.022 |
| 448 | 7 | 0.75 | 0.2 | 0.70 | 0.095 | 0.157 | -0.208 | -0.061 |
| 449 | 7 | 0.75 | 0.2 | 0.85 | 0.083 | 0.147 | -0.227 | -0.083 |
| 450 | 7 | 0.75 | 0.2 | 1.00 | 0.065 | 0.145 | -0.234 | -0.091 |
| 451 | 7 | 1.00 | 1.0 | 0.00 | 0.000 | 0.142 | -0.099 | -0.015 |

| TP | SS | Bias | Ell | Corr | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|
| 452 | 7 | 1.00 | 1.0 | 0.40 | 0.034 | 0.143 | -0.101 | -0.016 |
| 453 | 7 | 1.00 | 1.0 | 0.70 | 0.054 | 0.147 | -0.100 | -0.016 |
| 454 | 7 | 1.00 | 1.0 | 0.85 | 0.059 | 0.149 | -0.100 | -0.016 |
| 455 | 7 | 1.00 | 1.0 | 1.00 | 0.064 | 0.149 | -0.100 | -0.016 |
| 456 | 7 | 1.00 | 0.8 | 0.00 | 0.043 | 0.164 | -0.093 | -0.003 |
| 457 | 7 | 1.00 | 0.8 | 0.40 | 0.057 | 0.161 | -0.103 | -0.013 |
| 458 | 7 | 1.00 | 0.8 | 0.70 | 0.069 | 0.159 | -0.113 | -0.025 |
| 459 | 7 | 1.00 | 0.8 | 0.85 | 0.063 | 0.159 | -0.117 | -0.029 |
| 460 | 7 | 1.00 | 0.8 | 1.00 | 0.065 | 0.159 | -0.118 | -0.030 |
| 461 | 7 | 1.00 | 0.6 | 0.00 | 0.084 | 0.194 | -0.085 | 0.019 |
| 462 | 7 | 1.00 | 0.6 | 0.40 | 0.078 | 0.183 | -0.109 | -0.008 |
| 463 | 7 | 1.00 | 0.6 | 0.70 | 0.071 | 0.171 | -0.136 | -0.038 |
| 464 | 7 | 1.00 | 0.6 | 0.85 | 0.062 | 0.168 | -0.145 | -0.048 |
| 465 | 7 | 1.00 | 0.6 | 1.00 | 0.064 | 0.167 | -0.148 | -0.051 |
| 466 | 7 | 1.00 | 0.4 | 0.00 | 0.143 | 0.221 | -0.082 | 0.044 |
| 467 | 7 | 1.00 | 0.4 | 0.40 | 0.091 | 0.207 | -0.122 | -0.001 |
| 468 | 7 | 1.00 | 0.4 | 0.70 | 0.074 | 0.182 | -0.169 | -0.055 |
| 469 | 7 | 1.00 | 0.4 | 0.85 | 0.069 | 0.175 | -0.184 | -0.071 |
| 470 | 7 | 1.00 | 0.4 | 1.00 | 0.058 | 0.173 | -0.189 | -0.077 |
| 471 | 7 | 1.00 | 0.2 | 0.00 | 0.203 | 0.212 | -0.115 | 0.050 |
| 472 | 7 | 1.00 | 0.2 | 0.40 | 0.096 | 0.228 | -0.156 | 0.000 |
| 473 | 7 | 1.00 | 0.2 | 0.70 | 0.084 | 0.190 | -0.219 | -0.074 |
| 474 | 7 | 1.00 | 0.2 | 0.85 | 0.074 | 0.179 | -0.237 | -0.096 |
| 475 | 7 | 1.00 | 0.2 | 1.00 | 0.062 | 0.177 | -0.244 | -0.103 |
| 476 | 7 | 1.50 | 1.0 | 0.00 | -0.002 | 0.168 | -0.102 | -0.036 |
| 477 | 7 | 1.50 | 1.0 | 0.40 | 0.029 | 0.174 | -0.103 | -0.037 |
| 478 | 7 | 1.50 | 1.0 | 0.70 | 0.050 | 0.186 | -0.102 | -0.036 |
| 479 | 7 | 1.50 | 1.0 | 0.85 | 0.054 | 0.191 | -0.102 | -0.036 |
| 480 | 7 | 1.50 | 1.0 | 1.00 | 0.064 | 0.192 | -0.102 | -0.036 |
| 481 | 7 | 1.50 | 0.8 | 0.00 | 0.013 | 0.183 | -0.100 | -0.029 |
| 482 | 7 | 1.50 | 0.8 | 0.40 | 0.041 | 0.187 | -0.109 | -0.038 |
| 483 | 7 | 1.50 | 0.8 | 0.70 | 0.045 | 0.194 | -0.119 | -0.049 |
| 484 | 7 | 1.50 | 0.8 | 0.85 | 0.047 | 0.197 | -0.122 | -0.053 |
| 485 | 7 | 1.50 | 0.8 | 1.00 | 0.045 | 0.198 | -0.124 | -0.054 |
| 486 | 7 | 1.50 | 0.6 | 0.00 | 0.034 | 0.198 | -0.101 | -0.021 |
| 487 | 7 | 1.50 | 0.6 | 0.40 | 0.042 | 0.202 | -0.118 | -0.039 |
| 488 | 7 | 1.50 | 0.6 | 0.70 | 0.041 | 0.202 | -0.140 | -0.063 |
| 489 | 7 | 1.50 | 0.6 | 0.85 | 0.030 | 0.201 | -0.148 | -0.071 |
| 490 | 7 | 1.50 | 0.6 | 1.00 | 0.025 | 0.202 | -0.151 | -0.074 |
| 491 | 7 | 1.50 | 0.4 | 0.00 | 0.043 | 0.200 | -0.114 | -0.018 |

| TP | SS | Bias | Ell | Corr | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|
| 492 | 7 | 1.50 | 0.4 | 0.40 | 0.046 | 0.215 | -0.135 | -0.041 |
| 493 | 7 | 1.50 | 0.4 | 0.70 | 0.040 | 0.209 | -0.168 | -0.077 |
| 494 | 7 | 1.50 | 0.4 | 0.85 | 0.029 | 0.205 | -0.180 | -0.090 |
| 495 | 7 | 1.50 | 0.4 | 1.00 | 0.009 | 0.205 | -0.184 | -0.095 |
| 496 | 7 | 1.50 | 0.2 | 0.00 | 0.056 | 0.185 | -0.145 | -0.022 |
| 497 | 7 | 1.50 | 0.2 | 0.40 | 0.040 | 0.224 | -0.165 | -0.045 |
| 498 | 7 | 1.50 | 0.2 | 0.70 | 0.047 | 0.215 | -0.204 | -0.090 |
| 499 | 7 | 1.50 | 0.2 | 0.85 | 0.038 | 0.208 | -0.218 | -0.106 |
| 500 | 7 | 1.50 | 0.2 | 1.00 | 0.010 | 0.207 | -0.223 | -0.112 |
| 501 | 7 | 2.00 | 1.0 | 0.00 | -0.008 | 0.170 | -0.088 | -0.049 |
| 502 | 7 | 2.00 | 1.0 | 0.40 | 0.014 | 0.183 | -0.088 | -0.050 |
| 503 | 7 | 2.00 | 1.0 | 0.70 | 0.001 | 0.202 | -0.088 | -0.050 |
| 504 | 7 | 2.00 | 1.0 | 0.85 | 0.008 | 0.208 | -0.088 | -0.050 |
| 505 | 7 | 2.00 | 1.0 | 1.00 | 0.012 | 0.211 | -0.088 | -0.050 |
| 506 | 7 | 2.00 | 0.8 | 0.00 | 0.002 | 0.176 | -0.091 | -0.047 |
| 507 | 7 | 2.00 | 0.8 | 0.40 | 0.014 | 0.190 | -0.097 | -0.054 |
| 508 | 7 | 2.00 | 0.8 | 0.70 | -0.009 | 0.207 | -0.104 | -0.061 |
| 509 | 7 | 2.00 | 0.8 | 0.85 | -0.008 | 0.212 | -0.107 | -0.064 |
| 510 | 7 | 2.00 | 0.8 | 1.00 | -0.016 | 0.214 | -0.108 | -0.065 |
| 511 | 7 | 2.00 | 0.6 | 0.00 | 0.005 | 0.178 | -0.099 | -0.046 |
| 512 | 7 | 2.00 | 0.6 | 0.40 | 0.018 | 0.197 | -0.109 | -0.057 |
| 513 | 7 | 2.00 | 0.6 | 0.70 | -0.003 | 0.211 | -0.123 | -0.072 |
| 514 | 7 | 2.00 | 0.6 | 0.85 | -0.033 | 0.215 | -0.129 | -0.078 |
| 515 | 7 | 2.00 | 0.6 | 1.00 | -0.047 | 0.217 | -0.131 | -0.080 |
| 516 | 7 | 2.00 | 0.4 | 0.00 | 0.003 | 0.173 | -0.114 | -0.048 |
| 517 | 7 | 2.00 | 0.4 | 0.40 | 0.016 | 0.204 | -0.125 | -0.060 |
| 518 | 7 | 2.00 | 0.4 | 0.70 | 0.010 | 0.216 | -0.145 | -0.081 |
| 519 | 7 | 2.00 | 0.4 | 0.85 | -0.024 | 0.218 | -0.153 | -0.090 |
| 520 | 7 | 2.00 | 0.4 | 1.00 | -0.071 | 0.219 | -0.156 | -0.093 |
| 521 | 7 | 2.00 | 0.2 | 0.00 | 0.002 | 0.159 | -0.138 | -0.051 |
| 522 | 7 | 2.00 | 0.2 | 0.40 | 0.013 | 0.207 | -0.149 | -0.064 |
| 523 | 7 | 2.00 | 0.2 | 0.70 | 0.026 | 0.220 | -0.172 | -0.089 |
| 524 | 7 | 2.00 | 0.2 | 0.85 | 0.014 | 0.219 | -0.182 | -0.100 |
| 525 | 7 | 2.00 | 0.2 | 1.00 | -0.064 | 0.221 | -0.186 | -0.104 |
| 526 | 10 | 0.00 | 1.0 | 0.00 | -0.039 | 0.022 | -0.145 | 0.002 |
| 527 | 10 | 0.00 | 1.0 | 0.40 | -0.044 | 0.020 | -0.147 | 0.000 |
| 528 | 10 | 0.00 | 1.0 | 0.70 | -0.038 | 0.019 | -0.147 | 0.000 |
| 529 | 10 | 0.00 | 1.0 | 0.85 | -0.033 | 0.019 | -0.147 | 0.000 |
| 530 | 10 | 0.00 | 1.0 | 1.00 | -0.034 | 0.019 | -0.147 | 0.000 |
| 531 | 10 | 0.00 | 0.8 | 0.00 | 0.010 | 0.022 | -0.140 | 0.007 |

| TP | SS | Bias | Ell | Corr | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|
| 532 | 10 | 0.00 | 0.8 | 0.40 | 0.007 | 0.021 | -0.143 | 0.003 |
| 533 | 10 | 0.00 | 0.8 | 0.70 | -0.005 | 0.020 | -0.146 | -0.001 |
| 534 | 10 | 0.00 | 0.8 | 0.85 | -0.017 | 0.019 | -0.147 | -0.002 |
| 535 | 10 | 0.00 | 0.8 | 1.00 | -0.030 | 0.019 | -0.148 | -0.002 |
| 536 | 10 | 0.00 | 0.6 | 0.00 | 0.061 | 0.027 | -0.126 | 0.026 |
| 537 | 10 | 0.00 | 0.6 | 0.40 | 0.046 | 0.023 | -0.139 | 0.011 |
| 538 | 10 | 0.00 | 0.6 | 0.70 | 0.018 | 0.020 | -0.154 | -0.006 |
| 539 | 10 | 0.00 | 0.6 | 0.85 | 0.004 | 0.020 | -0.158 | -0.012 |
| 540 | 10 | 0.00 | 0.6 | 1.00 | -0.022 | 0.019 | -0.160 | -0.013 |
| 541 | 10 | 0.00 | 0.4 | 0.00 | 0.119 | 0.037 | -0.100 | 0.069 |
| 542 | 10 | 0.00 | 0.4 | 0.40 | 0.072 | 0.030 | -0.135 | 0.026 |
| 543 | 10 | 0.00 | 0.4 | 0.70 | 0.046 | 0.022 | -0.173 | -0.019 |
| 544 | 10 | 0.00 | 0.4 | 0.85 | 0.023 | 0.020 | -0.184 | -0.032 |
| 545 | 10 | 0.00 | 0.4 | 1.00 | -0.006 | 0.020 | -0.188 | -0.037 |
| 546 | 10 | 0.00 | 0.2 | 0.00 | 0.256 | 0.021 | -0.098 | 0.117 |
| 547 | 10 | 0.00 | 0.2 | 0.40 | 0.101 | 0.037 | -0.160 | 0.040 |
| 548 | 10 | 0.00 | 0.2 | 0.70 | 0.049 | 0.023 | -0.226 | -0.042 |
| 549 | 10 | 0.00 | 0.2 | 0.85 | 0.038 | 0.021 | -0.244 | -0.063 |
| 550 | 10 | 0.00 | 0.2 | 1.00 | 0.023 | 0.022 | -0.249 | -0.070 |
| 551 | 10 | 0.25 | 1.0 | 0.00 | -0.034 | 0.035 | -0.137 | 0.001 |
| 552 | 10 | 0.25 | 1.0 | 0.40 | -0.030 | 0.033 | -0.139 | -0.001 |
| 553 | 10 | 0.25 | 1.0 | 0.70 | -0.034 | 0.033 | -0.139 | -0.001 |
| 554 | 10 | 0.25 | 1.0 | 0.85 | -0.031 | 0.033 | -0.139 | -0.001 |
| 555 | 10 | 0.25 | 1.0 | 1.00 | -0.025 | 0.032 | -0.139 | -0.001 |
| 556 | 10 | 0.25 | 0.8 | 0.00 | 0.016 | 0.039 | -0.132 | 0.007 |
| 557 | 10 | 0.25 | 0.8 | 0.40 | 0.018 | 0.042 | -0.132 | 0.007 |
| 558 | 10 | 0.25 | 0.8 | 0.70 | -0.001 | 0.036 | -0.140 | -0.002 |
| 559 | 10 | 0.25 | 0.8 | 0.85 | -0.001 | 0.035 | -0.142 | -0.004 |
| 560 | 10 | 0.25 | 0.8 | 1.00 | -0.015 | 0.035 | -0.142 | -0.004 |
| 561 | 10 | 0.25 | 0.6 | 0.00 | 0.061 | 0.049 | -0.117 | 0.028 |
| 562 | 10 | 0.25 | 0.6 | 0.40 | 0.051 | 0.044 | -0.131 | 0.011 |
| 563 | 10 | 0.25 | 0.6 | 0.70 | 0.035 | 0.040 | -0.147 | -0.008 |
| 564 | 10 | 0.25 | 0.6 | 0.85 | 0.011 | 0.039 | -0.153 | -0.014 |
| 565 | 10 | 0.25 | 0.6 | 1.00 | -0.014 | 0.039 | -0.155 | -0.016 |
| 566 | 10 | 0.25 | 0.4 | 0.00 | 0.134 | 0.066 | -0.095 | 0.071 |
| 567 | 10 | 0.25 | 0.4 | 0.40 | 0.081 | 0.056 | -0.133 | 0.026 |
| 568 | 10 | 0.25 | 0.4 | 0.70 | 0.054 | 0.045 | -0.173 | -0.021 |
| 569 | 10 | 0.25 | 0.4 | 0.85 | 0.038 | 0.043 | -0.184 | -0.035 |
| 570 | 10 | 0.25 | 0.4 | 1.00 | 0.005 | 0.042 | -0.189 | -0.039 |
| 571 | 10 | 0.25 | 0.2 | 0.00 | 0.275 | 0.054 | -0.094 | 0.116 |

| TP | SS | Bias | Ell | Corr | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|
| 572 | 10 | 0.25 | 0.2 | 0.40 | 0.109 | 0.067 | -0.156 | 0.039 |
| 573 | 10 | 0.25 | 0.2 | 0.70 | 0.066 | 0.049 | -0.223 | -0.044 |
| 574 | 10 | 0.25 | 0.2 | 0.85 | 0.052 | 0.045 | -0.241 | -0.065 |
| 575 | 10 | 0.25 | 0.2 | 1.00 | 0.030 | 0.046 | -0.247 | -0.073 |
| 576 | 10 | 0.50 | 1.0 | 0.00 | -0.022 | 0.068 | -0.133 | -0.001 |
| 577 | 10 | 0.50 | 1.0 | 0.40 | -0.007 | 0.067 | -0.134 | -0.003 |
| 578 | 10 | 0.50 | 1.0 | 0.70 | -0.004 | 0.067 | -0.134 | -0.003 |
| 579 | 10 | 0.50 | 1.0 | 0.85 | -0.006 | 0.067 | -0.134 | -0.003 |
| 580 | 10 | 0.50 | 1.0 | 1.00 | 0.001 | 0.067 | -0.134 | -0.003 |
| 581 | 10 | 0.50 | 0.8 | 0.00 | 0.033 | 0.081 | -0.129 | 0.008 |
| 582 | 10 | 0.50 | 0.8 | 0.40 | 0.032 | 0.078 | -0.135 | 0.001 |
| 583 | 10 | 0.50 | 0.8 | 0.70 | 0.033 | 0.076 | -0.141 | -0.006 |
| 584 | 10 | 0.50 | 0.8 | 0.85 | 0.023 | 0.075 | -0.143 | -0.008 |
| 585 | 10 | 0.50 | 0.8 | 1.00 | 0.009 | 0.075 | -0.144 | -0.009 |
| 586 | 10 | 0.50 | 0.6 | 0.00 | 0.079 | 0.101 | -0.119 | 0.031 |
| 587 | 10 | 0.50 | 0.6 | 0.40 | 0.067 | 0.094 | -0.137 | 0.011 |
| 588 | 10 | 0.50 | 0.6 | 0.70 | 0.053 | 0.086 | -0.157 | -0.013 |
| 589 | 10 | 0.50 | 0.6 | 0.85 | 0.042 | 0.084 | -0.163 | -0.020 |
| 590 | 10 | 0.50 | 0.6 | 1.00 | 0.021 | 0.084 | -0.165 | -0.023 |
| 591 | 10 | 0.50 | 0.4 | 0.00 | 0.163 | 0.130 | -0.096 | 0.074 |
| 592 | 10 | 0.50 | 0.4 | 0.40 | 0.095 | 0.115 | -0.137 | 0.025 |
| 593 | 10 | 0.50 | 0.4 | 0.70 | 0.070 | 0.097 | -0.181 | -0.027 |
| 594 | 10 | 0.50 | 0.4 | 0.85 | 0.067 | 0.093 | -0.194 | -0.042 |
| 595 | 10 | 0.50 | 0.4 | 1.00 | 0.035 | 0.092 | -0.198 | -0.047 |
| 596 | 10 | 0.50 | 0.2 | 0.00 | 0.296 | 0.128 | -0.118 | 0.110 |
| 597 | 10 | 0.50 | 0.2 | 0.40 | 0.119 | 0.134 | -0.177 | 0.035 |
| 598 | 10 | 0.50 | 0.2 | 0.70 | 0.080 | 0.106 | -0.244 | -0.049 |
| 599 | 10 | 0.50 | 0.2 | 0.85 | 0.070 | 0.099 | -0.262 | -0.072 |
| 600 | 10 | 0.50 | 0.2 | 1.00 | 0.064 | 0.099 | -0.268 | -0.079 |
| 601 | 10 | 0.75 | 1.0 | 0.00 | -0.004 | 0.107 | -0.146 | -0.006 |
| 602 | 10 | 0.75 | 1.0 | 0.40 | 0.015 | 0.106 | -0.148 | -0.008 |
| 603 | 10 | 0.75 | 1.0 | 0.70 | 0.031 | 0.109 | -0.148 | -0.008 |
| 604 | 10 | 0.75 | 1.0 | 0.85 | 0.034 | 0.109 | -0.148 | -0.008 |
| 605 | 10 | 0.75 | 1.0 | 1.00 | 0.036 | 0.110 | -0.148 | -0.008 |
| 606 | 10 | 0.75 | 0.8 | 0.00 | 0.036 | 0.127 | -0.141 | 0.005 |
| 607 | 10 | 0.75 | 0.8 | 0.40 | 0.045 | 0.124 | -0.148 | -0.004 |
| 608 | 10 | 0.75 | 0.8 | 0.70 | 0.054 | 0.122 | -0.157 | -0.013 |
| 609 | 10 | 0.75 | 0.8 | 0.85 | 0.059 | 0.121 | -0.159 | -0.017 |
| 610 | 10 | 0.75 | 0.8 | 1.00 | 0.048 | 0.121 | -0.161 | -0.018 |
| 611 | 10 | 0.75 | 0.6 | 0.00 | 0.086 | 0.157 | -0.132 | 0.030 |

| TP | SS | Bias | Ell | Corr | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|
| 612 | 10 | 0.75 | 0.6 | 0.40 | 0.078 | 0.146 | -0.153 | 0.005 |
| 613 | 10 | 0.75 | 0.6 | 0.70 | 0.064 | 0.136 | -0.177 | -0.023 |
| 614 | 10 | 0.75 | 0.6 | 0.85 | 0.067 | 0.133 | -0.185 | -0.032 |
| 615 | 10 | 0.75 | 0.6 | 1.00 | 0.061 | 0.132 | -0.188 | -0.036 |
| 616 | 10 | 0.75 | 0.4 | 0.00 | 0.167 | 0.191 | -0.115 | 0.067 |
| 617 | 10 | 0.75 | 0.4 | 0.40 | 0.093 | 0.173 | -0.158 | 0.016 |
| 618 | 10 | 0.75 | 0.4 | 0.70 | 0.084 | 0.149 | -0.204 | -0.039 |
| 619 | 10 | 0.75 | 0.4 | 0.85 | 0.081 | 0.143 | -0.217 | -0.056 |
| 620 | 10 | 0.75 | 0.4 | 1.00 | 0.071 | 0.142 | -0.222 | -0.061 |
| 621 | 10 | 0.75 | 0.2 | 0.00 | 0.272 | 0.191 | -0.143 | 0.088 |
| 622 | 10 | 0.75 | 0.2 | 0.40 | 0.114 | 0.197 | -0.195 | 0.022 |
| 623 | 10 | 0.75 | 0.2 | 0.70 | 0.092 | 0.159 | -0.260 | -0.061 |
| 624 | 10 | 0.75 | 0.2 | 0.85 | 0.084 | 0.150 | -0.278 | -0.083 |
| 625 | 10 | 0.75 | 0.2 | 1.00 | 0.075 | 0.148 | -0.284 | -0.091 |
| 626 | 10 | 1.00 | 1.0 | 0.00 | -0.005 | 0.138 | -0.156 | -0.015 |
| 627 | 10 | 1.00 | 1.0 | 0.40 | 0.032 | 0.139 | -0.157 | -0.016 |
| 628 | 10 | 1.00 | 1.0 | 0.70 | 0.055 | 0.145 | -0.157 | -0.016 |
| 629 | 10 | 1.00 | 1.0 | 0.85 | 0.063 | 0.146 | -0.157 | -0.016 |
| 630 | 10 | 1.00 | 1.0 | 1.00 | 0.069 | 0.147 | -0.157 | -0.016 |
| 631 | 10 | 1.00 | 0.8 | 0.00 | 0.032 | 0.162 | -0.147 | -0.003 |
| 632 | 10 | 1.00 | 0.8 | 0.40 | 0.054 | 0.159 | -0.156 | -0.013 |
| 633 | 10 | 1.00 | 0.8 | 0.70 | 0.068 | 0.158 | -0.166 | -0.025 |
| 634 | 10 | 1.00 | 0.8 | 0.85 | 0.070 | 0.158 | -0.170 | -0.029 |
| 635 | 10 | 1.00 | 0.8 | 1.00 | 0.073 | 0.159 | -0.171 | -0.030 |
| 636 | 10 | 1.00 | 0.6 | 0.00 | 0.071 | 0.192 | -0.136 | 0.019 |
| 637 | 10 | 1.00 | 0.6 | 0.40 | 0.073 | 0.182 | -0.159 | -0.008 |
| 638 | 10 | 1.00 | 0.6 | 0.70 | 0.076 | 0.172 | -0.185 | -0.038 |
| 639 | 10 | 1.00 | 0.6 | 0.85 | 0.076 | 0.169 | -0.193 | -0.048 |
| 640 | 10 | 1.00 | 0.6 | 1.00 | 0.070 | 0.168 | -0.196 | -0.051 |
| 641 | 10 | 1.00 | 0.4 | 0.00 | 0.131 | 0.221 | -0.135 | 0.044 |
| 642 | 10 | 1.00 | 0.4 | 0.40 | 0.078 | 0.208 | -0.173 | -0.001 |
| 643 | 10 | 1.00 | 0.4 | 0.70 | 0.081 | 0.184 | -0.218 | -0.055 |
| 644 | 10 | 1.00 | 0.4 | 0.85 | 0.078 | 0.177 | -0.231 | -0.071 |
| 645 | 10 | 1.00 | 0.4 | 1.00 | 0.073 | 0.176 | -0.236 | -0.077 |
| 646 | 10 | 1.00 | 0.2 | 0.00 | 0.199 | 0.213 | -0.175 | 0.050 |
| 647 | 10 | 1.00 | 0.2 | 0.40 | 0.086 | 0.230 | -0.214 | 0.000 |
| 648 | 10 | 1.00 | 0.2 | 0.70 | 0.082 | 0.193 | -0.273 | -0.074 |
| 649 | 10 | 1.00 | 0.2 | 0.85 | 0.075 | 0.182 | -0.290 | -0.096 |
| 650 | 10 | 1.00 | 0.2 | 1.00 | 0.076 | 0.181 | -0.296 | -0.103 |
| 651 | 10 | 1.50 | 1.0 | 0.00 | -0.002 | 0.165 | -0.162 | -0.036 |

| TP | SS | Bias | Ell | Corr | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|
| 652 | 10 | 1.50 | 1.0 | 0.40 | 0.041 | 0.173 | -0.163 | -0.037 |
| 653 | 10 | 1.50 | 1.0 | 0.70 | 0.055 | 0.186 | -0.163 | -0.036 |
| 654 | 10 | 1.50 | 1.0 | 0.85 | 0.070 | 0.190 | -0.163 | -0.036 |
| 655 | 10 | 1.50 | 1.0 | 1.00 | 0.071 | 0.192 | -0.163 | -0.036 |
| 656 | 10 | 1.50 | 0.8 | 0.00 | 0.009 | 0.182 | -0.164 | -0.029 |
| 657 | 10 | 1.50 | 0.8 | 0.40 | 0.043 | 0.187 | -0.172 | -0.038 |
| 658 | 10 | 1.50 | 0.8 | 0.70 | 0.054 | 0.194 | -0.181 | -0.049 |
| 659 | 10 | 1.50 | 0.8 | 0.85 | 0.056 | 0.197 | -0.184 | -0.053 |
| 660 | 10 | 1.50 | 0.8 | 1.00 | 0.055 | 0.199 | -0.186 | -0.054 |
| 661 | 10 | 1.50 | 0.6 | 0.00 | 0.021 | 0.197 | -0.165 | -0.021 |
| 662 | 10 | 1.50 | 0.6 | 0.40 | 0.042 | 0.202 | -0.181 | -0.039 |
| 663 | 10 | 1.50 | 0.6 | 0.70 | 0.049 | 0.203 | -0.201 | -0.063 |
| 664 | 10 | 1.50 | 0.6 | 0.85 | 0.040 | 0.203 | -0.208 | -0.071 |
| 665 | 10 | 1.50 | 0.6 | 1.00 | 0.039 | 0.204 | -0.210 | -0.074 |
| 666 | 10 | 1.50 | 0.4 | 0.00 | 0.034 | 0.201 | -0.176 | -0.018 |
| 667 | 10 | 1.50 | 0.4 | 0.40 | 0.042 | 0.216 | -0.195 | -0.041 |
| 668 | 10 | 1.50 | 0.4 | 0.70 | 0.050 | 0.211 | -0.226 | -0.077 |
| 669 | 10 | 1.50 | 0.4 | 0.85 | 0.042 | 0.208 | -0.236 | -0.090 |
| 670 | 10 | 1.50 | 0.4 | 1.00 | 0.024 | 0.207 | -0.240 | -0.095 |
| 671 | 10 | 1.50 | 0.2 | 0.00 | 0.045 | 0.186 | -0.216 | -0.022 |
| 672 | 10 | 1.50 | 0.2 | 0.40 | 0.033 | 0.226 | -0.235 | -0.045 |
| 673 | 10 | 1.50 | 0.2 | 0.70 | 0.045 | 0.217 | -0.271 | -0.090 |
| 674 | 10 | 1.50 | 0.2 | 0.85 | 0.050 | 0.210 | -0.284 | -0.106 |
| 675 | 10 | 1.50 | 0.2 | 1.00 | 0.030 | 0.210 | -0.288 | -0.112 |
| 676 | 10 | 2.00 | 1.0 | 0.00 | -0.009 | 0.168 | -0.146 | -0.049 |
| 677 | 10 | 2.00 | 1.0 | 0.40 | 0.021 | 0.182 | -0.146 | -0.050 |
| 678 | 10 | 2.00 | 1.0 | 0.70 | 0.021 | 0.202 | -0.146 | -0.050 |
| 679 | 10 | 2.00 | 1.0 | 0.85 | 0.019 | 0.209 | -0.146 | -0.050 |
| 680 | 10 | 2.00 | 1.0 | 1.00 | 0.024 | 0.212 | -0.146 | -0.050 |
| 681 | 10 | 2.00 | 0.8 | 0.00 | -0.003 | 0.175 | -0.147 | -0.047 |
| 682 | 10 | 2.00 | 0.8 | 0.40 | 0.022 | 0.190 | -0.153 | -0.054 |
| 683 | 10 | 2.00 | 0.8 | 0.70 | 0.006 | 0.207 | -0.160 | -0.061 |
| 684 | 10 | 2.00 | 0.8 | 0.85 | -0.004 | 0.213 | -0.162 | -0.064 |
| 685 | 10 | 2.00 | 0.8 | 1.00 | -0.005 | 0.215 | -0.163 | -0.065 |
| 686 | 10 | 2.00 | 0.6 | 0.00 | 0.003 | 0.178 | -0.159 | -0.046 |
| 687 | 10 | 2.00 | 0.6 | 0.40 | 0.022 | 0.198 | -0.168 | -0.057 |
| 688 | 10 | 2.00 | 0.6 | 0.70 | 0.012 | 0.212 | -0.182 | -0.072 |
| 689 | 10 | 2.00 | 0.6 | 0.85 | -0.014 | 0.216 | -0.187 | -0.078 |
| 690 | 10 | 2.00 | 0.6 | 1.00 | -0.025 | 0.236 | -0.177 | -0.066 |
| 691 | 10 | 2.00 | 0.4 | 0.00 | -0.002 | 0.173 | -0.177 | -0.048 |

| TP | SS | Bias | Ell | Corr | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|
| 692 | 10 | 2.00 | 0.4 | 0.40 | 0.021 | 0.205 | -0.187 | -0.060 |
| 693 | 10 | 2.00 | 0.4 | 0.70 | 0.022 | 0.218 | -0.206 | -0.081 |
| 694 | 10 | 2.00 | 0.4 | 0.85 | -0.003 | 0.219 | -0.214 | -0.090 |
| 695 | 10 | 2.00 | 0.4 | 1.00 | -0.061 | 0.221 | -0.216 | -0.093 |
| 696 | 10 | 2.00 | 0.2 | 0.00 | -0.003 | 0.160 | -0.220 | -0.051 |
| 697 | 10 | 2.00 | 0.2 | 0.40 | 0.010 | 0.209 | -0.231 | -0.064 |
| 698 | 10 | 2.00 | 0.2 | 0.70 | 0.027 | 0.222 | -0.252 | -0.089 |
| 699 | 10 | 2.00 | 0.2 | 0.85 | 0.029 | 0.221 | -0.261 | -0.100 |
| 700 | 10 | 2.00 | 0.2 | 1.00 | -0.035 | 0.222 | -0.264 | -0.104 |
| 701 | 15 | 0.00 | 1.0 | 0.00 | -0.068 | 0.012 | -0.172 | 0.002 |
| 702 | 15 | 0.00 | 1.0 | 0.40 | -0.048 | 0.010 | -0.173 | 0.000 |
| 703 | 15 | 0.00 | 1.0 | 0.70 | -0.055 | 0.010 | -0.173 | 0.000 |
| 704 | 15 | 0.00 | 1.0 | 0.85 | -0.049 | 0.009 | -0.173 | 0.000 |
| 705 | 15 | 0.00 | 1.0 | 1.00 | -0.051 | 0.009 | -0.173 | 0.000 |
| 706 | 15 | 0.00 | 0.8 | 0.00 | 0.012 | 0.013 | -0.166 | 0.007 |
| 707 | 15 | 0.00 | 0.8 | 0.40 | 0.003 | 0.011 | -0.170 | 0.003 |
| 708 | 15 | 0.00 | 0.8 | 0.70 | -0.017 | 0.010 | -0.173 | -0.001 |
| 709 | 15 | 0.00 | 0.8 | 0.85 | -0.031 | 0.010 | -0.173 | -0.002 |
| 710 | 15 | 0.00 | 0.8 | 1.00 | -0.046 | 0.010 | -0.174 | -0.002 |
| 711 | 15 | 0.00 | 0.6 | 0.00 | 0.038 | 0.017 | -0.150 | 0.026 |
| 712 | 15 | 0.00 | 0.6 | 0.40 | 0.029 | 0.014 | -0.162 | 0.011 |
| 713 | 15 | 0.00 | 0.6 | 0.70 | 0.010 | 0.011 | -0.176 | -0.006 |
| 714 | 15 | 0.00 | 0.6 | 0.85 | -0.006 | 0.011 | -0.181 | -0.012 |
| 715 | 15 | 0.00 | 0.6 | 1.00 | -0.043 | 0.011 | -0.183 | -0.013 |
| 716 | 15 | 0.00 | 0.4 | 0.00 | 0.090 | 0.026 | -0.128 | 0.069 |
| 717 | 15 | 0.00 | 0.4 | 0.40 | 0.051 | 0.020 | -0.163 | 0.026 |
| 718 | 15 | 0.00 | 0.4 | 0.70 | 0.025 | 0.013 | -0.199 | -0.019 |
| 719 | 15 | 0.00 | 0.4 | 0.85 | 0.015 | 0.012 | -0.210 | -0.032 |
| 720 | 15 | 0.00 | 0.4 | 1.00 | -0.022 | 0.013 | -0.214 | -0.037 |
| 721 | 15 | 0.00 | 0.2 | 0.00 | 0.234 | 0.006 | -0.120 | 0.117 |
| 722 | 15 | 0.00 | 0.2 | 0.40 | 0.078 | 0.026 | -0.180 | 0.040 |
| 723 | 15 | 0.00 | 0.2 | 0.70 | 0.022 | 0.015 | -0.244 | -0.042 |
| 724 | 15 | 0.00 | 0.2 | 0.85 | 0.025 | 0.013 | -0.261 | -0.063 |
| 725 | 15 | 0.00 | 0.2 | 1.00 | 0.023 | 0.015 | -0.267 | -0.070 |
| 726 | 15 | 0.25 | 1.0 | 0.00 | -0.060 | 0.026 | -0.176 | 0.001 |
| 727 | 15 | 0.25 | 1.0 | 0.40 | -0.044 | 0.024 | -0.178 | -0.001 |
| 728 | 15 | 0.25 | 1.0 | 0.70 | -0.033 | 0.024 | -0.178 | -0.001 |
| 729 | 15 | 0.25 | 1.0 | 0.85 | -0.027 | 0.023 | -0.178 | -0.001 |
| 730 | 15 | 0.25 | 1.0 | 1.00 | -0.030 | 0.023 | -0.178 | -0.001 |
| 731 | 15 | 0.25 | 0.8 | 0.00 | 0.015 | 0.030 | -0.175 | 0.007 |

| TP | SS | Bias | Ell | Corr | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|
| 732 | 15 | 0.25 | 0.8 | 0.40 | 0.008 | 0.028 | -0.179 | 0.002 |
| 733 | 15 | 0.25 | 0.8 | 0.70 | 0.003 | 0.027 | -0.183 | -0.002 |
| 734 | 15 | 0.25 | 0.8 | 0.85 | -0.007 | 0.027 | -0.184 | -0.004 |
| 735 | 15 | 0.25 | 0.8 | 1.00 | -0.024 | 0.027 | -0.185 | -0.004 |
| 736 | 15 | 0.25 | 0.6 | 0.00 | 0.042 | 0.039 | -0.156 | 0.028 |
| 737 | 15 | 0.25 | 0.6 | 0.40 | 0.037 | 0.035 | -0.169 | 0.011 |
| 738 | 15 | 0.25 | 0.6 | 0.70 | 0.027 | 0.032 | -0.185 | -0.008 |
| 739 | 15 | 0.25 | 0.6 | 0.85 | 0.019 | 0.031 | -0.190 | -0.014 |
| 740 | 15 | 0.25 | 0.6 | 1.00 | -0.014 | 0.031 | -0.192 | -0.016 |
| 741 | 15 | 0.25 | 0.4 | 0.00 | 0.114 | 0.054 | -0.133 | 0.071 |
| 742 | 15 | 0.25 | 0.4 | 0.40 | 0.056 | 0.046 | -0.169 | 0.026 |
| 743 | 15 | 0.25 | 0.4 | 0.70 | 0.039 | 0.037 | -0.207 | -0.021 |
| 744 | 15 | 0.25 | 0.4 | 0.85 | 0.030 | 0.035 | -0.218 | -0.035 |
| 745 | 15 | 0.25 | 0.4 | 1.00 | 0.005 | 0.036 | -0.222 | -0.039 |
| 746 | 15 | 0.25 | 0.2 | 0.00 | 0.261 | 0.041 | -0.130 | 0.116 |
| 747 | 15 | 0.25 | 0.2 | 0.40 | 0.095 | 0.057 | -0.190 | 0.039 |
| 748 | 15 | 0.25 | 0.2 | 0.70 | 0.046 | 0.041 | -0.254 | -0.044 |
| 749 | 15 | 0.25 | 0.2 | 0.85 | 0.039 | 0.038 | -0.271 | -0.065 |
| 750 | 15 | 0.25 | 0.2 | 1.00 | 0.035 | 0.040 | -0.277 | -0.073 |
| 751 | 15 | 0.50 | 1.0 | 0.00 | -0.032 | 0.061 | -0.164 | -0.001 |
| 752 | 15 | 0.50 | 1.0 | 0.40 | -0.018 | 0.059 | -0.165 | -0.003 |
| 753 | 15 | 0.50 | 1.0 | 0.70 | 0.003 | 0.060 | -0.165 | -0.003 |
| 754 | 15 | 0.50 | 1.0 | 0.85 | 0.008 | 0.060 | -0.165 | -0.003 |
| 755 | 15 | 0.50 | 1.0 | 1.00 | 0.007 | 0.060 | -0.165 | -0.003 |
| 756 | 15 | 0.50 | 0.8 | 0.00 | 0.022 | 0.073 | -0.166 | 0.008 |
| 757 | 15 | 0.50 | 0.8 | 0.40 | 0.026 | 0.072 | -0.171 | 0.002 |
| 758 | 15 | 0.50 | 0.8 | 0.70 | 0.025 | 0.070 | -0.177 | -0.006 |
| 759 | 15 | 0.50 | 0.8 | 0.85 | 0.024 | 0.069 | -0.179 | -0.008 |
| 760 | 15 | 0.50 | 0.8 | 1.00 | 0.017 | 0.069 | -0.180 | -0.009 |
| 761 | 15 | 0.50 | 0.6 | 0.00 | 0.066 | 0.094 | -0.155 | 0.031 |
| 762 | 15 | 0.50 | 0.6 | 0.40 | 0.051 | 0.087 | -0.172 | 0.011 |
| 763 | 15 | 0.50 | 0.6 | 0.70 | 0.050 | 0.081 | -0.191 | -0.013 |
| 764 | 15 | 0.50 | 0.6 | 0.85 | 0.043 | 0.079 | -0.197 | -0.020 |
| 765 | 15 | 0.50 | 0.6 | 1.00 | 0.033 | 0.079 | -0.200 | -0.023 |
| 766 | 15 | 0.50 | 0.4 | 0.00 | 0.155 | 0.122 | -0.122 | 0.074 |
| 767 | 15 | 0.50 | 0.4 | 0.40 | 0.070 | 0.108 | -0.162 | 0.025 |
| 768 | 15 | 0.50 | 0.4 | 0.70 | 0.062 | 0.092 | -0.204 | -0.027 |
| 769 | 15 | 0.50 | 0.4 | 0.85 | 0.053 | 0.088 | -0.217 | -0.042 |
| 770 | 15 | 0.50 | 0.4 | 1.00 | 0.041 | 0.088 | -0.221 | -0.047 |
| 771 | 15 | 0.50 | 0.2 | 0.00 | 0.298 | 0.119 | -0.137 | 0.110 |

| TP | SS | Bias | Ell | Corr | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|
| 772 | 15 | 0.50 | 0.2 | 0.40 | 0.111 | 0.128 | -0.195 | 0.035 |
| 773 | 15 | 0.50 | 0.2 | 0.70 | 0.085 | 0.101 | -0.261 | -0.049 |
| 774 | 15 | 0.50 | 0.2 | 0.85 | 0.061 | 0.095 | -0.278 | -0.072 |
| 775 | 15 | 0.50 | 0.2 | 1.00 | 0.054 | 0.095 | -0.284 | -0.079 |
| 776 | 15 | 0.75 | 1.0 | 0.00 | -0.005 | 0.101 | -0.182 | -0.006 |
| 777 | 15 | 0.75 | 1.0 | 0.40 | 0.020 | 0.101 | -0.183 | -0.008 |
| 778 | 15 | 0.75 | 1.0 | 0.70 | 0.034 | 0.104 | -0.183 | -0.008 |
| 779 | 15 | 0.75 | 1.0 | 0.85 | 0.041 | 0.105 | -0.183 | -0.008 |
| 780 | 15 | 0.75 | 1.0 | 1.00 | 0.043 | 0.105 | -0.183 | -0.008 |
| 781 | 15 | 0.75 | 0.8 | 0.00 | 0.031 | 0.122 | -0.179 | 0.005 |
| 782 | 15 | 0.75 | 0.8 | 0.40 | 0.039 | 0.119 | -0.186 | -0.004 |
| 783 | 15 | 0.75 | 0.8 | 0.70 | 0.050 | 0.118 | -0.194 | -0.013 |
| 784 | 15 | 0.75 | 0.8 | 0.85 | 0.044 | 0.118 | -0.197 | -0.017 |
| 785 | 15 | 0.75 | 0.8 | 1.00 | 0.051 | 0.118 | -0.198 | -0.018 |
| 786 | 15 | 0.75 | 0.6 | 0.00 | 0.073 | 0.152 | -0.166 | 0.030 |
| 787 | 15 | 0.75 | 0.6 | 0.40 | 0.058 | 0.143 | -0.186 | 0.005 |
| 788 | 15 | 0.75 | 0.6 | 0.70 | 0.069 | 0.133 | -0.209 | -0.023 |
| 789 | 15 | 0.75 | 0.6 | 0.85 | 0.066 | 0.131 | -0.217 | -0.032 |
| 790 | 15 | 0.75 | 0.6 | 1.00 | 0.061 | 0.130 | -0.220 | -0.036 |
| 791 | 15 | 0.75 | 0.4 | 0.00 | 0.162 | 0.187 | -0.148 | 0.067 |
| 792 | 15 | 0.75 | 0.4 | 0.40 | 0.069 | 0.170 | -0.189 | 0.016 |
| 793 | 15 | 0.75 | 0.4 | 0.70 | 0.080 | 0.147 | -0.233 | -0.039 |
| 794 | 15 | 0.75 | 0.4 | 0.85 | 0.072 | 0.142 | -0.246 | -0.056 |
| 795 | 15 | 0.75 | 0.4 | 1.00 | 0.070 | 0.141 | -0.251 | -0.061 |
| 796 | 15 | 0.75 | 0.2 | 0.00 | 0.281 | 0.187 | -0.170 | 0.088 |
| 797 | 15 | 0.75 | 0.2 | 0.40 | 0.103 | 0.195 | -0.220 | 0.022 |
| 798 | 15 | 0.75 | 0.2 | 0.70 | 0.094 | 0.158 | -0.283 | -0.061 |
| 799 | 15 | 0.75 | 0.2 | 0.85 | 0.077 | 0.149 | -0.300 | -0.083 |
| 800 | 15 | 0.75 | 0.2 | 1.00 | 0.070 | 0.148 | -0.306 | -0.091 |
| 801 | 15 | 1.00 | 1.0 | 0.00 | -0.006 | 0.133 | -0.184 | -0.015 |
| 802 | 15 | 1.00 | 1.0 | 0.40 | 0.028 | 0.136 | -0.185 | -0.016 |
| 803 | 15 | 1.00 | 1.0 | 0.70 | 0.052 | 0.142 | -0.185 | -0.016 |
| 804 | 15 | 1.00 | 1.0 | 0.85 | 0.062 | 0.144 | -0.185 | -0.016 |
| 805 | 15 | 1.00 | 1.0 | 1.00 | 0.067 | 0.145 | -0.185 | -0.016 |
| 806 | 15 | 1.00 | 0.8 | 0.00 | 0.025 | 0.158 | -0.173 | -0.003 |
| 807 | 15 | 1.00 | 0.8 | 0.40 | 0.052 | 0.156 | -0.182 | -0.013 |
| 808 | 15 | 1.00 | 0.8 | 0.70 | 0.065 | 0.157 | -0.192 | -0.025 |
| 809 | 15 | 1.00 | 0.8 | 0.85 | 0.070 | 0.157 | -0.195 | -0.029 |
| 810 | 15 | 1.00 | 0.8 | 1.00 | 0.074 | 0.157 | -0.196 | -0.030 |
| 811 | 15 | 1.00 | 0.6 | 0.00 | 0.062 | 0.190 | -0.163 | 0.019 |

| TP | SS | Bias | Ell | Corr | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|
| 812 | 15 | 1.00 | 0.6 | 0.40 | 0.060 | 0.181 | -0.185 | -0.008 |
| 813 | 15 | 1.00 | 0.6 | 0.70 | 0.080 | 0.171 | -0.210 | -0.038 |
| 814 | 15 | 1.00 | 0.6 | 0.85 | 0.076 | 0.169 | -0.218 | -0.048 |
| 815 | 15 | 1.00 | 0.6 | 1.00 | 0.075 | 0.168 | -0.221 | -0.051 |
| 816 | 15 | 1.00 | 0.4 | 0.00 | 0.126 | 0.219 | -0.155 | 0.044 |
| 817 | 15 | 1.00 | 0.4 | 0.40 | 0.061 | 0.208 | -0.192 | -0.001 |
| 818 | 15 | 1.00 | 0.4 | 0.70 | 0.082 | 0.184 | -0.235 | -0.055 |
| 819 | 15 | 1.00 | 0.4 | 0.85 | 0.075 | 0.178 | -0.248 | -0.071 |
| 820 | 15 | 1.00 | 0.4 | 1.00 | 0.073 | 0.177 | -0.253 | -0.077 |
| 821 | 15 | 1.00 | 0.2 | 0.00 | 0.198 | 0.212 | -0.186 | 0.050 |
| 822 | 15 | 1.00 | 0.2 | 0.40 | 0.067 | 0.230 | -0.224 | 0.000 |
| 823 | 15 | 1.00 | 0.2 | 0.70 | 0.078 | 0.194 | -0.282 | -0.074 |
| 824 | 15 | 1.00 | 0.2 | 0.85 | 0.076 | 0.183 | -0.299 | -0.096 |
| 825 | 15 | 1.00 | 0.2 | 1.00 | 0.076 | 0.182 | -0.305 | -0.103 |
| 826 | 15 | 1.50 | 1.0 | 0.00 | -0.013 | 0.163 | -0.198 | -0.036 |
| 827 | 15 | 1.50 | 1.0 | 0.40 | 0.044 | 0.171 | -0.199 | -0.037 |
| 828 | 15 | 1.50 | 1.0 | 0.70 | 0.067 | 0.185 | -0.199 | -0.036 |
| 829 | 15 | 1.50 | 1.0 | 0.85 | 0.074 | 0.190 | -0.199 | -0.036 |
| 830 | 15 | 1.50 | 1.0 | 1.00 | 0.079 | 0.192 | -0.199 | -0.036 |
| 831 | 15 | 1.50 | 0.8 | 0.00 | 0.001 | 0.181 | -0.192 | -0.029 |
| 832 | 15 | 1.50 | 0.8 | 0.40 | 0.046 | 0.186 | -0.200 | -0.038 |
| 833 | 15 | 1.50 | 0.8 | 0.70 | 0.061 | 0.195 | -0.209 | -0.049 |
| 834 | 15 | 1.50 | 0.8 | 0.85 | 0.068 | 0.198 | -0.212 | -0.053 |
| 835 | 15 | 1.50 | 0.8 | 1.00 | 0.068 | 0.200 | -0.213 | -0.054 |
| 836 | 15 | 1.50 | 0.6 | 0.00 | 0.014 | 0.197 | -0.196 | -0.021 |
| 837 | 15 | 1.50 | 0.6 | 0.40 | 0.044 | 0.203 | -0.211 | -0.039 |
| 838 | 15 | 1.50 | 0.6 | 0.70 | 0.055 | 0.204 | -0.231 | -0.063 |
| 839 | 15 | 1.50 | 0.6 | 0.85 | 0.059 | 0.204 | -0.238 | -0.071 |
| 840 | 15 | 1.50 | 0.6 | 1.00 | 0.063 | 0.205 | -0.240 | -0.074 |
| 841 | 15 | 1.50 | 0.4 | 0.00 | 0.020 | 0.201 | -0.212 | -0.018 |
| 842 | 15 | 1.50 | 0.4 | 0.40 | 0.039 | 0.217 | -0.231 | -0.041 |
| 843 | 15 | 1.50 | 0.4 | 0.70 | 0.053 | 0.212 | -0.260 | -0.077 |
| 844 | 15 | 1.50 | 0.4 | 0.85 | 0.053 | 0.209 | -0.270 | -0.090 |
| 845 | 15 | 1.50 | 0.4 | 1.00 | 0.049 | 0.209 | -0.274 | -0.095 |
| 846 | 15 | 1.50 | 0.2 | 0.00 | 0.032 | 0.187 | -0.255 | -0.022 |
| 847 | 15 | 1.50 | 0.2 | 0.40 | 0.031 | 0.228 | -0.273 | -0.045 |
| 848 | 15 | 1.50 | 0.2 | 0.70 | 0.045 | 0.219 | -0.307 | -0.090 |
| 849 | 15 | 1.50 | 0.2 | 0.85 | 0.051 | 0.212 | -0.319 | -0.106 |
| 850 | 15 | 1.50 | 0.2 | 1.00 | 0.052 | 0.212 | -0.324 | -0.112 |
| 851 | 15 | 2.00 | 1.0 | 0.00 | -0.013 | 0.167 | -0.182 | -0.049 |

| TP | SS | Bias | Ell | Corr | Grubbs | Rand | Eth | CEP3 |
|---|---|---|---|---|---|---|---|---|
| 852 | 15 | 2.00 | 1.0 | 0.40 | 0.031 | 0.181 | -0.183 | -0.050 |
| 853 | 15 | 2.00 | 1.0 | 0.70 | 0.035 | 0.202 | -0.183 | -0.050 |
| 854 | 15 | 2.00 | 1.0 | 0.85 | 0.040 | 0.209 | -0.182 | -0.050 |
| 855 | 15 | 2.00 | 1.0 | 1.00 | 0.044 | 0.212 | -0.182 | -0.050 |
| 856 | 15 | 2.00 | 0.8 | 0.00 | -0.003 | 0.175 | -0.185 | -0.047 |
| 857 | 15 | 2.00 | 0.8 | 0.40 | 0.032 | 0.190 | -0.190 | -0.054 |
| 858 | 15 | 2.00 | 0.8 | 0.70 | 0.031 | 0.207 | -0.197 | -0.061 |
| 859 | 15 | 2.00 | 0.8 | 0.85 | 0.020 | 0.213 | -0.199 | -0.064 |
| 860 | 15 | 2.00 | 0.8 | 1.00 | 0.015 | 0.216 | -0.200 | -0.065 |
| 861 | 15 | 2.00 | 0.6 | 0.00 | 0.002 | 0.178 | -0.192 | -0.046 |
| 862 | 15 | 2.00 | 0.6 | 0.40 | 0.024 | 0.199 | -0.201 | -0.057 |
| 863 | 15 | 2.00 | 0.6 | 0.70 | 0.029 | 0.213 | -0.214 | -0.072 |
| 864 | 15 | 2.00 | 0.6 | 0.85 | 0.010 | 0.217 | -0.219 | -0.078 |
| 865 | 15 | 2.00 | 0.6 | 1.00 | -0.022 | 0.220 | -0.220 | -0.080 |
| 866 | 15 | 2.00 | 0.4 | 0.00 | -0.004 | 0.174 | -0.209 | -0.048 |
| 867 | 15 | 2.00 | 0.4 | 0.40 | 0.014 | 0.206 | -0.219 | -0.060 |
| 868 | 15 | 2.00 | 0.4 | 0.70 | 0.032 | 0.219 | -0.237 | -0.081 |
| 869 | 15 | 2.00 | 0.4 | 0.85 | 0.019 | 0.220 | -0.244 | -0.090 |
| 870 | 15 | 2.00 | 0.4 | 1.00 | -0.035 | 0.222 | -0.247 | -0.093 |
| 871 | 15 | 2.00 | 0.2 | 0.00 | -0.007 | 0.161 | -0.257 | -0.051 |
| 872 | 15 | 2.00 | 0.2 | 0.40 | 0.010 | 0.210 | -0.267 | -0.064 |
| 873 | 15 | 2.00 | 0.2 | 0.70 | 0.027 | 0.223 | -0.287 | -0.089 |
| 874 | 15 | 2.00 | 0.2 | 0.85 | 0.034 | 0.222 | -0.295 | -0.100 |
| 875 | 15 | 2.00 | 0.2 | 1.00 | 0.007 | 0.224 | -0.298 | -0.104 |

# Appendix G. *Comparative Summary*

This Appendix summarizes how well the four CEP estimation methods did compared to each other. The following pages list the test points and their associated data characteristics. The four right hand columns list the first, second, third, and fourth methods in the order of best to worst. Next to the name of the method, a grade is given to indicate how well it did with respect to the magnitude of its relative error. The abbreviations and grade range follow.

<u>Index</u>

Test Point - TP

<u>Parameters</u>

Sample Size - SS

Bias - Bias

Ellipticity - Ell

Correlation - Corr

<u>Estimation Methods</u>

Grubbs-Patnaik/chi-square method - GR

Modified RAND-234 method - RA

Ethridge method - ET

CEP3 method - C3

<u>Range of Grades</u>

Grade A: 0.0% → 2.5%

Grade B: 2.5% → 5.0%

Grade C: 5.0% → 7.5%

Grade D: 7.5% → 10.0%

Grade E: 10.0% → 15.0%

Grade F: 15.0% → 20.0%

Grade G: 20.0% → 30.0%

| TP | SS | Bias | Ell | Corr | 1ST | 2ND | 3RD | 4TH |
|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 0.00 | 1.0 | 0.00 | C3--A | ET--B | GB--D | RA--D |
| 2 | 3 | 0.00 | 1.0 | 0.40 | C3--A | ET--B | GB--C | RA--D |
| 3 | 3 | 0.00 | 1.0 | 0.70 | C3--A | ET--B | GB--C | RA--D |
| 4 | 3 | 0.00 | 1.0 | 0.85 | C3--A | ET--B | GB--D | RA--D |
| 5 | 3 | 0.00 | 1.0 | 1.00 | C3--A | ET--B | GB--C | RA--D |
| 6 | 3 | 0.00 | 0.8 | 0.00 | C3--A | ET--B | RA--D | GB--E |
| 7 | 3 | 0.00 | 0.8 | 0.40 | C3--A | ET--B | RA--D | GB--D |
| 8 | 3 | 0.00 | 0.8 | 0.70 | C3--A | ET--B | RA--D | GB--D |
| 9 | 3 | 0.00 | 0.8 | 0.85 | C3--A | ET--B | RA--D | GB--D |
| 10 | 3 | 0.00 | 0.8 | 1.00 | C3--A | ET--B | GB--D | RA--D |
| 11 | 3 | 0.00 | 0.6 | 0.00 | ET--A | C3--B | RA--D | GB--E |
| 12 | 3 | 0.00 | 0.6 | 0.40 | C3--A | ET--B | RA--D | GB--E |
| 13 | 3 | 0.00 | 0.6 | 0.70 | C3--A | ET--B | RA--D | GB--E |
| 14 | 3 | 0.00 | 0.6 | 0.85 | C3--A | ET--C | RA--D | GB--D |
| 15 | 3 | 0.00 | 0.6 | 1.00 | C3--A | ET--C | GB--D | RA--D |
| 16 | 3 | 0.00 | 0.4 | 0.00 | ET--A | C3--C | RA--E | GB--G |
| 17 | 3 | 0.00 | 0.4 | 0.40 | C3--B | ET--B | RA--E | GB--F |
| 18 | 3 | 0.00 | 0.4 | 0.70 | C3--A | ET--D | RA--D | GB--E |
| 19 | 3 | 0.00 | 0.4 | 0.85 | C3--B | RA--D | ET--D | GB--D |
| 20 | 3 | 0.00 | 0.4 | 1.00 | C3--B | RA--D | GB--D | ET--D |
| 21 | 3 | 0.00 | 0.2 | 0.00 | ET--A | C3--E | RA--E | GB--G |
| 22 | 3 | 0.00 | 0.2 | 0.40 | C3--B | ET--C | RA--E | GB--G |
| 23 | 3 | 0.00 | 0.2 | 0.70 | C3--B | RA--D | ET--E | GB--E |
| 24 | 3 | 0.00 | 0.2 | 0.85 | C3--C | RA--C | GB--E | ET--F |
| 25 | 3 | 0.00 | 0.2 | 1.00 | C3--C | RA--C | GB--D | ET--F |
| 26 | 3 | 0.25 | 1.0 | 0.00 | C3--A | ET--B | GB--D | RA--D |
| 27 | 3 | 0.25 | 1.0 | 0.40 | C3--A | ET--B | GB--C | RA--D |
| 28 | 3 | 0.25 | 1.0 | 0.70 | C3--A | ET--B | GB--D | RA--D |
| 29 | 3 | 0.25 | 1.0 | 0.85 | C3--A | ET--B | GB--D | RA--D |
| 30 | 3 | 0.25 | 1.0 | 1.00 | C3--A | ET--B | GB--C | RA--D |
| 31 | 3 | 0.25 | 0.8 | 0.00 | C3--A | ET--B | RA--D | GB--E |
| 32 | 3 | 0.25 | 0.8 | 0.40 | C3--A | ET--B | RA--D | GB--D |
| 33 | 3 | 0.25 | 0.8 | 0.70 | C3--A | ET--B | GB--D | RA--D |
| 34 | 3 | 0.25 | 0.8 | 0.85 | C3--A | ET--B | GB--D | RA--D |
| 35 | 3 | 0.25 | 0.8 | 1.00 | C3--A | ET--B | GB--D | RA--D |
| 36 | 3 | 0.25 | 0.6 | 0.00 | ET--A | C3--B | RA--E | GB--E |
| 37 | 3 | 0.25 | 0.6 | 0.40 | C3--A | ET--B | RA--E | GB--E |
| 38 | 3 | 0.25 | 0.6 | 0.70 | C3--A | ET--C | RA--D | GB--E |
| 39 | 3 | 0.25 | 0.6 | 0.85 | C3--A | ET--C | GB--D | RA--D |
| 40 | 3 | 0.25 | 0.6 | 1.00 | C3--A | ET--C | GB--D | RA--D |

| TP | SS | Bias | Ell | Corr | 1ST | 2ND | 3RD | 4TH |
|---|---|---|---|---|---|---|---|---|
| 41 | 3 | 0.25 | 0.4 | 0.00 | ET--A | C3--C | RA--E | GB--G |
| 42 | 3 | 0.25 | 0.4 | 0.40 | C3--B | ET--B | RA--E | GB--F |
| 43 | 3 | 0.25 | 0.4 | 0.70 | C3--A | ET--D | RA--D | GB--E |
| 44 | 3 | 0.25 | 0.4 | 0.85 | C3--B | RA--D | GB--D | ET--D |
| 45 | 3 | 0.25 | 0.4 | 1.00 | C3--B | GB--C | RA--D | ET--D |
| 46 | 3 | 0.25 | 0.2 | 0.00 | ET--A | C3--E | RA--E | GB--G |
| 47 | 3 | 0.25 | 0.2 | 0.40 | C3--B | ET--C | RA--E | GB--G |
| 48 | 3 | 0.25 | 0.2 | 0.70 | C3--B | RA--D | GB--E | ET--E |
| 49 | 3 | 0.25 | 0.2 | 0.85 | C3--C | RA--D | GB--E | ET--F |
| 50 | 3 | 0.25 | 0.2 | 1.00 | C3--C | GB--D | RA--D | ET--F |
| 51 | 3 | 0.50 | 1.0 | 0.00 | C3--A | ET--B | GB--C | RA--E |
| 52 | 3 | 0.50 | 1.0 | 0.40 | C3--A | ET--B | GB--D | RA--E |
| 53 | 3 | 0.50 | 1.0 | 0.70 | C3--A | ET--B | GB--D | RA--E |
| 54 | 3 | 0.50 | 1.0 | 0.85 | C3--A | ET--B | GB--D | RA--E |
| 55 | 3 | 0.50 | 1.0 | 1.00 | C3--A | ET--B | GB--D | RA--E |
| 56 | 3 | 0.50 | 0.8 | 0.00 | C3--A | ET--B | GB--E | RA--E |
| 57 | 3 | 0.50 | 0.8 | 0.40 | C3--A | ET--B | GB--E | RA--E |
| 58 | 3 | 0.50 | 0.8 | 0.70 | C3--A | ET--B | GB--D | RA--E |
| 59 | 3 | 0.50 | 0.8 | 0.85 | C3--A | ET--B | GB--D | RA--E |
| 60 | 3 | 0.50 | 0.8 | 1.00 | C3--A | ET--B | GB--D | RA--E |
| 61 | 3 | 0.50 | 0.6 | 0.00 | ET--A | C3--B | RA--E | GB--F |
| 62 | 3 | 0.50 | 0.6 | 0.40 | C3--A | ET--B | GB--E | RA--E |
| 63 | 3 | 0.50 | 0.6 | 0.70 | C3--A | ET--C | GB--E | RA--E |
| 64 | 3 | 0.50 | 0.6 | 0.85 | C3--A | ET--C | GB--D | RA--E |
| 65 | 3 | 0.50 | 0.6 | 1.00 | C3--A | ET--C | GB--D | RA--E |
| 66 | 3 | 0.50 | 0.4 | 0.00 | ET--A | C3--C | RA--F | GB--G |
| 67 | 3 | 0.50 | 0.4 | 0.40 | C3--B | ET--B | RA--F | GB--F |
| 68 | 3 | 0.50 | 0.4 | 0.70 | C3--B | ET--D | GB--E | RA--E |
| 69 | 3 | 0.50 | 0.4 | 0.85 | C3--B | GB--D | ET--E | RA--E |
| 70 | 3 | 0.50 | 0.4 | 1.00 | C3--B | GB--C | ET--E | RA--E |
| 71 | 3 | 0.50 | 0.2 | 0.00 | ET--A | C3--E | RA--F | GB--G |
| 72 | 3 | 0.50 | 0.2 | 0.40 | C3--B | ET--C | RA--F | GB--F |
| 73 | 3 | 0.50 | 0.2 | 0.70 | C3--B | GB--E | RA--E | ET--E |
| 74 | 3 | 0.50 | 0.2 | 0.85 | C3--C | GB--D | RA--E | ET--F |
| 75 | 3 | 0.50 | 0.2 | 1.00 | GB--C | C3--D | RA--E | ET--F |
| 76 | 3 | 0.75 | 1.0 | 0.00 | C3--A | ET--B | GB--C | RA--E |
| 77 | 3 | 0.75 | 1.0 | 0.40 | C3--A | ET--B | GB--D | RA--E |
| 78 | 3 | 0.75 | 1.0 | 0.70 | C3--A | ET--B | GB--D | RA--E |
| 79 | 3 | 0.75 | 1.0 | 0.85 | C3--A | ET--B | GB--D | RA--E |
| 80 | 3 | 0.75 | 1.0 | 1.00 | C3--A | ET--B | GB--D | RA--E |

| TP | SS | Bias | Ell | Corr | 1ST | 2ND | 3RD | 4TH |
|---|---|---|---|---|---|---|---|---|
| 81 | 3 | 0.75 | 0.8 | 0.00 | C3--A | ET--B | GB--D | RA--F |
| 82 | 3 | 0.75 | 0.8 | 0.40 | C3--A | ET--B | GB--D | RA--F |
| 83 | 3 | 0.75 | 0.8 | 0.70 | C3--A | ET--B | GB--D | RA--E |
| 84 | 3 | 0.75 | 0.8 | 0.85 | C3--A | ET--C | GB--D | RA--E |
| 85 | 3 | 0.75 | 0.8 | 1.00 | C3--A | ET--C | GB--D | RA--E |
| 86 | 3 | 0.75 | 0.6 | 0.00 | ET--A | C3--B | GB--E | RA--F |
| 87 | 3 | 0.75 | 0.6 | 0.40 | C3--A | ET--B | GB--E | RA--F |
| 88 | 3 | 0.75 | 0.6 | 0.70 | C3--A | ET--C | GB--D | RA--F |
| 89 | 3 | 0.75 | 0.6 | 0.85 | C3--B | ET--D | GB--D | RA--E |
| 90 | 3 | 0.75 | 0.6 | 1.00 | C3--B | GB--C | ET--D | RA--E |
| 91 | 3 | 0.75 | 0.4 | 0.00 | ET--A | C3--C | RA--G | GB--G |
| 92 | 3 | 0.75 | 0.4 | 0.40 | C3--A | ET--C | GB--E | RA--F |
| 93 | 3 | 0.75 | 0.4 | 0.70 | C3--B | GB--D | ET--E | RA--F |
| 94 | 3 | 0.75 | 0.4 | 0.85 | C3--C | GB--D | ET--E | RA--F |
| 95 | 3 | 0.75 | 0.4 | 1.00 | GB--C | C3--C | ET--E | RA--E |
| 96 | 3 | 0.75 | 0.2 | 0.00 | ET--A | C3--D | RA--G | GB--G |
| 97 | 3 | 0.75 | 0.2 | 0.40 | C3--A | ET--C | GB--F | RA--G |
| 98 | 3 | 0.75 | 0.2 | 0.70 | C3--C | GB--D | ET--E | RA--F |
| 99 | 3 | 0.75 | 0.2 | 0.85 | GB--C | C3--D | RA--F | ET--F |
| 100 | 3 | 0.75 | 0.2 | 1.00 | GB--B | C3--D | RA--E | ET--F |
| 101 | 3 | 1.00 | 1.0 | 0.00 | C3--A | ET--B | GB--B | RA--F |
| 102 | 3 | 1.00 | 1.0 | 0.40 | C3--A | ET--B | GB--C | RA--F |
| 103 | 3 | 1.00 | 1.0 | 0.70 | C3--A | ET--B | GB--D | RA--F |
| 104 | 3 | 1.00 | 1.0 | 0.85 | C3--A | ET--B | GB--D | RA--F |
| 105 | 3 | 1.00 | 1.0 | 1.00 | C3--A | ET--B | GB--D | RA--F |
| 106 | 3 | 1.00 | 0.8 | 0.00 | C3--A | ET--B | GB--D | RA--F |
| 107 | 3 | 1.00 | 0.8 | 0.40 | C3--A | ET--B | GB--D | RA--F |
| 108 | 3 | 1.00 | 0.8 | 0.70 | C3--B | ET--C | GB--D | RA--F |
| 109 | 3 | 1.00 | 0.8 | 0.85 | C3--B | ET--C | GB--C | RA--F |
| 110 | 3 | 1.00 | 0.8 | 1.00 | C3--B | ET--C | GB--C | RA--F |
| 111 | 3 | 1.00 | 0.6 | 0.00 | C3--A | ET--B | GB--E | RA--G |
| 112 | 3 | 1.00 | 0.6 | 0.40 | C3--A | ET--C | GB--D | RA--F |
| 113 | 3 | 1.00 | 0.6 | 0.70 | C3--B | GB--C | ET--D | RA--F |
| 114 | 3 | 1.00 | 0.6 | 0.85 | C3--B | GB--C | ET--D | RA--F |
| 115 | 3 | 1.00 | 0.6 | 1.00 | C3--C | GB--C | ET--D | RA--F |
| 116 | 3 | 1.00 | 0.4 | 0.00 | ET--A | C3--B | GB--F | RA--G |
| 117 | 3 | 1.00 | 0.4 | 0.40 | C3--A | ET--C | GB--E | RA--G |
| 118 | 3 | 1.00 | 0.4 | 0.70 | C3--C | GB--C | ET--E | RA--F |
| 119 | 3 | 1.00 | 0.4 | 0.85 | GB--B | C3--C | ET--E | RA--F |
| 120 | 3 | 1.00 | 0.4 | 1.00 | GB--B | C3--D | ET--E | RA--F |

| TP | SS | Bias | Ell | Corr | 1ST | 2ND | 3RD | 4TH |
|---|---|---|---|---|---|---|---|---|
| 121 | 3 | 1.00 | 0.2 | 0.00 | ET--B | C3--C | RA--G | GB--G |
| 122 | 3 | 1.00 | 0.2 | 0.40 | C3--A | ET--D | GB--E | RA--G |
| 123 | 3 | 1.00 | 0.2 | 0.70 | GB--C | C3--C | ET--F | RA--F |
| 124 | 3 | 1.00 | 0.2 | 0.85 | GB--B | C3--D | RA--F | ET--F |
| 125 | 3 | 1.00 | 0.2 | 1.00 | GB--A | C3--E | RA--F | ET--F |
| 126 | 3 | 1.50 | 1.0 | 0.00 | GB--A | C3--B | ET--B | RA--F |
| 127 | 3 | 1.50 | 1.0 | 0.40 | GB--B | C3--B | ET--B | RA--F |
| 128 | 3 | 1.50 | 1.0 | 0.70 | C3--B | GB--B | ET--B | RA--F |
| 129 | 3 | 1.50 | 1.0 | 0.85 | C3--B | GB--B | ET--B | RA--F |
| 130 | 3 | 1.50 | 1.0 | 1.00 | C3--B | GB--B | ET--B | RA--F |
| 131 | 3 | 1.50 | 0.8 | 0.00 | C3--B | GB--B | ET--B | RA--F |
| 132 | 3 | 1.50 | 0.8 | 0.40 | GB--B | C3--B | ET--C | RA--F |
| 133 | 3 | 1.50 | 0.8 | 0.70 | GB--A | C3--B | ET--C | RA--F |
| 134 | 3 | 1.50 | 0.8 | 0.85 | GB--A | C3--C | ET--C | RA--F |
| 135 | 3 | 1.50 | 0.8 | 1.00 | GB--A | C3--C | ET--C | RA--F |
| 136 | 3 | 1.50 | 0.6 | 0.00 | C3--A | ET--B | GB--C | RA--F |
| 137 | 3 | 1.50 | 0.6 | 0.40 | C3--B | GB--B | ET--C | RA--G |
| 138 | 3 | 1.50 | 0.6 | 0.70 | GB--A | C3--C | ET--D | RA--F |
| 139 | 3 | 1.50 | 0.6 | 0.85 | GB--A | C3--C | ET--D | RA--F |
| 140 | 3 | 1.50 | 0.6 | 1.00 | GB--A | C3--C | ET--D | RA--F |
| 141 | 3 | 1.50 | 0.4 | 0.00 | C3--A | ET--C | GB--D | RA--F |
| 142 | 3 | 1.50 | 0.4 | 0.40 | GB--B | C3--B | ET--D | RA--G |
| 143 | 3 | 1.50 | 0.4 | 0.70 | GB--A | C3--D | ET--E | RA--G |
| 144 | 3 | 1.50 | 0.4 | 0.85 | GB--A | C3--D | ET--E | RA--F |
| 145 | 3 | 1.50 | 0.4 | 1.00 | GB--B | C3--D | ET--E | RA--F |
| 146 | 3 | 1.50 | 0.2 | 0.00 | C3--A | ET--D | GB--D | RA--F |
| 147 | 3 | 1.50 | 0.2 | 0.40 | C3--B | GB--C | ET--D | RA--G |
| 148 | 3 | 1.50 | 0.2 | 0.70 | GB--A | C3--D | ET--E | RA--G |
| 149 | 3 | 1.50 | 0.2 | 0.85 | GB--A | C3--E | ET--F | RA--F |
| 150 | 3 | 1.50 | 0.2 | 1.00 | GB--C | C3--E | ET--F | RA--F |
| 151 | 3 | 2.00 | 1.0 | 0.00 | GB--A | ET--B | C3--B | RA--F |
| 152 | 3 | 2.00 | 1.0 | 0.40 | GB--A | ET--B | C3--C | RA--F |
| 153 | 3 | 2.00 | 1.0 | 0.70 | GB--A | ET--B | C3--C | RA--G |
| 154 | 3 | 2.00 | 1.0 | 0.85 | GB--A | ET--B | C3--C | RA--G |
| 155 | 3 | 2.00 | 1.0 | 1.00 | GB--A | ET--B | C3--C | RA--G |
| 156 | 3 | 2.00 | 0.8 | 0.00 | GB--A | ET--B | C3--B | RA--F |
| 157 | 3 | 2.00 | 0.8 | 0.40 | GB--A | ET--C | C3--C | RA--F |
| 158 | 3 | 2.00 | 0.8 | 0.70 | GB--B | ET--C | C3--C | RA--G |
| 159 | 3 | 2.00 | 0.8 | 0.85 | GB--B | ET--C | C3--C | RA--G |
| 160 | 3 | 2.00 | 0.8 | 1.00 | GB--B | ET--C | C3--C | RA--G |

| TP | SS | Bias | Ell | Corr | 1ST | 2ND | 3RD | 4TH |
|---|---|---|---|---|---|---|---|---|
| 161 | 3 | 2.00 | 0.6 | 0.00 | GB--A | C3--B | ET--C | RA--F |
| 162 | 3 | 2.00 | 0.6 | 0.40 | GB--A | C3--C | ET--C | RA--F |
| 163 | 3 | 2.00 | 0.6 | 0.70 | GB--B | C3--C | ET--D | RA--G |
| 164 | 3 | 2.00 | 0.6 | 0.85 | GB--C | C3--D | ET--D | RA--G |
| 165 | 3 | 2.00 | 0.6 | 1.00 | GB--C | C3--D | ET--D | RA--G |
| 166 | 3 | 2.00 | 0.4 | 0.00 | GB--B | C3--B | ET--C | RA--F |
| 167 | 3 | 2.00 | 0.4 | 0.40 | GB--A | C3--C | ET--C | RA--F |
| 168 | 3 | 2.00 | 0.4 | 0.70 | GB--B | C3--D | ET--D | RA--G |
| 169 | 3 | 2.00 | 0.4 | 0.85 | GB--C | C3--D | ET--E | RA--G |
| 170 | 3 | 2.00 | 0.4 | 1.00 | C3--D | GB--D | ET--E | RA--G |
| 171 | 3 | 2.00 | 0.2 | 0.00 | GB--B | C3--C | ET--C | RA--F |
| 172 | 3 | 2.00 | 0.2 | 0.40 | GB--A | C3--C | ET--D | RA--G |
| 173 | 3 | 2.00 | 0.2 | 0.70 | GB--A | C3--D | ET--E | RA--G |
| 174 | 3 | 2.00 | 0.2 | 0.85 | GB--C | C3--E | ET--E | RA--G |
| 175 | 3 | 2.00 | 0.2 | 1.00 | C3--E | ET--E | GB--E | RA--G |
| 176 | 5 | 0.00 | 1.0 | 0.00 | C3--A | GB--A | RA--B | ET--C |
| 177 | 5 | 0.00 | 1.0 | 0.40 | C3--A | GB--A | RA--B | ET--C |
| 178 | 5 | 0.00 | 1.0 | 0.70 | C3--A | GB--A | RA--B | ET--C |
| 179 | 5 | 0.00 | 1.0 | 0.85 | C3--A | GB--A | RA--B | ET--C |
| 180 | 5 | 0.00 | 1.0 | 1.00 | C3--A | GB--A | RA--B | ET--C |
| 181 | 5 | 0.00 | 0.8 | 0.00 | C3--A | GB--B | RA--B | ET--C |
| 182 | 5 | 0.00 | 0.8 | 0.40 | C3--A | GB--B | RA--B | ET--C |
| 183 | 5 | 0.00 | 0.8 | 0.70 | C3--A | GB--B | RA--B | ET--C |
| 184 | 5 | 0.00 | 0.8 | 0.85 | C3--A | GB--A | RA--B | ET--C |
| 185 | 5 | 0.00 | 0.8 | 1.00 | C3--A | GB--A | RA--B | ET--C |
| 186 | 5 | 0.00 | 0.6 | 0.00 | C3--B | ET--B | RA--C | GB--D |
| 187 | 5 | 0.00 | 0.6 | 0.40 | C3--A | RA--C | ET--C | GB--D |
| 188 | 5 | 0.00 | 0.6 | 0.70 | C3--A | RA--B | GB--C | ET--D |
| 189 | 5 | 0.00 | 0.6 | 0.85 | C3--A | GB--B | RA--B | ET--D |
| 190 | 5 | 0.00 | 0.6 | 1.00 | C3--A | GB--A | RA--B | ET--D |
| 191 | 5 | 0.00 | 0.4 | 0.00 | ET--B | C3--C | RA--C | GB--F |
| 192 | 5 | 0.00 | 0.4 | 0.40 | C3--B | RA--C | ET--C | GB--E |
| 193 | 5 | 0.00 | 0.4 | 0.70 | C3--A | RA--B | GB--D | ET--E |
| 194 | 5 | 0.00 | 0.4 | 0.85 | C3--B | RA--B | GB--C | ET--E |
| 195 | 5 | 0.00 | 0.4 | 1.00 | GB--B | C3--B | RA--B | ET--E |
| 196 | 5 | 0.00 | 0.2 | 0.00 | ET--B | RA--C | C3--E | GB--G |
| 197 | 5 | 0.00 | 0.2 | 0.40 | C3--B | RA--C | ET--D | GB--F |
| 198 | 5 | 0.00 | 0.2 | 0.70 | C3--B | RA--B | GB--D | ET--F |
| 199 | 5 | 0.00 | 0.2 | 0.85 | RA--B | C3--C | GB--D | ET--F |
| 200 | 5 | 0.00 | 0.2 | 1.00 | RA--B | GB--B | C3--C | ET--F |

| TP | SS | Bias | Ell | Corr | 1ST | 2ND | 3RD | 4TH |
|---|---|---|---|---|---|---|---|---|
| 201 | 5 | 0.25 | 1.0 | 0.00 | C3--A | GB--A | RA--C | ET--C |
| 202 | 5 | 0.25 | 1.0 | 0.40 | C3--A | GB--A | RA--C | ET--C |
| 203 | 5 | 0.25 | 1.0 | 0.70 | C3--A | GB--A | RA--C | ET--C |
| 204 | 5 | 0.25 | 1.0 | 0.85 | C3--A | GB--A | RA--C | ET--C |
| 205 | 5 | 0.25 | 1.0 | 1.00 | C3--A | GB--A | RA--C | ET--C |
| 206 | 5 | 0.25 | 0.8 | 0.00 | C3--A | GB--B | ET--C | RA--C |
| 207 | 5 | 0.25 | 0.8 | 0.40 | C3--A | GB--B | RA--C | ET--C |
| 208 | 5 | 0.25 | 0.8 | 0.70 | C3--A | GB--B | RA--C | ET--C |
| 209 | 5 | 0.25 | 0.8 | 0.85 | C3--A | GB--B | RA--C | ET--C |
| 210 | 5 | 0.25 | 0.8 | 1.00 | C3--A | GB--A | RA--C | ET--C |
| 211 | 5 | 0.25 | 0.6 | 0.00 | C3--B | ET--B | RA--D | GB--E |
| 212 | 5 | 0.25 | 0.6 | 0.40 | C3--A | ET--C | RA--C | GB--D |
| 213 | 5 | 0.25 | 0.6 | 0.70 | C3--A | RA--C | GB--C | ET--D |
| 214 | 5 | 0.25 | 0.6 | 0.85 | C3--A | GB--B | RA--C | ET--D |
| 215 | 5 | 0.25 | 0.6 | 1.00 | C3--A | GB--B | RA--C | ET--D |
| 216 | 5 | 0.25 | 0.4 | 0.00 | ET--B | C3--C | RA--D | GB--F |
| 217 | 5 | 0.25 | 0.4 | 0.40 | C3--B | ET--C | RA--D | GB--E |
| 218 | 5 | 0.25 | 0.4 | 0.70 | C3--A | RA--C | GB--D | ET--E |
| 219 | 5 | 0.25 | 0.4 | 0.85 | C3--B | RA--C | GB--C | ET--E |
| 220 | 5 | 0.25 | 0.4 | 1.00 | GB--B | C3--B | RA--C | ET--E |
| 221 | 5 | 0.25 | 0.2 | 0.00 | ET--B | RA--D | C3--E | GB--G |
| 222 | 5 | 0.25 | 0.2 | 0.40 | C3--B | RA--D | ET--D | GB--F |
| 223 | 5 | 0.25 | 0.2 | 0.70 | C3--B | RA--C | GB--D | ET--F |
| 224 | 5 | 0.25 | 0.2 | 0.85 | RA--C | C3--C | GB--D | ET--F |
| 225 | 5 | 0.25 | 0.2 | 1.00 | GB--C | RA--C | C3--C | ET--F |
| 226 | 5 | 0.50 | 1.0 | 0.00 | C3--A | GB--A | ET--C | RA--D |
| 227 | 5 | 0.50 | 1.0 | 0.40 | C3--A | GB--B | ET--C | RA--D |
| 228 | 5 | 0.50 | 1.0 | 0.70 | C3--A | GB--B | ET--C | RA--D |
| 229 | 5 | 0.50 | 1.0 | 0.85 | C3--A | GB--B | ET--C | RA--D |
| 230 | 5 | 0.50 | 1.0 | 1.00 | C3--A | GB--B | ET--C | RA--D |
| 231 | 5 | 0.50 | 0.8 | 0.00 | C3--A | GB--C | ET--C | RA--D |
| 232 | 5 | 0.50 | 0.8 | 0.40 | C3--A | GB--C | ET--C | RA--D |
| 233 | 5 | 0.50 | 0.8 | 0.70 | C3--A | GB--C | ET--C | RA--D |
| 234 | 5 | 0.50 | 0.8 | 0.85 | C3--A | GB--B | ET--C | RA--D |
| 235 | 5 | 0.50 | 0.8 | 1.00 | C3--A | GB--B | ET--C | RA--D |
| 236 | 5 | 0.50 | 0.6 | 0.00 | C3--B | ET--B | GB--E | RA--E |
| 237 | 5 | 0.50 | 0.6 | 0.40 | C3--A | ET--C | GB--D | RA--E |
| 238 | 5 | 0.50 | 0.6 | 0.70 | C3--A | GB--D | ET--D | RA--E |
| 239 | 5 | 0.50 | 0.6 | 0.85 | C3--A | GB--C | ET--D | RA--D |
| 240 | 5 | 0.50 | 0.6 | 1.00 | C3--A | GB--B | RA--D | ET--D |

| TP | SS | Bias | Ell | Corr | 1ST | 2ND | 3RD | 4TH |
|---|---|---|---|---|---|---|---|---|
| 241 | 5 | 0.50 | 0.4 | 0.00 | ET--B | C3--C | RA--E | GB--F |
| 242 | 5 | 0.50 | 0.4 | 0.40 | C3--B | ET--D | RA--E | GB--E |
| 243 | 5 | 0.50 | 0.4 | 0.70 | C3--B | GB--D | RA--E | ET--E |
| 244 | 5 | 0.50 | 0.4 | 0.85 | C3--B | GB--D | RA--E | ET--E |
| 245 | 5 | 0.50 | 0.4 | 1.00 | C3--B | GB--C | RA--E | ET--E |
| 246 | 5 | 0.50 | 0.2 | 0.00 | ET--B | C3--E | RA--F | GB--G |
| 247 | 5 | 0.50 | 0.2 | 0.40 | C3--B | ET--E | RA--E | GB--F |
| 248 | 5 | 0.50 | 0.2 | 0.70 | C3--B | GB--E | RA--E | ET--F |
| 249 | 5 | 0.50 | 0.2 | 0.85 | C3--C | GB--D | RA--E | ET--F |
| 250 | 5 | 0.50 | 0.2 | 1.00 | GB--C | C3--D | RA--E | ET--G |
| 251 | 5 | 0.75 | 1.0 | 0.00 | C3--A | GB--A | ET--C | RA--E |
| 252 | 5 | 0.75 | 1.0 | 0.40 | C3--A | GB--B | ET--C | RA--E |
| 253 | 5 | 0.75 | 1.0 | 0.70 | C3--A | GB--C | ET--C | RA--E |
| 254 | 5 | 0.75 | 1.0 | 0.85 | C3--A | GB--C | ET--C | RA--E |
| 255 | 5 | 0.75 | 1.0 | 1.00 | C3--A | GB--C | ET--C | RA--E |
| 256 | 5 | 0.75 | 0.8 | 0.00 | C3--A | GB--C | ET--C | RA--E |
| 257 | 5 | 0.75 | 0.8 | 0.40 | C3--A | GB--C | ET--C | RA--E |
| 258 | 5 | 0.75 | 0.8 | 0.70 | C3--A | GB--C | ET--D | RA--E |
| 259 | 5 | 0.75 | 0.8 | 0.85 | C3--A | GB--C | ET--D | RA--E |
| 260 | 5 | 0.75 | 0.8 | 1.00 | C3--A | GB--C | ET--D | RA--E |
| 261 | 5 | 0.75 | 0.6 | 0.00 | C3--B | ET--C | GB--E | RA--F |
| 262 | 5 | 0.75 | 0.6 | 0.40 | C3--A | ET--C | GB--D | RA--F |
| 263 | 5 | 0.75 | 0.6 | 0.70 | C3--A | GB--D | ET--E | RA--E |
| 264 | 5 | 0.75 | 0.6 | 0.85 | C3--B | GB--C | ET--E | RA--E |
| 265 | 5 | 0.75 | 0.6 | 1.00 | C3--B | GB--C | ET--E | RA--E |
| 266 | 5 | 0.75 | 0.4 | 0.00 | ET--B | C3--C | GB--F | RA--G |
| 267 | 5 | 0.75 | 0.4 | 0.40 | C3--A | ET--D | GB--E | RA--F |
| 268 | 5 | 0.75 | 0.4 | 0.70 | C3--B | GB--D | ET--E | RA--F |
| 269 | 5 | 0.75 | 0.4 | 0.85 | C3--C | GB--C | RA--E | ET--F |
| 270 | 5 | 0.75 | 0.4 | 1.00 | GB--C | C3--C | RA--E | ET--F |
| 271 | 5 | 0.75 | 0.2 | 0.00 | ET--C | C3--D | RA--G | GB--G |
| 272 | 5 | 0.75 | 0.2 | 0.40 | C3--A | ET--E | GB--E | RA--G |
| 273 | 5 | 0.75 | 0.2 | 0.70 | C3--C | GB--D | RA--F | ET--F |
| 274 | 5 | 0.75 | 0.2 | 0.85 | C3--B | ET--E | GB--G | RA--G |
| 275 | 5 | 0.75 | 0.2 | 1.00 | GB--C | C3--D | RA--E | ET--G |
| 276 | 5 | 1.00 | 1.0 | 0.00 | C3--A | GB--A | ET--C | RA--E |
| 277 | 5 | 1.00 | 1.0 | 0.40 | C3--A | GB--B | ET--C | RA--E |
| 278 | 5 | 1.00 | 1.0 | 0.70 | C3--A | GB--C | ET--C | RA--F |
| [illegible] | 5 | 1.00 | 1.0 | 0.85 | C3--A | GB--C | ET--C | RA--F |
| [illegible] | 5 | 1.00 | 1.0 | 1.00 | C3--A | GB--C | ET--C | RA--F |

| TP | SS | Bias | Ell | Corr | 1ST | 2ND | 3RD | 4TH |
|---|---|---|---|---|---|---|---|---|
| 281 | 5 | 1.00 | 0.8 | 0.00 | C3--A | GB--C | ET--C | RA--F |
| 282 | 5 | 1.00 | 0.8 | 0.40 | C3--A | GB--C | ET--D | RA--F |
| 283 | 5 | 1.00 | 0.8 | 0.70 | C3--B | GB--C | ET--D | RA--F |
| 284 | 5 | 1.00 | 0.8 | 0.85 | C3--B | GB--C | ET--D | RA--F |
| 285 | 5 | 1.00 | 0.8 | 1.00 | C3--B | GB--C | ET--D | RA--F |
| 286 | 5 | 1.00 | 0.6 | 0.00 | C3--A | ET--C | GB--D | RA--F |
| 287 | 5 | 1.00 | 0.6 | 0.40 | C3--A | ET--D | GB--D | RA--F |
| 288 | 5 | 1.00 | 0.6 | 0.70 | C3--B | GB--C | ET--E | RA--F |
| 289 | 5 | 1.00 | 0.6 | 0.85 | C3--B | GB--C | ET--E | RA--F |
| 290 | 5 | 1.00 | 0.6 | 1.00 | C3--C | GB--C | ET--E | RA--F |
| 291 | 5 | 1.00 | 0.4 | 0.00 | C3--B | ET--C | GB--F | RA--G |
| 292 | 5 | 1.00 | 0.4 | 0.40 | C3--A | ET--D | GB--E | RA--G |
| 293 | 5 | 1.00 | 0.4 | 0.70 | C3--C | GB--C | ET--E | RA--F |
| 294 | 5 | 1.00 | 0.4 | 0.85 | GB--C | C3--C | ET--F | RA--F |
| 295 | 5 | 1.00 | 0.4 | 1.00 | GB--B | C3--D | ET--F | RA--F |
| 296 | 5 | 1.00 | 0.2 | 0.00 | C3--C | ET--D | GB--G | RA--G |
| 297 | 5 | 1.00 | 0.2 | 0.40 | C3--A | GB--E | ET--E | RA--G |
| 298 | 5 | 1.00 | 0.2 | 0.70 | C3--C | GB--D | RA--F | ET--F |
| 299 | 5 | 1.00 | 0.2 | 0.85 | GB--C | C3--D | RA--F | ET--G |
| 300 | 5 | 1.00 | 0.2 | 1.00 | GB--B | C3--E | RA--F | ET--G |
| 301 | 5 | 1.50 | 1.0 | 0.00 | GB--A | C3--B | ET--C | RA--F |
| 302 | 5 | 1.50 | 1.0 | 0.40 | GB--B | C3--B | ET--C | RA--F |
| 303 | 5 | 1.50 | 1.0 | 0.70 | C3--B | GB--B | ET--C | RA--F |
| 304 | 5 | 1.50 | 1.0 | 0.85 | C3--B | GB--C | ET--C | RA--F |
| 305 | 5 | 1.50 | 1.0 | 1.00 | C3--B | GB--B | ET--C | RA--F |
| 306 | 5 | 1.50 | 0.8 | 0.00 | GB--A | C3--B | ET--C | RA--F |
| 307 | 5 | 1.50 | 0.8 | 0.40 | C3--B | GB--B | ET--D | RA--F |
| 308 | 5 | 1.50 | 0.8 | 0.70 | GB--B | C3--B | ET--D | RA--F |
| 309 | 5 | 1.50 | 0.8 | 0.85 | GB--B | C3--C | ET--D | RA--F |
| 310 | 5 | 1.50 | 0.8 | 1.00 | GB--B | C3--C | ET--D | RA--F |
| 311 | 5 | 1.50 | 0.6 | 0.00 | C3--A | GB--B | ET--D | RA--F |
| 312 | 5 | 1.50 | 0.6 | 0.40 | C3--B | GB--B | ET--D | RA--G |
| 313 | 5 | 1.50 | 0.6 | 0.70 | GB--B | C3--C | ET--E | RA--G |
| 314 | 5 | 1.50 | 0.6 | 0.85 | GB--A | C3--C | ET--E | RA--G |
| 315 | 5 | 1.50 | 0.6 | 1.00 | GB--A | C3--C | ET--E | RA--G |
| 316 | 5 | 1.50 | 0.4 | 0.00 | C3--A | GB--C | ET--D | RA--F |
| 317 | 5 | 1.50 | 0.4 | 0.40 | C3--B | GB--B | ET--E | RA--G |
| 318 | 5 | 1.50 | 0.4 | 0.70 | GB--B | C3--D | ET--E | RA--G |
| 319 | 5 | 1.50 | 0.4 | 0.85 | GB--A | C3--D | ET--F | RA--G |
| 320 | 5 | 1.50 | 0.4 | 1.00 | GB--A | C3--D | ET--F | RA--G |

| TP | SS | Bias | Ell | Corr | 1ST | 2ND | 3RD | 4TH |
|---|---|---|---|---|---|---|---|---|
| 321 | 5 | 1.50 | 0.2 | 0.00 | C3--A | GB--C | ET--E | RA--F |
| 322 | 5 | 1.50 | 0.2 | 0.40 | C3--B | GB--B | ET--E | RA--G |
| 323 | 5 | 1.50 | 0.2 | 0.70 | GB--B | C3--D | ET--F | RA--G |
| 324 | 5 | 1.50 | 0.2 | 0.85 | GB--A | C3--E | ET--F | RA--G |
| 325 | 5 | 1.50 | 0.2 | 1.00 | GB--A | C3--E | ET--F | RA--G |
| 326 | 5 | 2.00 | 1.0 | 0.00 | GB--A | C3--B | ET--C | RA--F |
| 327 | 5 | 2.00 | 1.0 | 0.40 | GB--A | C3--C | ET--C | RA--F |
| 328 | 5 | 2.00 | 1.0 | 0.70 | GB--A | C3--C | ET--C | RA--G |
| 329 | 5 | 2.00 | 1.0 | 0.85 | GB--A | C3--C | ET--C | RA--G |
| 330 | 5 | 2.00 | 1.0 | 1.00 | GB--A | C3--C | ET--C | RA--G |
| 331 | 5 | 2.00 | 0.8 | 0.00 | GB--A | C3--B | ET--C | RA--F |
| 332 | 5 | 2.00 | 0.8 | 0.40 | GB--A | C3--C | ET--C | RA--F |
| 333 | 5 | 2.00 | 0.8 | 0.70 | GB--A | C3--C | ET--D | RA--G |
| 334 | 5 | 2.00 | 0.8 | 0.85 | GB--B | C3--C | ET--D | RA--G |
| 335 | 5 | 2.00 | 0.8 | 1.00 | GB--B | C3--C | ET--D | RA--G |
| 336 | 5 | 2.00 | 0.6 | 0.00 | GB--A | C3--B | ET--C | RA--F |
| 337 | 5 | 2.00 | 0.6 | 0.40 | GB--A | C3--C | ET--D | RA--F |
| 338 | 5 | 2.00 | 0.6 | 0.70 | GB--A | C3--C | ET--D | RA--G |
| 339 | 5 | 2.00 | 0.6 | 0.85 | GB--B | C3--D | ET--E | RA--G |
| 340 | 5 | 2.00 | 0.6 | 1.00 | GB--C | C3--D | ET--E | RA--G |
| 341 | 5 | 2.00 | 0.4 | 0.00 | GB--A | C3--B | ET--D | RA--F |
| 342 | 5 | 2.00 | 0.4 | 0.40 | GB--A | C3--C | ET--D | RA--G |
| 343 | 5 | 2.00 | 0.4 | 0.70 | GB--A | C3--D | ET--E | RA--G |
| 344 | 5 | 2.00 | 0.4 | 0.85 | GB--B | C3--D | ET--E | RA--G |
| 345 | 5 | 2.00 | 0.4 | 1.00 | C3--D | GB--D | ET--E | RA--G |
| 346 | 5 | 2.00 | 0.2 | 0.00 | GB--A | C3--C | ET--D | RA--F |
| 347 | 5 | 2.00 | 0.2 | 0.40 | GB--A | C3--C | ET--E | RA--G |
| 348 | 5 | 2.00 | 0.2 | 0.70 | GB--A | C3--D | ET--E | RA--G |
| 349 | 5 | 2.00 | 0.2 | 0.85 | GB--A | C3--E | ET--E | RA--G |
| 350 | 5 | 2.00 | 0.2 | 1.00 | GB--D | C3--E | ET--E | RA--G |
| 351 | 7 | 0.00 | 1.0 | 0.00 | C3--A | GB--A | RA--B | ET--D |
| 352 | 7 | 0.00 | 1.0 | 0.40 | C3--A | GB--B | RA--B | ET--D |
| 353 | 7 | 0.00 | 1.0 | 0.70 | C3--A | GB--A | RA--B | ET--D |
| 354 | 7 | 0.00 | 1.0 | 0.85 | C3--A | GB--B | RA--B | ET--D |
| 355 | 7 | 0.00 | 1.0 | 1.00 | C3--A | GB--A | RA--B | ET--D |
| 356 | 7 | 0.00 | 0.8 | 0.00 | C3--A | GB--B | RA--B | ET--D |
| 357 | 7 | 0.00 | 0.8 | 0.40 | C3--A | GB--A | RA--B | ET--D |
| 358 | 7 | 0.00 | 0.8 | 0.70 | C3--A | GB--A | RA--B | ET--D |
| 359 | 7 | 0.00 | 0.8 | 0.85 | GB--A | C3--A | RA--B | ET--D |
| 360 | 7 | 0.00 | 0.8 | 1.00 | C3--A | GB--A | RA--B | ET--D |

| TP | SS | Bias | Ell | Corr | 1ST | 2ND | 3RD | 4TH |
|---|---|---|---|---|---|---|---|---|
| 361 | 7 | 0.00 | 0.6 | 0.00 | C3--B | RA--B | ET--D | GB--D |
| 362 | 7 | 0.00 | 0.6 | 0.40 | C3--A | RA--B | GB--C | ET--D |
| 363 | 7 | 0.00 | 0.6 | 0.70 | C3--A | RA--B | GB--B | ET--E |
| 364 | 7 | 0.00 | 0.6 | 0.85 | C3--A | GB--A | RA--B | ET--E |
| 365 | 7 | 0.00 | 0.6 | 1.00 | GB--A | C3--A | RA--B | ET--E |
| 366 | 7 | 0.00 | 0.4 | 0.00 | RA--C | ET--C | C3--C | GB--E |
| 367 | 7 | 0.00 | 0.4 | 0.40 | C3--B | RA--B | ET--D | GB--D |
| 368 | 7 | 0.00 | 0.4 | 0.70 | C3--A | RA--B | GB--C | ET--E |
| 369 | 7 | 0.00 | 0.4 | 0.85 | RA--B | C3--B | GB--B | ET--E |
| 370 | 7 | 0.00 | 0.4 | 1.00 | GB--A | RA--B | C3--B | ET--F |
| 371 | 7 | 0.00 | 0.2 | 0.00 | RA--B | ET--C | C3--E | GB--G |
| 372 | 7 | 0.00 | 0.2 | 0.40 | C3--B | RA--C | ET--E | GB--E |
| 373 | 7 | 0.00 | 0.2 | 0.70 | RA--B | C3--B | GB--C | ET--F |
| 374 | 7 | 0.00 | 0.2 | 0.85 | RA--B | GB--C | C3--C | ET--G |
| 375 | 7 | 0.00 | 0.2 | 1.00 | RA--B | GB--B | C3--C | ET--G |
| 376 | 7 | 0.25 | 1.0 | 0.00 | C3--A | GB--A | RA--B | ET--D |
| 377 | 7 | 0.25 | 1.0 | 0.40 | C3--A | GB--A | RA--B | ET--D |
| 378 | 7 | 0.25 | 1.0 | 0.70 | C3--A | GB--A | RA--B | ET--D |
| 379 | 7 | 0.25 | 1.0 | 0.85 | C3--A | GB--A | RA--B | ET--D |
| 380 | 7 | 0.25 | 1.0 | 1.00 | C3--A | GB--A | RA--B | ET--D |
| 381 | 7 | 0.25 | 0.8 | 0.00 | C3--A | GB--B | RA--B | ET--D |
| 382 | 7 | 0.25 | 0.8 | 0.40 | C3--A | GB--A | RA--B | ET--D |
| 383 | 7 | 0.25 | 0.8 | 0.70 | C3--A | GB--A | RA--B | ET--D |
| 384 | 7 | 0.25 | 0.8 | 0.85 | C3--A | GB--A | RA--B | ET--D |
| 385 | 7 | 0.25 | 0.8 | 1.00 | GB--A | C3--A | RA--B | ET--D |
| 386 | 7 | 0.25 | 0.6 | 0.00 | C3--B | RA--C | ET--D | GB--D |
| 387 | 7 | 0.25 | 0.6 | 0.40 | C3--A | RA--C | GB--C | ET--D |
| 388 | 7 | 0.25 | 0.6 | 0.70 | C3--A | GB--B | RA--B | ET--E |
| 389 | 7 | 0.25 | 0.6 | 0.85 | C3--A | GB--B | RA--B | ET--E |
| 390 | 7 | 0.25 | 0.6 | 1.00 | GB--A | C3--A | RA--B | ET--E |
| 391 | 7 | 0.25 | 0.4 | 0.00 | ET--C | C3--C | RA--D | GB--F |
| 392 | 7 | 0.25 | 0.4 | 0.40 | C3--B | RA--C | ET--D | GB--E |
| 393 | 7 | 0.25 | 0.4 | 0.70 | C3--A | RA--C | GB--C | ET--E |
| 394 | 7 | 0.25 | 0.4 | 0.85 | C3--B | RA--B | GB--B | ET--E |
| 395 | 7 | 0.25 | 0.4 | 1.00 | GB--A | C3--B | RA--B | ET--F |
| 396 | 7 | 0.25 | 0.2 | 0.00 | RA--A | C3--B | ET--E | GB--G |
| 397 | 7 | 0.25 | 0.2 | 0.40 | C3--B | RA--D | ET--E | GB--E |
| 398 | 7 | 0.25 | 0.2 | 0.70 | C3--B | RA--C | GB--D | ET--F |
| 399 | 7 | 0.25 | 0.2 | 0.85 | RA--C | C3--C | GB--C | ET--G |
| 400 | 7 | 0.25 | 0.2 | 1.00 | GB--B | RA--C | C3--C | ET--G |

| TP | SS | Bias | Ell | Corr | 1ST | 2ND | 3RD | 4TH |
|---|---|---|---|---|---|---|---|---|
| 401 | 7 | 0.50 | 1.0 | 0.00 | C3--A | GB--A | RA--D | ET--D |
| 402 | 7 | 0.50 | 1.0 | 0.40 | C3--A | GB--A | RA--C | ET--D |
| 403 | 7 | 0.50 | 1.0 | 0.70 | C3--A | GB--A | RA--C | ET--D |
| 404 | 7 | 0.50 | 1.0 | 0.85 | C3--A | GB--A | RA--C | ET--D |
| 405 | 7 | 0.50 | 1.0 | 1.00 | C3--A | GB--A | RA--C | ET--D |
| 406 | 7 | 0.50 | 0.8 | 0.00 | C3--A | GB--B | ET--D | RA--D |
| 407 | 7 | 0.50 | 0.8 | 0.40 | C3--A | GB--B | RA--D | ET--D |
| 408 | 7 | 0.50 | 0.8 | 0.70 | C3--A | GB--B | RA--D | ET--D |
| 409 | 7 | 0.50 | 0.8 | 0.85 | C3--A | GB--B | RA--D | ET--D |
| 410 | 7 | 0.50 | 0.8 | 1.00 | C3--A | GB--A | RA--D | ET--D |
| 411 | 7 | 0.50 | 0.6 | 0.00 | C3--B | ET--C | GB--D | RA--E |
| 412 | 7 | 0.50 | 0.6 | 0.40 | C3--A | GB--D | ET--D | RA--D |
| 413 | 7 | 0.50 | 0.6 | 0.70 | C3--A | GB--C | RA--D | ET--E |
| 414 | 7 | 0.50 | 0.6 | 0.85 | C3--A | GB--C | RA--D | ET--E |
| 415 | 7 | 0.50 | 0.6 | 1.00 | C3--A | GB--B | RA--D | ET--E |
| 416 | 7 | 0.50 | 0.4 | 0.00 | ET--C | C3--C | RA--E | GB--F |
| 417 | 7 | 0.50 | 0.4 | 0.40 | C3--B | ET--D | GB--E | RA--E |
| 418 | 7 | 0.50 | 0.4 | 0.70 | C3--B | GB--D | RA--E | ET--E |
| 419 | 7 | 0.50 | 0.4 | 0.85 | C3--B | GB--C | RA--D | ET--F |
| 420 | 7 | 0.50 | 0.4 | 1.00 | GB--B | C3--B | RA--D | ET--F |
| 421 | 7 | 0.50 | 0.2 | 0.00 | ET--C | C3--E | RA--E | GB--G |
| 422 | 7 | 0.50 | 0.2 | 0.40 | C3--B | ET--E | GB--E | RA--E |
| 423 | 7 | 0.50 | 0.2 | 0.70 | C3--B | GB--D | RA--E | ET--F |
| 424 | 7 | 0.50 | 0.2 | 0.85 | C3--C | GB--D | RA--D | ET--G |
| 425 | 7 | 0.50 | 0.2 | 1.00 | GB--C | C3--D | RA--D | ET--G |
| 426 | 7 | 0.75 | 1.0 | 0.00 | GB--A | C3--A | ET--D | RA--E |
| 427 | 7 | 0.75 | 1.0 | 0.40 | C3--A | GB--A | ET--D | RA--E |
| 428 | 7 | 0.75 | 1.0 | 0.70 | C3--A | GB--B | ET--D | RA--E |
| 429 | 7 | 0.75 | 1.0 | 0.85 | C3--A | GB--B | ET--D | RA--E |
| 430 | 7 | 0.75 | 1.0 | 1.00 | C3--A | GB--B | ET--D | RA--E |
| 431 | 7 | 0.75 | 0.8 | 0.00 | C3--A | GB--B | ET--D | RA--E |
| 432 | 7 | 0.75 | 0.8 | 0.40 | C3--A | GB--B | ET--D | RA--E |
| 433 | 7 | 0.75 | 0.8 | 0.70 | C3--A | GB--B | ET--E | RA--E |
| 434 | 7 | 0.75 | 0.8 | 0.85 | C3--A | GB--C | ET--E | RA--E |
| 435 | 7 | 0.75 | 0.8 | 1.00 | C3--A | GB--C | ET--E | RA--E |
| 436 | 7 | 0.75 | 0.6 | 0.00 | C3--B | ET--D | GB--D | RA--F |
| 437 | 7 | 0.75 | 0.6 | 0.40 | C3--A | GB--D | ET--D | RA--E |
| 438 | 7 | 0.75 | 0.6 | 0.70 | C3--A | GB--C | ET--E | RA--E |
| 439 | 7 | 0.75 | 0.6 | 0.85 | C3--B | GB--C | ET--E | RA--E |
| 440 | 7 | 0.75 | 0.6 | 1.00 | C3--B | GB--C | RA--E | ET--E |

| TP | SS | Bias | Ell | Corr | 1ST | 2ND | 3RD | 4TH |
|---|---|---|---|---|---|---|---|---|
| 441 | 7 | 0.75 | 0.4 | 0.00 | ET--C | C3--C | GB--F | RA--F |
| 442 | 7 | 0.75 | 0.4 | 0.40 | C3--A | GB--E | ET--E | RA--F |
| 443 | 7 | 0.75 | 0.4 | 0.70 | C3--B | GB--D | RA--E | ET--F |
| 444 | 7 | 0.75 | 0.4 | 0.85 | C3--C | GB--C | RA--E | ET--F |
| 445 | 7 | 0.75 | 0.4 | 1.00 | GB--C | C3--C | RA--E | ET--F |
| 446 | 7 | 0.75 | 0.2 | 0.00 | ET--D | C3--D | RA--F | GB--G |
| 447 | 7 | 0.75 | 0.2 | 0.40 | C3--A | GB--E | ET--E | RA--F |
| 448 | 7 | 0.75 | 0.2 | 0.70 | C3--C | GB--D | RA--F | ET--G |
| 449 | 7 | 0.75 | 0.2 | 0.85 | C3--D | GB--D | RA--E | ET--G |
| 450 | 7 | 0.75 | 0.2 | 1.00 | GB--C | C3--D | RA--E | ET--G |
| 451 | 7 | 1.00 | 1.0 | 0.00 | GB--A | C3--A | ET--D | RA--E |
| 452 | 7 | 1.00 | 1.0 | 0.40 | C3--A | GB--B | ET--E | RA--E |
| 453 | 7 | 1.00 | 1.0 | 0.70 | C3--A | GB--C | ET--E | RA--E |
| 454 | 7 | 1.00 | 1.0 | 0.85 | C3--A | GB--C | ET--E | RA--E |
| 455 | 7 | 1.00 | 1.0 | 1.00 | C3--A | GB--C | ET--E | RA--E |
| 456 | 7 | 1.00 | 0.8 | 0.00 | C3--A | GB--B | ET--D | RA--F |
| 457 | 7 | 1.00 | 0.8 | 0.40 | C3--A | GB--C | ET--E | RA--F |
| 458 | 7 | 1.00 | 0.8 | 0.70 | C3--B | GB--C | ET--E | RA--F |
| 459 | 7 | 1.00 | 0.8 | 0.85 | C3--B | GB--C | ET--E | RA--F |
| 460 | 7 | 1.00 | 0.8 | 1.00 | C3--B | GB--C | ET--E | RA--F |
| 461 | 7 | 1.00 | 0.6 | 0.00 | C3--A | GB--D | ET--D | RA--F |
| 462 | 7 | 1.00 | 0.6 | 0.40 | C3--A | GB--D | ET--E | RA--F |
| 463 | 7 | 1.00 | 0.6 | 0.70 | C3--B | GB--C | ET--E | RA--F |
| 464 | 7 | 1.00 | 0.6 | 0.85 | C3--B | GB--C | ET--E | RA--F |
| 465 | 7 | 1.00 | 0.6 | 1.00 | C3--C | GB--C | ET--E | RA--F |
| 466 | 7 | 1.00 | 0.4 | 0.00 | C3--B | ET--D | GB--E | RA--G |
| 467 | 7 | 1.00 | 0.4 | 0.40 | C3--A | GB--D | ET--E | RA--G |
| 468 | 7 | 1.00 | 0.4 | 0.70 | C3--C | GB--C | ET--F | RA--F |
| 469 | 7 | 1.00 | 0.4 | 0.85 | GB--C | C3--C | RA--F | ET--F |
| 470 | 7 | 1.00 | 0.4 | 1.00 | GB--C | C3--D | RA--F | ET--F |
| 471 | 7 | 1.00 | 0.2 | 0.00 | C3--C | ET--E | GB--G | RA--G |
| 472 | 7 | 1.00 | 0.2 | 0.40 | C3--A | GB--D | ET--F | RA--G |
| 473 | 7 | 1.00 | 0.2 | 0.70 | C3--C | GB--D | RA--F | ET--G |
| 474 | 7 | 1.00 | 0.2 | 0.85 | GB--C | C3--D | RA--F | ET--G |
| 475 | 7 | 1.00 | 0.2 | 1.00 | GB--C | C3--E | RA--F | ET--G |
| 476 | 7 | 1.50 | 1.0 | 0.00 | GB--A | C3--B | ET--E | RA--F |
| 477 | 7 | 1.50 | 1.0 | 0.40 | GB--B | C3--B | ET--E | RA--F |
| 478 | 7 | 1.50 | 1.0 | 0.70 | C3--B | GB--C | ET--E | RA--F |
| 479 | 7 | 1.50 | 1.0 | 0.85 | C3--B | GB--C | ET--E | RA--F |
| 480 | 7 | 1.50 | 1.0 | 1.00 | C3--B | GB--C | ET--E | RA--F |

| TP | SS | Bias | Ell | Corr | 1ST | 2ND | 3RD | 4TH |
|---|---|---|---|---|---|---|---|---|
| 481 | 7 | 1.50 | 0.8 | 0.00 | GB--A | C3--B | ET--E | RA--F |
| 482 | 7 | 1.50 | 0.8 | 0.40 | C3--B | GB--B | ET--E | RA--F |
| 483 | 7 | 1.50 | 0.8 | 0.70 | GB--B | C3--B | ET--E | RA--F |
| 484 | 7 | 1.50 | 0.8 | 0.85 | GB--B | C3--C | ET--E | RA--F |
| 485 | 7 | 1.50 | 0.8 | 1.00 | GB--B | C3--C | ET--E | RA--F |
| 486 | 7 | 1.50 | 0.6 | 0.00 | C3--A | GB--B | ET--E | RA--F |
| 487 | 7 | 1.50 | 0.6 | 0.40 | C3--B | GB--B | ET--E | RA--G |
| 488 | 7 | 1.50 | 0.6 | 0.70 | GB--B | C3--C | ET--E | RA--G |
| 489 | 7 | 1.50 | 0.6 | 0.85 | GB--B | C3--C | ET--E | RA--G |
| 490 | 7 | 1.50 | 0.6 | 1.00 | GB--B | C3--C | ET--F | RA--G |
| 491 | 7 | 1.50 | 0.4 | 0.00 | C3--A | GB--B | ET--E | RA--G |
| 492 | 7 | 1.50 | 0.4 | 0.40 | C3--B | GB--B | ET--E | RA--G |
| 493 | 7 | 1.50 | 0.4 | 0.70 | GB--B | C3--D | ET--F | RA--G |
| 494 | 7 | 1.50 | 0.4 | 0.85 | GB--B | C3--D | ET--F | RA--G |
| 495 | 7 | 1.50 | 0.4 | 1.00 | GB--A | C3--D | ET--F | RA--G |
| 496 | 7 | 1.50 | 0.2 | 0.00 | C3--A | GB--C | ET--E | RA--F |
| 497 | 7 | 1.50 | 0.2 | 0.40 | GB--B | C3--B | ET--F | RA--G |
| 498 | 7 | 1.50 | 0.2 | 0.70 | GB--B | C3--D | ET--G | RA--G |
| 499 | 7 | 1.50 | 0.2 | 0.85 | GB--B | C3--E | RA--G | ET--G |
| 500 | 7 | 1.50 | 0.2 | 1.00 | GB--A | C3--E | RA--G | ET--G |
| 501 | 7 | 2.00 | 1.0 | 0.00 | GB--A | C3--B | ET--D | RA--F |
| 502 | 7 | 2.00 | 1.0 | 0.40 | GB--A | C3--C | ET--D | RA--F |
| 503 | 7 | 2.00 | 1.0 | 0.70 | GB--A | C3--C | ET--D | RA--G |
| 504 | 7 | 2.00 | 1.0 | 0.85 | GB--A | C3--C | ET--D | RA--G |
| 505 | 7 | 2.00 | 1.0 | 1.00 | GB--A | C3--C | ET--D | RA--G |
| 506 | 7 | 2.00 | 0.8 | 0.00 | GB--A | C3--B | ET--D | RA--F |
| 507 | 7 | 2.00 | 0.8 | 0.40 | GB--A | C3--C | ET--D | RA--F |
| 508 | 7 | 2.00 | 0.8 | 0.70 | GB--A | C3--C | ET--E | RA--G |
| 509 | 7 | 2.00 | 0.8 | 0.85 | GB--A | C3--C | ET--E | RA--G |
| 510 | 7 | 2.00 | 0.8 | 1.00 | GB--A | C3--C | ET--E | RA--G |
| 511 | 7 | 2.00 | 0.6 | 0.00 | GB--A | C3--B | ET--D | RA--F |
| 512 | 7 | 2.00 | 0.6 | 0.40 | GB--A | C3--C | ET--E | RA--F |
| 513 | 7 | 2.00 | 0.6 | 0.70 | GB--A | C3--C | ET--E | RA--G |
| 514 | 7 | 2.00 | 0.6 | 0.85 | GB--B | C3--D | ET--E | RA--G |
| 515 | 7 | 2.00 | 0.6 | 1.00 | GB--B | C3--D | ET--E | RA--G |
| 516 | 7 | 2.00 | 0.4 | 0.00 | GB--A | C3--B | ET--E | RA--F |
| 517 | 7 | 2.00 | 0.4 | 0.40 | GB--A | C3--C | ET--E | RA--G |
| 518 | 7 | 2.00 | 0.4 | 0.70 | GB--A | C3--D | ET--E | RA--G |
| 519 | 7 | 2.00 | 0.4 | 0.85 | GB--A | C3--D | ET--F | RA--G |
| 520 | 7 | 2.00 | 0.4 | 1.00 | GB--C | C3--D | ET--F | RA--G |

| TP | SS | Bias | Ell | Corr | 1ST | 2ND | 3RD | 4TH |
|---|---|---|---|---|---|---|---|---|
| 521 | 7 | 2.00 | 0.2 | 0.00 | GB--A | C3--C | ET--E | RA--F |
| 522 | 7 | 2.00 | 0.2 | 0.40 | GB--A | C3--C | ET--E | RA--G |
| 523 | 7 | 2.00 | 0.2 | 0.70 | GB--B | C3--D | ET--F | RA--G |
| 524 | 7 | 2.00 | 0.2 | 0.85 | GB--A | C3--E | ET--F | RA--G |
| 525 | 7 | 2.00 | 0.2 | 1.00 | GB--C | C3--E | ET--F | RA--G |
| 526 | 10 | 0.00 | 1.0 | 0.00 | C3--A | RA--A | GB--B | ET--E |
| 527 | 10 | 0.00 | 1.0 | 0.40 | C3--A | RA--A | GB--B | ET--E |
| 528 | 10 | 0.00 | 1.0 | 0.70 | C3--A | RA--A | GB--B | ET--E |
| 529 | 10 | 0.00 | 1.0 | 0.85 | C3--A | RA--A | GB--B | ET--E |
| 530 | 10 | 0.00 | 1.0 | 1.00 | C3--A | RA--A | GB--B | ET--E |
| 531 | 10 | 0.00 | 0.8 | 0.00 | C3--A | GB--A | RA--A | ET--E |
| 532 | 10 | 0.00 | 0.8 | 0.40 | C3--A | GB--A | RA--A | ET--E |
| 533 | 10 | 0.00 | 0.8 | 0.70 | C3--A | GB--A | RA--A | ET--E |
| 534 | 10 | 0.00 | 0.8 | 0.85 | C3--A | GB--A | RA--A | ET--E |
| 535 | 10 | 0.00 | 0.8 | 1.00 | C3--A | RA--A | GB--B | ET--E |
| 536 | 10 | 0.00 | 0.6 | 0.00 | C3--B | RA--B | GB--C | ET--E |
| 537 | 10 | 0.00 | 0.6 | 0.40 | C3--A | RA--A | GB--B | ET--E |
| 538 | 10 | 0.00 | 0.6 | 0.70 | C3--A | GB--A | RA--A | ET--F |
| 539 | 10 | 0.00 | 0.6 | 0.85 | GB--A | C3--A | RA--A | ET--F |
| 540 | 10 | 0.00 | 0.6 | 1.00 | C3--A | RA--A | GB--A | ET--F |
| 541 | 10 | 0.00 | 0.4 | 0.00 | RA--B | C3--C | ET--E | GB--E |
| 542 | 10 | 0.00 | 0.4 | 0.40 | C3--B | RA--B | GB--C | ET--E |
| 543 | 10 | 0.00 | 0.4 | 0.70 | C3--A | RA--A | GB--B | ET--F |
| 544 | 10 | 0.00 | 0.4 | 0.85 | RA--A | GB--A | C3--B | ET--F |
| 545 | 10 | 0.00 | 0.4 | 1.00 | GB--A | RA--A | C3--B | ET--F |
| 546 | 10 | 0.00 | 0.2 | 0.00 | RA--A | ET--D | C3--E | GB--G |
| 547 | 10 | 0.00 | 0.2 | 0.40 | RA--B | C3--B | GB--E | ET--F |
| 548 | 10 | 0.00 | 0.2 | 0.70 | RA--A | C3--B | GB--B | ET--G |
| 549 | 10 | 0.00 | 0.2 | 0.85 | RA--A | GB--B | C3--C | ET--G |
| 550 | 10 | 0.00 | 0.2 | 1.00 | RA--A | GB--A | C3--C | ET--G |
| 551 | 10 | 0.25 | 1.0 | 0.00 | C3--A | GB--B | RA--B | ET--E |
| 552 | 10 | 0.25 | 1.0 | 0.40 | C3--A | GB--B | RA--B | ET--E |
| 553 | 10 | 0.25 | 1.0 | 0.70 | C3--A | RA--B | GB--B | ET--E |
| 554 | 10 | 0.25 | 1.0 | 0.85 | C3--A | GB--B | RA--B | ET--E |
| 555 | 10 | 0.25 | 1.0 | 1.00 | C3--A | GB--B | RA--B | ET--E |
| 556 | 10 | 0.25 | 0.8 | 0.00 | C3--A | GB--A | RA--B | ET--E |
| 557 | 10 | 0.25 | 0.8 | 0.40 | C3--A | GB--A | RA--B | ET--E |
| 558 | 10 | 0.25 | 0.8 | 0.70 | GB--A | C3--A | RA--B | ET--E |
| 559 | 10 | 0.25 | 0.8 | 0.85 | GB--A | C3--A | RA--B | ET--E |
| 560 | 10 | 0.25 | 0.8 | 1.00 | C3--A | GB--A | RA--B | ET--E |

| TP | SS | Bias | Ell | Corr | 1ST | 2ND | 3RD | 4TH |
|---|---|---|---|---|---|---|---|---|
| 561 | 10 | 0.25 | 0.6 | 0.00 | C3--B | RA--B | GB--C | ET--E |
| 562 | 10 | 0.25 | 0.6 | 0.40 | C3--A | RA--B | GB--C | ET--E |
| 563 | 10 | 0.25 | 0.6 | 0.70 | C3--A | GB--B | RA--B | ET--E |
| 564 | 10 | 0.25 | 0.6 | 0.85 | GB--A | C3--A | RA--B | ET--F |
| 565 | 10 | 0.25 | 0.6 | 1.00 | GB--A | C3--A | RA--B | ET--F |
| 566 | 10 | 0.25 | 0.4 | 0.00 | RA--C | C3--C | ET--D | GB--E |
| 567 | 10 | 0.25 | 0.4 | 0.40 | C3--B | RA--C | GB--D | ET--E |
| 568 | 10 | 0.25 | 0.4 | 0.70 | C3--A | RA--B | GB--C | ET--F |
| 569 | 10 | 0.25 | 0.4 | 0.85 | C3--B | GB--B | RA--B | ET--F |
| 570 | 10 | 0.25 | 0.4 | 1.00 | GB--A | C3--B | RA--B | ET--F |
| 571 | 10 | 0.25 | 0.2 | 0.00 | RA--C | ET--D | C3--E | GB--G |
| 572 | 10 | 0.25 | 0.2 | 0.40 | C3--B | RA--C | GB--E | ET--F |
| 573 | 10 | 0.25 | 0.2 | 0.70 | C3--B | RA--B | GB--C | ET--G |
| 574 | 10 | 0.25 | 0.2 | 0.85 | RA--B | GB--C | C3--C | ET--G |
| 575 | 10 | 0.25 | 0.2 | 1.00 | GB--B | RA--B | C3--C | ET--G |
| 576 | 10 | 0.50 | 1.0 | 0.00 | C3--A | GB--A | RA--C | ET--E |
| 577 | 10 | 0.50 | 1.0 | 0.40 | C3--A | GB--A | RA--C | ET--E |
| 573 | 10 | 0.50 | 1.0 | 0.70 | C3--A | GB--A | RA--C | ET--E |
| 579 | 10 | 0.50 | 1.0 | 0.85 | C3--A | GB--A | RA--C | ET--E |
| 580 | 10 | 0.50 | 1.0 | 1.00 | GB--A | C3--A | RA--C | ET--E |
| 581 | 10 | 0.50 | 0.8 | 0.00 | C3--A | GB--B | RA--D | ET--E |
| 582 | 10 | 0.50 | 0.8 | 0.40 | C3--A | GB--B | RA--D | ET--E |
| 583 | 10 | 0.50 | 0.8 | 0.70 | C3--A | GB--B | RA--D | ET--E |
| 584 | 10 | 0.50 | 0.8 | 0.85 | C3--A | GB--A | RA--D | ET--E |
| 585 | 10 | 0.50 | 0.8 | 1.00 | C3--A | GB--A | RA--D | ET--E |
| 586 | 10 | 0.50 | 0.6 | 0.00 | C3--B | GB--D | RA--E | ET--E |
| 587 | 10 | 0.50 | 0.6 | 0.40 | C3--A | GB--C | RA--D | ET--E |
| 588 | 10 | 0.50 | 0.6 | 0.70 | C3--A | GB--C | RA--D | ET--F |
| 589 | 10 | 0.50 | 0.6 | 0.85 | C3--A | GB--B | RA--D | ET--F |
| 590 | 10 | 0.50 | 0.6 | 1.00 | GB--A | C3--A | RA--D | ET--F |
| 591 | 10 | 0.50 | 0.4 | 0.00 | C3--C | ET--D | RA--E | GB--F |
| 592 | 10 | 0.50 | 0.4 | 0.40 | C3--B | GB--D | RA--E | ET--E |
| 593 | 10 | 0.50 | 0.4 | 0.70 | C3--B | GB--C | RA--D | ET--F |
| 594 | 10 | 0.50 | 0.4 | 0.85 | C3--B | GB--C | RA--D | ET--F |
| 595 | 10 | 0.50 | 0.4 | 1.00 | GB--B | C3--B | RA--D | ET--F |
| 596 | 10 | 0.50 | 0.2 | 0.00 | C3--E | ET--E | RA--E | GB--G |
| 597 | 10 | 0.50 | 0.2 | 0.40 | C3--B | GB--E | RA--E | ET--F |
| 598 | 10 | 0.50 | 0.2 | 0.70 | C3--B | GB--D | RA--E | ET--G |
| 599 | 10 | 0.50 | 0.2 | 0.85 | GB--C | C3--C | RA--D | ET--G |
| 600 | 10 | 0.50 | 0.2 | 1.00 | GB--C | C3--D | RA--D | ET--G |

| TP | SS | Bias | Ell | Corr | 1ST | 2ND | 3RD | 4TH |
|---|---|---|---|---|---|---|---|---|
| 601 | 10 | 0.75 | 1.0 | 0.00 | GB--A | C3--A | RA--E | ET--E |
| 602 | 10 | 0.75 | 1.0 | 0.40 | C3--A | GB--A | RA--E | ET--E |
| 603 | 10 | 0.75 | 1.0 | 0.70 | C3--A | GB--B | RA--E | ET--E |
| 604 | 10 | 0.75 | 1.0 | 0.85 | C3--A | GB--B | RA--E | ET--E |
| 605 | 10 | 0.75 | 1.0 | 1.00 | C3--A | GB--B | RA--E | ET--E |
| 606 | 10 | 0.75 | 0.8 | 0.00 | C3--A | GB--B | RA--E | ET--E |
| 607 | 10 | 0.75 | 0.8 | 0.40 | C3--A | GB--B | RA--E | ET--E |
| 608 | 10 | 0.75 | 0.8 | 0.70 | C3--A | GB--C | RA--E | ET--F |
| 609 | 10 | 0.75 | 0.8 | 0.85 | C3--A | GB--C | RA--E | ET--F |
| 610 | 10 | 0.75 | 0.8 | 1.00 | C3--A | GB--B | RA--E | ET--F |
| 611 | 10 | 0.75 | 0.6 | 0.00 | C3--B | GB--D | ET--E | RA--F |
| 612 | 10 | 0.75 | 0.6 | 0.40 | C3--A | GB--D | RA--E | ET--F |
| 613 | 10 | 0.75 | 0.6 | 0.70 | C3--A | GB--C | RA--E | ET--F |
| 614 | 10 | 0.75 | 0.6 | 0.85 | C3--B | GB--C | RA--E | ET--F |
| 615 | 10 | 0.75 | 0.6 | 1.00 | C3--B | GB--C | RA--E | ET--F |
| 616 | 10 | 0.75 | 0.4 | 0.00 | C3--C | ET--E | GB--F | RA--F |
| 617 | 10 | 0.75 | 0.4 | 0.40 | C3--A | GB--D | ET--F | RA--F |
| 618 | 10 | 0.75 | 0.4 | 0.70 | C3--B | GB--D | RA--E | ET--G |
| 619 | 10 | 0.75 | 0.4 | 0.85 | C3--C | GB--D | RA--E | ET--G |
| 620 | 10 | 0.75 | 0.4 | 1.00 | C3--C | GB--C | RA--E | ET--G |
| 621 | 10 | 0.75 | 0.2 | 0.00 | C3--D | ET--E | RA--F | GB--G |
| 622 | 10 | 0.75 | 0.2 | 0.40 | C3--A | GB--E | ET--F | RA--F |
| 623 | 10 | 0.75 | 0.2 | 0.70 | C3--C | GB--D | RA--F | ET--G |
| 624 | 10 | 0.75 | 0.2 | 0.85 | C3--D | GB--D | RA--F | ET--G |
| 625 | 10 | 0.75 | 0.2 | 1.00 | GB--D | C3--D | RA--E | ET--G |
| 626 | 10 | 1.00 | 1.0 | 0.00 | GB--A | C3--A | RA--E | ET--F |
| 627 | 10 | 1.00 | 1.0 | 0.40 | C3--A | GB--B | RA--E | ET--F |
| 628 | 10 | 1.00 | 1.0 | 0.70 | C3--A | GB--C | RA--E | ET--F |
| 629 | 10 | 1.00 | 1.0 | 0.85 | C3--A | GB--C | RA--E | ET--F |
| 630 | 10 | 1.00 | 1.0 | 1.00 | C3--A | GB--C | RA--E | ET--F |
| 631 | 10 | 1.00 | 0.8 | 0.00 | C3--A | GB--B | ET--E | RA--F |
| 632 | 10 | 1.00 | 0.8 | 0.40 | C3--A | GB--C | ET--F | RA--F |
| 633 | 10 | 1.00 | 0.8 | 0.70 | C3--B | GB--C | RA--F | ET--F |
| 634 | 10 | 1.00 | 0.8 | 0.85 | C3--B | GB--C | RA--F | ET--F |
| 635 | 10 | 1.00 | 0.8 | 1.00 | C3--B | GB--C | RA--F | ET--F |
| 636 | 10 | 1.00 | 0.6 | 0.00 | C3--A | GB--C | ET--E | RA--F |
| 637 | 10 | 1.00 | 0.6 | 0.40 | C3--A | GB--C | ET--F | RA--F |
| 638 | 10 | 1.00 | 0.6 | 0.70 | C3--B | GB--D | RA--F | ET--F |
| 639 | 10 | 1.00 | 0.6 | 0.85 | C3--B | GB--D | RA--F | ET--F |
| 640 | 10 | 1.00 | 0.6 | 1.00 | C3--C | GB--C | RA--F | ET--F |

| TP | SS | Bias | Ell | Corr | 1ST | 2ND | 3RD | 4TH |
|---|---|---|---|---|---|---|---|---|
| 641 | 10 | 1.00 | 0.4 | 0.00 | C3--B | GB--E | ET--E | RA--G |
| 642 | 10 | 1.00 | 0.4 | 0.40 | C3--A | GB--D | ET--F | RA--G |
| 643 | 10 | 1.00 | 0.4 | 0.70 | C3--C | GB--D | RA--F | ET--G |
| 644 | 10 | 1.00 | 0.4 | 0.85 | C3--C | GB--D | RA--F | ET--G |
| 645 | 10 | 1.00 | 0.4 | 1.00 | GB--C | C3--D | RA--F | ET--G |
| 646 | 10 | 1.00 | 0.2 | 0.00 | C3--C | ET--F | GB--F | RA--G |
| 647 | 10 | 1.00 | 0.2 | 0.40 | C3--A | GB--D | ET--G | RA--G |
| 648 | 10 | 1.00 | 0.2 | 0.70 | C3--C | GB--D | RA--F | ET--G |
| 649 | 10 | 1.00 | 0.2 | 0.85 | GB--D | C3--D | RA--F | ET--G |
| 650 | 10 | 1.00 | 0.2 | 1.00 | GB--D | C3--E | RA--F | ET--G |
| 651 | 10 | 1.50 | 1.0 | 0.00 | GB--A | C3--B | ET--F | RA--F |
| 652 | 10 | 1.50 | 1.0 | 0.40 | C3--B | GB--B | ET--F | RA--F |
| 653 | 10 | 1.50 | 1.0 | 0.70 | C3--B | GB--C | ET--F | RA--F |
| 654 | 10 | 1.50 | 1.0 | 0.85 | C3--B | GB--C | ET--F | RA--F |
| 655 | 10 | 1.50 | 1.0 | 1.00 | C3--B | GB--C | ET--F | RA--F |
| 656 | 10 | 1.50 | 0.8 | 0.00 | GB--A | C3--B | ET--F | RA--F |
| 657 | 10 | 1.50 | 0.8 | 0.40 | C3--B | GB--B | ET--F | RA--F |
| 658 | 10 | 1.50 | 0.8 | 0.70 | C3--B | GB--C | ET--F | RA--F |
| 659 | 10 | 1.50 | 0.8 | 0.85 | C3--C | GB--C | ET--F | RA--F |
| 660 | 10 | 1.50 | 0.8 | 1.00 | C3--C | GB--C | ET--F | RA--F |
| 661 | 10 | 1.50 | 0.6 | 0.00 | C3--A | GB--A | ET--F | RA--F |
| 662 | 10 | 1.50 | 0.6 | 0.40 | C3--B | GB--B | ET--F | RA--G |
| 663 | 10 | 1.50 | 0.6 | 0.70 | GB--B | C3--C | ET--G | RA--G |
| 664 | 10 | 1.50 | 0.6 | 0.85 | GB--B | C3--C | RA--G | ET--G |
| 665 | 10 | 1.50 | 0.6 | 1.00 | GB--B | C3--C | RA--G | ET--G |
| 666 | 10 | 1.50 | 0.4 | 0.00 | C3--A | GB--B | ET--F | RA--G |
| 667 | 10 | 1.50 | 0.4 | 0.40 | C3--B | GB--B | ET--F | RA--G |
| 668 | 10 | 1.50 | 0.4 | 0.70 | GB--C | C3--D | RA--G | ET--G |
| 669 | 10 | 1.50 | 0.4 | 0.85 | GB--B | C3--D | RA--G | ET--G |
| 670 | 10 | 1.50 | 0.4 | 1.00 | GB--A | C3--D | RA--G | ET--G |
| 671 | 10 | 1.50 | 0.2 | 0.00 | C3--A | GB--B | RA--F | ET--G |
| 672 | 10 | 1.50 | 0.2 | 0.40 | GB--B | C3--B | RA--G | ET--G |
| 673 | 10 | 1.50 | 0.2 | 0.70 | GB--B | C3--D | RA--G | ET--G |
| 674 | 10 | 1.50 | 0.2 | 0.85 | GB--C | C3--E | RA--G | ET--G |
| 675 | 10 | 1.50 | 0.2 | 1.00 | GB--B | C3--E | RA--G | ET--G |
| 676 | 10 | 2.00 | 1.0 | 0.00 | GB--A | C3--B | ET--E | RA--F |
| 677 | 10 | 2.00 | 1.0 | 0.40 | GB--A | C3--C | ET--E | RA--F |
| 678 | 10 | 2.00 | 1.0 | 0.70 | GB--A | C3--C | ET--E | RA--G |
| 679 | 10 | 2.00 | 1.0 | 0.85 | GB--A | C3--C | ET--E | RA--G |
| 680 | 10 | 2.00 | 1.0 | 1.00 | GB--A | C3--C | ET--E | RA--G |

| TP | SS | Bias | Ell | Corr | 1ST | 2ND | 3RD | 4TH |
|---|---|---|---|---|---|---|---|---|
| 681 | 10 | 2.00 | 0.8 | 0.00 | GB--A | C3--B | ET--E | RA--F |
| 682 | 10 | 2.00 | 0.8 | 0.40 | GB--A | C3--C | ET--F | RA--F |
| 683 | 10 | 2.00 | 0.8 | 0.70 | GB--A | C3--C | ET--F | RA--G |
| 684 | 10 | 2.00 | 0.8 | 0.85 | GB--A | C3--C | ET--F | RA--G |
| 685 | 10 | 2.00 | 0.8 | 1.00 | GB--A | C3--C | ET--F | RA--G |
| 686 | 10 | 2.00 | 0.6 | 0.00 | GB--A | C3--B | ET--F | RA--F |
| 687 | 10 | 2.00 | 0.6 | 0.40 | GB--A | C3--C | ET--F | RA--F |
| 688 | 10 | 2.00 | 0.6 | 0.70 | GB--A | C3--C | ET--F | RA--G |
| 689 | 10 | 2.00 | 0.6 | 0.85 | GB--A | C3--D | ET--F | RA--G |
| 690 | 10 | 2.00 | 0.6 | 1.00 | GB--B | C3--C | ET--F | RA--G |
| 691 | 10 | 2.00 | 0.4 | 0.00 | GB--A | C3--B | RA--F | ET--F |
| 692 | 10 | 2.00 | 0.4 | 0.40 | GB--A | C3--C | ET--F | RA--G |
| 693 | 10 | 2.00 | 0.4 | 0.70 | GB--A | C3--D | ET--G | RA--G |
| 694 | 10 | 2.00 | 0.4 | 0.85 | GB--A | C3--D | ET--G | RA--G |
| 695 | 10 | 2.00 | 0.4 | 1.00 | GB--C | C3--D | ET--G | RA--G |
| 696 | 10 | 2.00 | 0.2 | 0.00 | GB--A | C3--C | RA--F | ET--G |
| 697 | 10 | 2.00 | 0.2 | 0.40 | GB--A | C3--C | RA--G | ET--G |
| 698 | 10 | 2.00 | 0.2 | 0.70 | GB--B | C3--D | RA--G | ET--G |
| 699 | 10 | 2.00 | 0.2 | 0.85 | GB--B | C3--E | RA--G | ET--G |
| 700 | 10 | 2.00 | 0.2 | 1.00 | GB--B | C3--E | RA--G | ET--G |
| 701 | 15 | 0.00 | 1.0 | 0.00 | C3--A | RA--A | GB--C | ET--F |
| 702 | 15 | 0.00 | 1.0 | 0.40 | C3--A | RA--A | GB--B | ET--F |
| 703 | 15 | 0.00 | 1.0 | 0.70 | C3--A | RA--A | GB--C | ET--F |
| 704 | 15 | 0.00 | 1.0 | 0.85 | C3--A | RA--A | GB--B | ET--F |
| 705 | 15 | 0.00 | 1.0 | 1.00 | C3--A | RA--A | GB--C | ET--F |
| 706 | 15 | 0.00 | 0.8 | 0.00 | C3--A | GB--A | RA--A | ET--F |
| 707 | 15 | 0.00 | 0.8 | 0.40 | C3--A | GB--A | RA--A | ET--F |
| 708 | 15 | 0.00 | 0.8 | 0.70 | C3--A | RA--A | GB--A | ET--F |
| 709 | 15 | 0.00 | 0.8 | 0.85 | C3--A | RA--A | GB--B | ET--F |
| 710 | 15 | 0.00 | 0.8 | 1.00 | C3--A | RA--A | GB--B | ET--F |
| 711 | 15 | 0.00 | 0.6 | 0.00 | RA--A | C3--B | GB--B | ET--F |
| 712 | 15 | 0.00 | 0.6 | 0.40 | C3--A | RA--A | GB--B | ET--F |
| 713 | 15 | 0.00 | 0.6 | 0.70 | C3--A | GB--A | RA--A | ET--F |
| 714 | 15 | 0.00 | 0.6 | 0.85 | GB--A | RA--A | C3--A | ET--F |
| 715 | 15 | 0.00 | 0.6 | 1.00 | RA--A | C3--A | GB--B | ET--F |
| 716 | 15 | 0.00 | 0.4 | 0.00 | RA--B | C3--C | GB--D | ET--E |
| 717 | 15 | 0.00 | 0.4 | 0.40 | RA--A | C3--B | GB--C | ET--F |
| 718 | 15 | 0.00 | 0.4 | 0.70 | RA--A | C3--A | GB--B | ET--F |
| 719 | 15 | 0.00 | 0.4 | 0.85 | RA--A | GB--A | C3--B | ET--G |
| 720 | 15 | 0.00 | 0.4 | 1.00 | RA--A | GB--A | C3--B | ET--G |

| TP | SS | Bias | Ell | Corr | 1ST | 2ND | 3RD | 4TH |
|---|---|---|---|---|---|---|---|---|
| 721 | 15 | 0.00 | 0.2 | 0.00 | RA--A | C3--E | ET--E | GB--G |
| 722 | 15 | 0.00 | 0.2 | 0.40 | RA--B | C3--B | GB--D | ET--F |
| 723 | 15 | 0.00 | 0.2 | 0.70 | RA--A | GB--A | C3--B | ET--G |
| 724 | 15 | 0.00 | 0.2 | 0.85 | RA--A | GB--B | C3--C | ET--G |
| 725 | 15 | 0.00 | 0.2 | 1.00 | RA--A | GB--A | C3--C | ET--G |
| 726 | 15 | 0.25 | 1.0 | 0.00 | C3--A | RA--B | GB--C | ET--F |
| 727 | 15 | 0.25 | 1.0 | 0.40 | C3--A | RA--A | GB--B | ET--F |
| 728 | 15 | 0.25 | 1.0 | 0.70 | C3--A | RA--A | GB--B | ET--F |
| 729 | 15 | 0.25 | 1.0 | 0.85 | C3--A | RA--A | GB--B | ET--F |
| 730 | 15 | 0.25 | 1.0 | 1.00 | C3--A | RA--A | GB--B | ET--F |
| 731 | 15 | 0.25 | 0.8 | 0.00 | C3--A | GB--A | RA--B | ET--F |
| 732 | 15 | 0.25 | 0.8 | 0.40 | C3--A | GB--A | RA--B | ET--F |
| 733 | 15 | 0.25 | 0.8 | 0.70 | C3--A | GB--A | RA--B | ET--F |
| 734 | 15 | 0.25 | 0.8 | 0.85 | C3--A | GB--A | RA--B | ET--F |
| 735 | 15 | 0.25 | 0.8 | 1.00 | C3--A | GB--A | RA--B | ET--F |
| 736 | 15 | 0.25 | 0.6 | 0.00 | C3--B | RA--B | GB--B | ET--F |
| 737 | 15 | 0.25 | 0.6 | 0.40 | C3--A | RA--B | GB--B | ET--F |
| 738 | 15 | 0.25 | 0.6 | 0.70 | C3--A | GB--B | RA--B | ET--F |
| 739 | 15 | 0.25 | 0.6 | 0.85 | C3--A | GB--A | RA--B | ET--F |
| 740 | 15 | 0.25 | 0.6 | 1.00 | GB--A | C3--A | RA--B | ET--F |
| 741 | 15 | 0.25 | 0.4 | 0.00 | RA--C | C3--C | GB--E | ET--E |
| 742 | 15 | 0.25 | 0.4 | 0.40 | C3--B | RA--B | GB--C | ET--F |
| 743 | 15 | 0.25 | 0.4 | 0.70 | C3--A | RA--B | GB--B | ET--G |
| 744 | 15 | 0.25 | 0.4 | 0.85 | GB--B | C3--B | RA--B | ET--G |
| 745 | 15 | 0.25 | 0.4 | 1.00 | GB--A | RA--B | C3--B | ET--G |
| 746 | 15 | 0.25 | 0.2 | 0.00 | RA--B | C3--E | ET--E | GB--G |
| 747 | 15 | 0.25 | 0.2 | 0.40 | C3--B | RA--C | GB--D | ET--F |
| 748 | 15 | 0.25 | 0.2 | 0.70 | RA--B | C3--B | GB--B | ET--G |
| 749 | 15 | 0.25 | 0.2 | 0.85 | RA--B | GB--B | C3--C | ET--G |
| 750 | 15 | 0.25 | 0.2 | 1.00 | GB--B | RA--B | C3--C | ET--G |
| 751 | 15 | 0.50 | 1.0 | 0.00 | C3--A | GB--B | RA--C | ET--F |
| 752 | 15 | 0.50 | 1.0 | 0.40 | C3--A | GB--A | RA--C | ET--F |
| 753 | 15 | 0.50 | 1.0 | 0.70 | C3--A | GB--A | RA--C | ET--F |
| 754 | 15 | 0.50 | 1.0 | 0.85 | C3--A | GB--A | RA--C | ET--F |
| 755 | 15 | 0.50 | 1.0 | 1.00 | C3--A | GB--A | RA--C | ET--F |
| 756 | 15 | 0.50 | 0.8 | 0.00 | C3--A | GB--A | RA--C | ET--F |
| 757 | 15 | 0.50 | 0.8 | 0.40 | C3--A | GB--B | RA--C | ET--F |
| 758 | 15 | 0.50 | 0.8 | 0.70 | C3--A | GB--B | RA--C | ET--F |
| 759 | 15 | 0.50 | 0.8 | 0.85 | C3--A | GB--A | RA--C | ET--F |
| 760 | 15 | 0.50 | 0.8 | 1.00 | C3--A | GB--A | RA--C | ET--F |

| TP | SS | Bias | Ell | Corr | 1ST | 2ND | 3RD | 4TH |
|---|---|---|---|---|---|---|---|---|
| 761 | 15 | 0.50 | 0.6 | 0.00 | C3--B | GB--C | RA--D | ET--F |
| 762 | 15 | 0.50 | 0.6 | 0.40 | C3--A | GB--C | RA--D | ET--F |
| 763 | 15 | 0.50 | 0.6 | 0.70 | C3--A | GB--C | RA--D | ET--F |
| 764 | 15 | 0.50 | 0.6 | 0.85 | C3--A | GB--B | RA--D | ET--F |
| 765 | 15 | 0.50 | 0.6 | 1.00 | C3--A | GB--B | RA--D | ET--G |
| 766 | 15 | 0.50 | 0.4 | 0.00 | C3--C | ET--E | RA--E | GB--F |
| 767 | 15 | 0.50 | 0.4 | 0.40 | C3--B | GB--C | RA--E | ET--F |
| 768 | 15 | 0.50 | 0.4 | 0.70 | C3--B | GB--C | RA--D | ET--G |
| 769 | 15 | 0.50 | 0.4 | 0.85 | C3--B | GB--C | RA--D | ET--G |
| 770 | 15 | 0.50 | 0.4 | 1.00 | GB--B | C3--B | RA--D | ET--G |
| 771 | 15 | 0.50 | 0.2 | 0.00 | C3--E | RA--E | ET--E | GB--G |
| 772 | 15 | 0.50 | 0.2 | 0.40 | C3--B | GB--E | RA--E | ET--F |
| 773 | 15 | 0.50 | 0.2 | 0.70 | C3--B | GB--D | RA--E | ET--G |
| 774 | 15 | 0.50 | 0.2 | 0.85 | GB--C | C3--C | RA--D | ET--G |
| 775 | 15 | 0.50 | 0.2 | 1.00 | GB--C | C3--D | RA--D | ET--G |
| 776 | 15 | 0.75 | 1.0 | 0.00 | GB--A | C3--A | RA--E | ET--F |
| 777 | 15 | 0.75 | 1.0 | 0.40 | C3--A | GB--A | RA--E | ET--F |
| 778 | 15 | 0.75 | 1.0 | 0.70 | C3--A | GB--B | RA--E | ET--F |
| 779 | 15 | 0.75 | 1.0 | 0.85 | C3--A | GB--B | RA--E | ET--F |
| 780 | 15 | 0.75 | 1.0 | 1.00 | C3--A | GB--B | RA--E | ET--F |
| 781 | 15 | 0.75 | 0.8 | 0.00 | C3--A | GB--B | RA--E | ET--F |
| 782 | 15 | 0.75 | 0.8 | 0.40 | C3--A | GB--B | RA--E | ET--F |
| 783 | 15 | 0.75 | 0.8 | 0.70 | C3--A | GB--C | RA--E | ET--F |
| 784 | 15 | 0.75 | 0.8 | 0.85 | C3--A | GB--B | RA--E | ET--F |
| 785 | 15 | 0.75 | 0.8 | 1.00 | C3--A | GB--C | RA--E | ET--F |
| 786 | 15 | 0.75 | 0.6 | 0.00 | C3--B | GB--C | RA--F | ET--F |
| 787 | 15 | 0.75 | 0.6 | 0.40 | C3--A | GB--C | RA--E | ET--F |
| 788 | 15 | 0.75 | 0.6 | 0.70 | C3--A | GB--C | RA--E | ET--G |
| 789 | 15 | 0.75 | 0.6 | 0.85 | C3--B | GB--C | RA--E | ET--G |
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| 794 | 15 | 0.75 | 0.4 | 0.85 | C3--C | GB--C | RA--E | ET--G |
| 795 | 15 | 0.75 | 0.4 | 1.00 | C3--C | GB--C | RA--E | ET--G |
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| 797 | 15 | 0.75 | 0.2 | 0.40 | C3--A | GB--E | RA--F | ET--G |
| 798 | 15 | 0.75 | 0.2 | 0.70 | C3--C | GB--D | RA--F | ET--G |
| 799 | 15 | 0.75 | 0.2 | 0.85 | GB--D | C3--D | RA--E | ET--G |
| 800 | 15 | 0.75 | 0.2 | 1.00 | GB--C | C3--D | RA--E | ET--G |

| TP | SS | Bias | Ell | Corr | 1ST | 2ND | 3RD | 4TH |
|---|---|---|---|---|---|---|---|---|
| 801 | 15 | 1.00 | 1.0 | 0.00 | GB--A | C3--A | RA--E | ET--F |
| 802 | 15 | 1.00 | 1.0 | 0.40 | C3--A | GB--B | RA--E | ET--F |
| 803 | 15 | 1.00 | 1.0 | 0.70 | C3--A | GB--C | RA--E | ET--F |
| 804 | 15 | 1.00 | 1.0 | 0.85 | C3--A | GB--C | RA--E | ET--F |
| 805 | 15 | 1.00 | 1.0 | 1.00 | C3--A | GB--C | RA--E | ET--F |
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| 807 | 15 | 1.00 | 0.8 | 0.4 | C3--A | GB--C | RA--F | ET--F |
| 808 | 15 | 1.00 | 0.8 | 0.70 | C3--B | GB--C | RA--F | ET--F |
| 809 | 15 | 1.00 | 0.8 | 0.85 | C3--B | GB--C | RA--F | ET--F |
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| 812 | 15 | 1.00 | 0.6 | 0.40 | C3--A | GB--C | RA--F | ET--F |
| 813 | 15 | 1.00 | 0.6 | 0.70 | C3--B | GB--D | RA--F | ET--G |
| 814 | 15 | 1.00 | 0.6 | 0.85 | C3--B | GB--D | RA--F | ET--G |
| 815 | 15 | 1.00 | 0.6 | 1.00 | C3--C | GB--D | RA--F | ET--G |
| 816 | 15 | 1.00 | 0.4 | 0.00 | C3--B | GB--E | ET--F | RA--G |
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| 823 | 15 | 1.00 | 0.2 | 0.70 | C3--C | GB--D | RA--F | ET--G |
| 824 | 15 | 1.00 | 0.2 | 0.85 | GB--D | C3--D | RA--F | ET--G |
| 825 | 15 | 1.00 | 0.2 | 1.00 | GB--D | C3--E | RA--F | ET--G |
| 826 | [illegible] | 1.50 | 1.0 | 0.00 | GB--A | C3--B | RA--F | ET--F |
| 827 | 15 | 1.50 | 1.0 | 0.40 | C3--B | GB--B | RA--F | ET--F |
| 828 | 15 | 1.50 | 1.0 | 0.70 | C3--B | GB--C | RA--F | ET--F |
| 829 | 15 | 1.50 | 1.0 | 0.85 | C3--B | GB--C | RA--F | ET--F |
| 830 | 15 | 1.50 | 1.0 | 1.00 | C3--B | GB--D | RA--F | ET--F |
| 831 | 15 | 1.50 | 0.8 | 0.00 | GB--A | C3--B | RA--F | ET--F |
| 832 | 15 | 1.50 | 0.8 | 0.40 | C3--B | GB--B | RA--F | ET--G |
| 833 | 15 | 1.50 | 0.8 | 0.70 | C3--B | GB--C | RA--F | ET--G |
| 834 | 15 | 1.50 | 0.8 | 0.85 | C3--C | GB--C | RA--F | ET--G |
| 835 | 15 | 1.50 | 0.8 | 1.00 | C3--C | GB--C | RA--G | ET--G |
| 836 | 15 | 1.50 | 0.6 | 0.00 | GB--A | C3--A | ET--F | RA--F |
| 837 | 15 | 1.50 | 0.6 | 0.40 | C3--B | GB--B | RA--G | ET--G |
| 838 | 15 | 1.50 | 0.6 | 0.70 | GB--C | C3--C | RA--G | ET--G |
| 839 | 15 | 1.50 | 0.6 | 0.85 | GB--C | C3--C | RA--G | ET--G |
| 840 | 15 | 1.50 | 0.6 | 1.00 | GB--C | C3--C | RA--G | ET--G |

| TP | SS | Bias | Ell | Corr | 1ST | 2ND | 3RD | 4TH |
|---|---|---|---|---|---|---|---|---|
| 841 | 15 | 1.50 | 0.4 | 0.00 | C3--A | GB--A | RA--G | ET--G |
| 842 | 15 | 1.50 | 0.4 | 0.40 | GB--B | C3--B | RA--G | ET--G |
| 843 | 15 | 1.50 | 0.4 | 0.70 | GB--C | C3--D | RA--G | ET--G |
| 844 | 15 | 1.50 | 0.4 | 0.85 | GB--C | C3--D | RA--G | ET--G |
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| 847 | 15 | 1.50 | 0.2 | 0.40 | GB--B | C3--B | RA--G | ET--G |
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| 849 | 15 | 1.50 | 0.2 | 0.85 | GB--C | C3--E | RA--G | ET--G |
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| 852 | 15 | 2.00 | 1.0 | 0.40 | GB--B | C3--C | RA--F | ET--F |
| 853 | 15 | 2.00 | 1.0 | 0.70 | GB--B | C3--C | ET--F | RA--G |
| 854 | 15 | 2.00 | 1.0 | 0.85 | GB--B | C3--C | ET--F | RA--G |
| 855 | 15 | 2.00 | 1.0 | 1.00 | GB--B | C3--C | ET--F | RA--G |
| 856 | 15 | 2.00 | 0.8 | 0.00 | GB--A | C3--B | RA--F | ET--F |
| 857 | 15 | 2.00 | 0.8 | 0.40 | GB--B | C3--C | RA--F | ET--F |
| 858 | 15 | 2.00 | 0.8 | 0.70 | GB--B | C3--C | ET--F | RA--G |
| 859 | 15 | 2.00 | 0.8 | 0.85 | GB--A | C3--C | ET--F | RA--G |
| 860 | 15 | 2.00 | 0.8 | 1.00 | GB--A | C3--C | ET--G | RA--G |
| 861 | 15 | 2.00 | 0.6 | 0.00 | GB--A | C3--B | RA--F | ET--F |
| 862 | 15 | 2.00 | 0.6 | 0.40 | GB--A | C3--C | RA--F | ET--G |
| 863 | 15 | 2.00 | 0.6 | 0.70 | GB--B | C3--C | RA--G | ET--G |
| 864 | 15 | 2.00 | 0.6 | 0.85 | GB--A | C3--D | RA--G | ET--G |
| 865 | 15 | 2.00 | 0.6 | 1.00 | GB--A | C3--D | RA--G | ET--G |
| 866 | 15 | 2.00 | 0.4 | 0.00 | GB--A | C3--B | RA--F | ET--G |
| 867 | 15 | 2.00 | 0.4 | 0.40 | GB--A | C3--C | RA--G | ET--G |
| 868 | 15 | 2.00 | 0.4 | 0.70 | GB--B | C3--D | RA--G | ET--G |
| 869 | 15 | 2.00 | 0.4 | 0.85 | GB--A | C3--D | RA--G | ET--G |
| 870 | 15 | 2.00 | 0.4 | 1.00 | GB--B | [illegible] | RA--G | ET--G |
| 871 | 15 | 2.00 | 0.2 | 0.00 | GB--A | [illegible] | RA--F | ET--G |
| 872 | 15 | 2.00 | 0.2 | 0.40 | GB--A | C3--C | RA--G | ET--G |
| 873 | 15 | 2.00 | 0.2 | 0.70 | GB--B | C3--D | RA--G | ET--G |
| 874 | 15 | 2.00 | 0.2 | 0.85 | GB--B | C3--E | RA--G | ET--G |
| 875 | 15 | 2.00 | 0.2 | 1.00 | GB--A | C3--E | RA--G | ET--G |

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## *Vita*

Captain Peter Puhek was born on 18 January 1960 in San Diego, California. He graduated from Millard Preparatory School in Bandon, Oregon in 1979. He attended the United States Air Force Academy and received Bachelor of Science degrees in Management and Operations Research in June, 1983. After graduation, he was assigned to Vandenberg AFB, CA where he worked as a business manager for Vandenberg's Space Shuttle Site Activation Task Force. In 1987, he was transferred to Edwards AFB, CA where he was a data analyst for the B-2 Advanced Technology Bomber Combined Test Force. In August 1990, he entered the Graduate Operations Research Program, School of Engineerng, Air Force Institute of Technology, Wright-Patterson AFB, OH.

Permanent address: 5821 West 75th Street
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Several algebraic CEP estimation models were examined in this study. Each assumes that the crossrange and downrange miss distances of the sample data follow a bivariate normal distribution. The analysis determined the sensitivities of these models to changes in the parameters of sample size, bias, correlation, and ellipticity. The accuracy of each model is expressed in terms of relative error, and the parameter regions in which a certain method dominated as the most accurate were noted. In general, it was found that bias was the most significant parameter in determining the best CEP method. A simple method, based on the Rayleigh distribution, dominated as the best when bias was 0, .25, .5, .75, or 1, and the Grubbs-Patnaik/chi-square method dominated for the bias setting of 2 regardless of the settings of the other parameters. Levels of bias greater than 2 were not addressed.

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