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Economic Quality
of
Manufactured Product

By

W. A. SHEWHART, PH.D.

Member of the Technical Staff

BELL TELEPHONE LABORATORIES, INC.

MACMILLAN AND CO., LIMITED
ST. MARTIN'S STREET, LONDON

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"When numbers are large, chance is the best warrant
for certainty."

A. S. EDDINGTON,
The Nature of the Physical World

"A situation like this merely means that those details
which determine the future in terms of the past may
be so deep in the structure that at present we have
no immediate experimental knowledge of them and
we may for the present be compelled to give a treat-
ment from a statistical point of view based on con-
siderations of probability."

P. W. BRIDGMAN,
The Logic of Modern Physics

PREFACE

Broadly speaking, the object of industry is to set up economic ways and means of satisfying human wants and in so doing to reduce everything possible to routines requiring a minimum amount of human effort. Through the use of the scientific method, extended to take account of modern statistical concepts, it has been found possible to set up limits within which the results of routine efforts must lie if they are to be economical. Deviations in the results of a routine process outside such limits indicate that the routine has broken down and will no longer be economical until the cause of trouble is removed.

This book is the natural outgrowth of an investigation started some six years ago to develop a scientific basis for attaining economic control of quality of manufactured product through the establishment of control limits to indicate at every stage in the production process from raw materials to finished product when the quality of product is varying more than is economically desirable. As such, this book constitutes a record of progress and an indication of the direction in which future developments may be expected to take place. To get as quickly as possible a picture of the way control works, the reader may find it desirable, after going through Part I, to consider next the various practical illustrations given in Parts VI and VII and in Appendix I.

The material in this text was originally organized for presentation in one of the Out-of-Hour Courses in Bell Telephone Laboratories. Since then it has undergone revision for use in a course of lectures presented at the request of Stevens Institute of Technology in its Department of Economics of Engineering. Much of the work recorded herein is the result of the cooperative effort of many individuals. To a

considerable extent the experimental data are such as could have been accumulated only in a large industry.

On the theoretical side the author wishes to acknowledge the very helpful and suggestive criticisms of his colleague Dr. T. C. Fry and of Mr. E. C. Molina of the American Telephone and Telegraph Company. On the practical side he owes a great debt to another colleague, Mr. H. F. Dodge.

The task of accumulating and analyzing the large amount of data and of putting the manuscript in final form was borne by Miss Marion B. Cater and Miss Miriam S. Harold, assisted by Miss Fina E. Giraldi. Mr. F. W. Winters contributed to the development of the theory. The Bureau of Publication of the Laboratories cooperated in preparing the manuscript for publication. To each of these the author is deeply indebted.

The author is particularly indebted to R. L. Jones, Director of Apparatus Development, and to G. D. Edwards, Inspection Engineer, under whose helpful guidance the present basis for economic control of quality of manufactured product has been developed.

W. A. SHEWHART.

BELL TELEPHONE LABORATORIES, INC.
New York, N. Y.
April, 1931.

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Appendices

APPENDIX I

RESULTANT EFFECTS OF CONSTANT CAUSE SYSTEMS

1. *Introductory Remarks*

Our discussion of the problem of establishing the necessary and sufficient conditions for maximum control was based upon the following three assumptions:

- A.* The resultant effect X of the operation of the m causes is the sum of the effects of the separate causes.
- B.* The number m of causes is large.
- C.* The effect of any one cause is finite and is not greater than the resultant effect of all the others.

It was stated that under these conditions the distribution of resultant effects of a cause system approached normality as the number m of causes was increased indefinitely, at least in the sense that the skewness $\sqrt{\beta_{12X}}$ and the flatness β_{22X} of this distribution approach 0 and 3 respectively. We shall now consider the basis for this statement in more detail.

To start with it will be found helpful in trying to get an appreciation of the significance of the three limitations to carry through the details of finding the distribution of resultant effects of a few simple systems. For this purpose we shall consider eight such systems characterized as follows:

$$(a) \begin{cases} m = 5 \\ x: 0 \ 1; 0 \ 1; 0 \ 1; 0 \ 1; 0 \ 1. \\ p: \frac{1}{5} \frac{1}{5}; \frac{2}{5} \frac{1}{5}; \frac{3}{5} \frac{1}{5}; \frac{4}{5} \frac{1}{5}; \frac{5}{5} \frac{1}{5}. \end{cases}$$

$$(b) \begin{cases} m = 5 \\ x: 0 \ 1; 0 \ 2; 0 \ 3; 0 \ 4; 0 \ 5. \\ p: \frac{1}{5} \frac{1}{5}; \frac{2}{5} \frac{1}{5}; \frac{3}{5} \frac{1}{5}; \frac{4}{5} \frac{1}{5}; \frac{5}{5} \frac{1}{5}. \end{cases}$$

$$\begin{aligned}
 & \left. \begin{array}{l} m = 5 \\ x: \quad 0 \ 1; \quad 0 \ 2; \quad 0 \ 3; \quad 0 \ 4; \quad 0 \ 5. \\ p: \quad \frac{5}{8} \frac{1}{8}; \quad \frac{5}{8} \frac{1}{8}; \quad \frac{5}{8} \frac{1}{8}; \quad \frac{5}{8} \frac{1}{8}; \quad \frac{5}{8} \frac{1}{8}. \end{array} \right\} \\
 & \left. \begin{array}{l} m = 7 \\ x: \quad 0 \ 1; \quad 0 \ 2; \quad 0 \ 3; \quad 0 \ 4; \quad 0 \ 5; \quad 0 \ 6; \quad 0 \ 7. \\ p: \quad \frac{5}{8} \frac{1}{8}; \quad \frac{5}{8} \frac{1}{8}; \quad \frac{5}{8} \frac{1}{8}; \quad \frac{5}{8} \frac{1}{8}; \quad \frac{5}{8} \frac{1}{8}; \quad \frac{5}{8} \frac{1}{8}; \quad \frac{5}{8} \frac{1}{8}. \end{array} \right\} \\
 & \left. \begin{array}{l} m = 10 \\ x: \quad 0 \ 1; \quad 0 \ 2; \quad 0 \ 3; \quad 0 \ 4; \quad 0 \ 5; \quad 0 \ 6; \quad 0 \ 7; \quad 0 \ 8; \quad 0 \ 9; \quad 0 \ 10. \\ p: \quad \frac{5}{8} \frac{1}{8}; \quad \frac{5}{8} \frac{1}{8}; \quad \frac{5}{8} \frac{1}{8}; \quad \frac{5}{8} \frac{1}{8}; \quad \frac{5}{8} \frac{1}{8}; \quad \frac{5}{8} \frac{1}{8}; \quad \frac{5}{8} \frac{1}{8}; \quad \frac{5}{8} \frac{1}{8}; \quad \frac{5}{8} \frac{1}{8}; \quad \frac{5}{8} \frac{1}{8}. \end{array} \right\} \\
 & \left. \begin{array}{l} m = 5 \\ x: \quad 0 \ 1; \quad 0 \ 1; \quad 0 \ 1; \quad 0 \ 1; \quad 0 \ 1. \\ p: \quad \frac{5}{8} \frac{1}{8}; \quad \frac{4}{8} \frac{2}{8}; \quad \frac{3}{8} \frac{3}{8}; \quad \frac{2}{8} \frac{4}{8}; \quad \frac{1}{8} \frac{5}{8}. \end{array} \right\} \\
 & \left. \begin{array}{l} m = 6 \\ x: \quad 0 \ 1; \quad 0 \ 2; \quad 0 \ 4; \quad 0 \ 4; \quad 0 \ 2; \quad 0 \ 1. \\ p: \quad \frac{1}{2} \frac{1}{2}; \quad \frac{1}{2} \frac{1}{2}; \quad \frac{1}{2} \frac{1}{2}; \quad \frac{1}{2} \frac{1}{2}; \quad \frac{1}{2} \frac{1}{2}; \quad \frac{1}{2} \frac{1}{2}. \end{array} \right\} \\
 & \left. \begin{array}{l} m = 5 \\ x: \quad 0 \ 1; \quad 0 \ 2; \quad 0 \ 4; \quad 0 \ 8; \quad 0 \ 16. \\ p: \quad \frac{1}{2} \frac{1}{2}; \quad \frac{1}{2} \frac{1}{2}; \quad \frac{1}{2} \frac{1}{2}; \quad \frac{1}{2} \frac{1}{2}; \quad \frac{1}{2} \frac{1}{2}. \end{array} \right\}
 \end{aligned}$$

The notation used in describing the cause systems can be made clear by considering only the first one. Here we have a system of $m = 5$ causes. Each of these five causes may produce an effect of either 0 or 1. For each cause the probability of zero effect is $\frac{5}{8}$ and that of unit effect is $\frac{1}{8}$.

Using this cause system we may illustrate the method of finding the distribution of resultant effects. Obviously the magnitude of this effect may take on values 0, 1, 2, 3, 4, 5. The probability that the resultant effect will be zero is the compound probability of each component cause producing zero effect or $(\frac{5}{8})^5$. In a similar way the probabilities of getting a resultant effect equal to 1, 2, 3, 4, or 5 are respectively $5(\frac{1}{8})(\frac{5}{8})^4$, $10(\frac{1}{8})^2(\frac{5}{8})^3$, $10(\frac{1}{8})^3(\frac{5}{8})^2$, $5(\frac{1}{8})^4(\frac{5}{8})^1$, and $(\frac{1}{8})^5$. In this way we get the following distribution:

Resultant Effect X	0	1	2	3	4	5
Probability	0.401878	0.401878	0.160751	0.032150	0.003215	0.000129

This is shown graphically in Fig. 1-a. The distributions of the resultant effects of the seven other systems are also shown in Fig. 1. What significance do these results have?

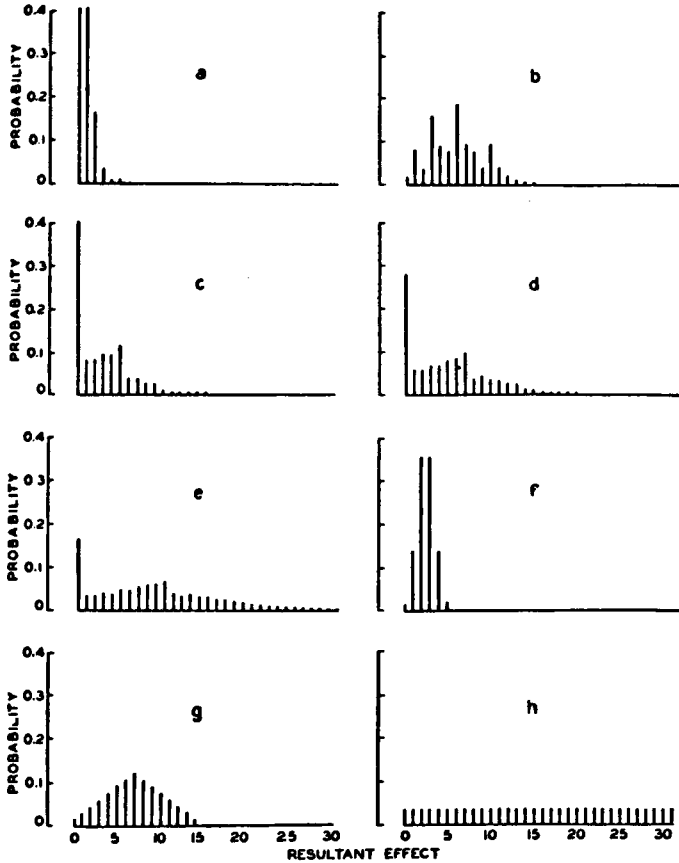


FIG. 1.—DISTRIBUTION OF RESULTANT EFFECTS OF SIMPLE CAUSE SYSTEMS.

In the first case we see that the distribution of resultant effects will always be characterized by the point binomial. Hence it will always monotonically decrease on either side of

the mode—in other words, it is a *smooth* distribution. Distributions *b*, *c*, *d*, and *e* indicate the effect of lack of uniformity among the component causes. From this viewpoint smoothness is a necessary condition. That it is not, however, a sufficient condition is evidenced by systems *f*, *g*, and *h*.

As long as the component causes are the same, we have already seen (Fig. 53) that the distribution of resultant effects approaches normality as the number of causes is increased. The condition that there shall be an indefinitely large number of causes is, however, certainly not sufficient as is shown by systems *g* and *h*, for in these cases the shapes of the distributions will always be those shown in Fig. 1-*g* and *h*. Of course, if we admit that the effect of any cause must be finite, systems such as *g* and *h* with an indefinitely large number *m* of causes are ruled out.

2. Practical Significance of Results

In practice one is confronted with an observed distribution and from its nature must often decide whether or not it is worth while looking for assignable causes of either Type I or Type II. We shall concern ourselves here only with the problem of deciding whether or not an observed distribution

TABLE I.—THERMAL UNITS PER CU. FT. OF GAS

1,391	1,318	1,203	1,291
1,416	1,268	1,380	1,273
1,367	1,294	1,349	1,242
1,258	1,368	1,360	1,231
1,289	1,330	1,313	1,320
1,199	1,254	1,351	1,340
1,275	1,226	1,289	1,420

gives evidence of the presence of a predominating cause, that is, an assignable cause of Type II.

Let us consider a typical problem. The operation data for a certain gas plant for one month expressed in terms of arbitrary thermal units per cubic foot of gas produced from oil by cracking are those given below in Table I. The data are tabulated in the order in which they were taken. Ideal operation calls for

as high and as nearly constant value as can economically be attained.

The following question was raised by the Director of Research of the large organization interested in these results:

If I understand the methods of statistics correctly, it should be possible to determine from these data whether or not there is a predominating cause of variation, and hence to determine whether or not it should be reasonable to expect that a marked improvement in product can be made by controlling one or at least a few causes of variation. Am I right in this interpretation of the possibilities of statistical methods?

In answer to such a question we can at least say something like the following. If we divide the data into subgroups of four in the order in which they were taken and apply Criterion I of Part VI, we get no evidence of lack of control, as may easily be verified by the reader. Assuming that the quality is controlled, we may now consider the evidence for the presence of a predominating effect. An examination of these data shows that they are more or less uniformly distributed over the range of variation as one might expect with a cause system such as (*h*). In other words, the observed results are consistent with the hypothesis that a predominating cause was present. Needless to say such evidence is not conclusive: it is suggestive.

3. Analytical Results

Let us now find expressions for the skewness $\sqrt{\beta_{12x}}$ and flatness β_{22x} of the distribution of resultant effects under simplifying assumptions.

If we let μ_i represent the *i*th moment of the effects of the *j*th cause about their expected value, it may be shown¹ that

$$\sigma^2 = \mu_2 = \sigma_1^2 + \sigma_2^2 + \dots + \sigma_j^2 + \dots + \sigma_m^2,$$

$$\mu_3 = \mu_{3_1} + \mu_{3_2} + \dots + \mu_{3_j} + \dots + \mu_{3_m},$$

and

$$\mu_4 = \sum_{j=1}^m (\mu_{4_j} - 3\sigma_j^4) + 3\mu_2^2,$$

¹ See for example *Elements of Statistics*, by A. L. Bowley, published by P. S. King & Son, Ltd., 1920, pp. 291-292.

where μ_i is the i th moment of the resultant effect of the m causes about the expected value of the resultant effect.

From these results we get

$$\beta_{1\Sigma X} = \frac{\mu_3^2}{\mu_2^3} = \frac{\left(\sum_{j=1}^m \mu_{3j}\right)^2}{\mu_2^3} \quad (1)$$

and

$$\beta_{2\Sigma X} = \frac{\mu_4}{\mu_2^2} = \frac{\sum_{j=1}^m (\mu_{4j} - 3\sigma_j^4) + 3\mu_2^2}{\mu_2^2} = \frac{\sum_{j=1}^m (\mu_{4j} - 3\sigma_j^4)}{\mu_2^2} + 3. \quad (2)$$

As a simple case let us assume that the distribution of effects of $(m - 1)$ of the component causes are the same, at least in respect to their second, third and fourth moments, all of which are assumed to be finite, which we shall denote by M_2 , M_3 , and M_4 . Let us assume that the remaining cause is predominating in the sense that the corresponding three moments of its effects are b_2M_2 , b_3M_3 , and b_4M_4 , where b_2 , b_3 , and b_4 are all positive and greater than unity. Under these conditions, we get

$$\beta_{1\Sigma X} = \frac{(m - 1 + b_3)^2 M_3^2}{(m - 1 + b_2)^3 M_2^3}$$

and

$$\beta_{2\Sigma X} = \frac{(m - 1 + b_4)M_4 - 3(m - 1 + b_2^2)M_2^2}{(m - 1 + b_2)^2 M_2^2} + 3.$$

Evidently these two expressions approach 0 and 3 respectively as the number m of causes becomes indefinitely large, assuming that b_2 , b_3 , and b_4 are finite. In this way we come to see that the skewness and flatness of a distribution of resultant effects will, in general, be approximately 0 and 3 if the number m of causes is *very* large.

4. Economic Significance of Control from a Design Viewpoint

In Chapter III of Part I we called attention to the fact that as a result of control we attain maximum benefits from quantity

production. Only general statements as to obtaining these benefits were given at that time. In Part III, however, we developed the theoretical basis for control, making it now possible to show specifically how control enables us to attain these benefits. We shall consider here only the simplest kind of examples.

A. *Example 1.*—Suppose that an assembly is to be made in which two washers are to be used, one brass and the other mica. Assume that it is desirable to maintain as closely as possible a uniform overall thickness of these two washers. This could be done, of course, by selecting the pairs of brass and mica washers to give the desired thickness. Such a process, however, would tend to counterbalance the benefits of quantity production, since the economies rising from assembly processes result from interchangeability of piece-parts.

Table 2 gives the results of measurements of thickness on one hundred tool-made samples each of mica and brass washers to be used in the manner previously indicated in the assembly of an important piece of telephone equipment. The reader may easily satisfy himself that both of these distributions are sufficiently near normal to indicate that each of the piece-parts was controlled, and we shall therefore assume this to be the case. For this size of sample we are perhaps justified in assuming that the observed standard deviations of these two distributions may reasonably be taken as the standard deviations σ_1 and σ_2 of the objective controlled distributions of mica and brass washers respectively. The theory of the previous section shows that under these conditions the standard deviation of a random assembly of two washers, one of each kind, is

$$\sigma = \sqrt{\sigma_1^2 + \sigma_2^2}.$$

Furthermore, it follows that the distribution of the sum of the thickness in such a random assembly will be normally distributed about a mean value which is the sum of the mean values of the two objective distributions.

Upon this basis, therefore, the design engineer is justified

TABLE 2.—TYPICAL DISTRIBUTION REQUISITE FOR EFFICIENT DESIGN

Thickness of Mica in Inches	Number of Washers	Thickness of Brass in Inches	Number of Washers
0.0088	1	0.0182	1
0.0089	1	0.0185	1
0.0092	1	0.0186	2
0.0093	1	0.0187	2
0.0094	1	0.0188	2
0.0095	1	0.0190	2
0.0098	2	0.0191	3
0.0099	1	0.0192	3
0.0100	2	0.0193	3
0.0101	5	0.0195	5
0.0102	2	0.0196	6
0.0103	3	0.0197	5
0.0104	7	0.0198	4
0.0105	5	0.0199	1
0.0106	8	0.0200	3
0.0107	10	0.0201	8
0.0108	10	0.0202	4
0.0109	7	0.0203	5
0.0110	5	0.0204	7
0.0111	3	0.0205	4
0.0112	5	0.0206	3
0.0113	6	0.0207	3
0.0114	6	0.0208	6
0.0115	3	0.0210	3
0.0116	3	0.0211	1
0.0119	1	0.0212	1
		0.0213	3
		0.0214	2
		0.0215	3
		0.0216	2
		0.0220	1
		0.0222	1

in predicting that the overall thickness of random assemblies of mica and brass washers will be distributed as shown in Fig. 2. The dots in this figure show how closely the first one hundred assemblies made from manufactured product check the prediction. Furthermore, if the observed average thickness of

each distribution is taken as the expected value of the distribution, the design engineer can easily calculate the percentage of assemblies that will be defective in respect to overall thickness subject to the assumptions that have been made.

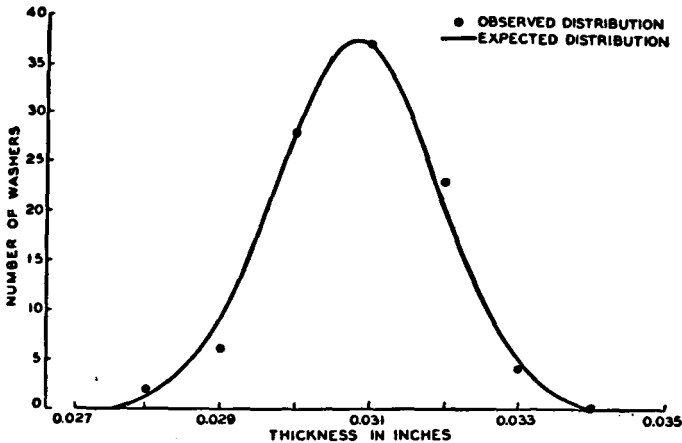


FIG. 2.—STATISTICAL METHOD MAKES PREDICTION IN DESIGN POSSIBLE.

B. *Example 2.*—For a shaft to operate in a bearing it is, of course, necessary to have a certain clearance. Thus, if ρ_1 and ρ_2 represent the radii of the bearing and shaft respectively, then the specification will, in general, state that the difference $\rho_1 - \rho_2$ must satisfy the inequality

$$d_1 \leq \rho_1 - \rho_2 \leq d_2,$$

where d_1 and d_2 are both positive. This situation is represented schematically in Fig. 3.

In most instances the shaft and bearing are fitted. Sometimes, however, it is of economic importance to be able to product shafts and bearings separately and to assemble these on the job. The question, of course, that is always raised is: What will be the expected rejection of such assemblies because of failure to satisfy the clearance specification?

From the theory of the previous section we see that this question can be answered readily, at least if we assume that radii of bearings and shafts are normally controlled with standard deviations σ_1 and σ_2 respectively. Under these conditions the difference $\rho_1 - \rho_2$ between any bearing and shaft chosen at random will be distributed normally about a mean value $\bar{\rho}_1 - \bar{\rho}_2$ with standard deviation

$$\sigma = \sqrt{\sigma_1^2 + \sigma_2^2}.$$

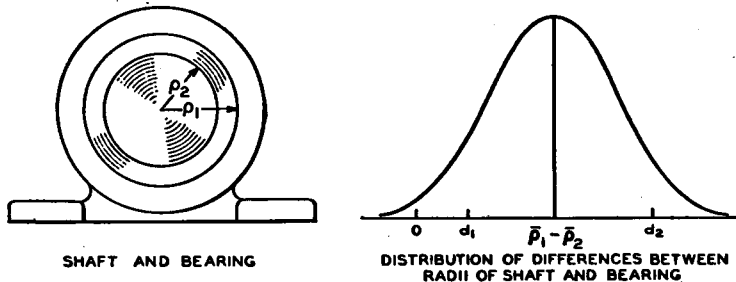


FIG. 3.—HOW MANY REJECTIONS SHOULD WE EXPECT IN ASSEMBLY?

Hence, the probability of a random assembly being rejected because the clearance fails to come within the required limits is given by

$$I - \int_{z_1}^{z_2} \frac{1}{\sqrt{2\pi}} e^{-z^2/2} dz,$$

where

$$z = \frac{(\rho_1 - \rho_2) - (\bar{\rho}_1 - \bar{\rho}_2)}{\sigma}$$

$$z_1 = \frac{d_1 - (\bar{\rho}_1 - \bar{\rho}_2)}{\sigma}$$

$$z_2 = \frac{d_2 - (\bar{\rho}_1 - \bar{\rho}_2)}{\sigma},$$

and the value of the integral can be read directly from Table A.

C. *Example 3.*—We shall now consider a problem involving maximum control. Many instances arise in production where

materials must be covered with protective coatings. Of such are the various kinds of platings, nickel, chromium, zinc, etc. In other instances we have coatings of paper or lead.

In practically every instance of this kind it is very desirable to maintain a uniform coating that is never less in thickness than some prescribed value. It is obviously desirable from the viewpoint of saving to reduce the variability to a minimum. Table 3 gives an observed distribution of one such kind of

TABLE 3.—DO THE VARIATIONS IN THICKNESS INDICATE A POSSIBLE SAVING?

Thickness in Inches	Number of Observations	Thickness in Inches	Number of Observations
0.125	2	0.131	20
0.126	12	0.132	5
0.127	21	0.133	3
0.128	18	0.134	0
0.129	33	0.135	3
0.130	33		

coating supposed always to be more than 0.124 inch in thickness. The histogram in Fig. 4 shows this distribution. What

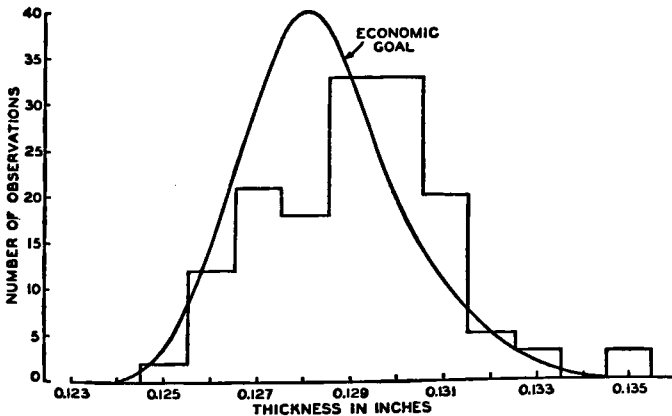


FIG. 4.—HOW MAXIMUM CONTROL SAVES MONEY.

does the theory of maximum control tell us about the uniformity of coating? In the light of the previous section the lack of smoothness in this distribution is indicative of the presence of assignable causes of variation which can be removed. In fact, an investigation revealed assignable causes of variation, and on removing these, the resulting quality approached the distribution shown by the smooth curve of Fig. 4, representing the state of maximum control for this particular kind of coating. By attaining this state of maximum control, it is apparent that the average thickness of coating is materially reduced without increasing the probability of obtaining a defective thickness.

Not only does control lead to a saving of material in such cases but it also leads to a more uniform product because as shown in Chapter XXIV of Part VII, it is practically impossible to sample for protective purposes unless the quality is controlled.

APPENDIX II

PRESENTATION OF ORIGINAL EXPERIMENTAL RESULTS USEFUL IN OBTAINING AN UNDER- STANDING OF THE FUNDAMENTAL PRINCIPLES UNDERLYING THE THEORY OF QUALITY CONTROL

The six tables in this appendix give in detail the results of 4,000 drawings from each of the three experimental universes referred to in the text. Tables A, B, and C give the original drawings divided into groups of four in the order in which they occurred. Tables D, E, and F give various statistics for these samples of four. It should not be inferred that these statistics are arranged to correspond to the samples as this is not always the case. We have made extensive use of these data in our discussions of the theory of quality control, and it is advisable to reproduce these data if for no other reason than that the reader may wish to carry out for himself computations similar to those referred to throughout the text.

There is, however, a far more important reason for presenting these experimental results. It will have become apparent by this time that statistical theory rests upon a fundamental natural law—the law of large numbers. In the last analysis we must always appeal to experimental evidence to justify our belief in such a law and to give us a feeling for its physical significance. For example, in the discussion of the theory of statistics, we always have to talk about doing something again and again under *the same essential conditions*; or, as we have said, under a controlled condition where the *chance cause system is constant*.

We have used these data in various places throughout the book to illustrate a controlled phenomenon. In particular we

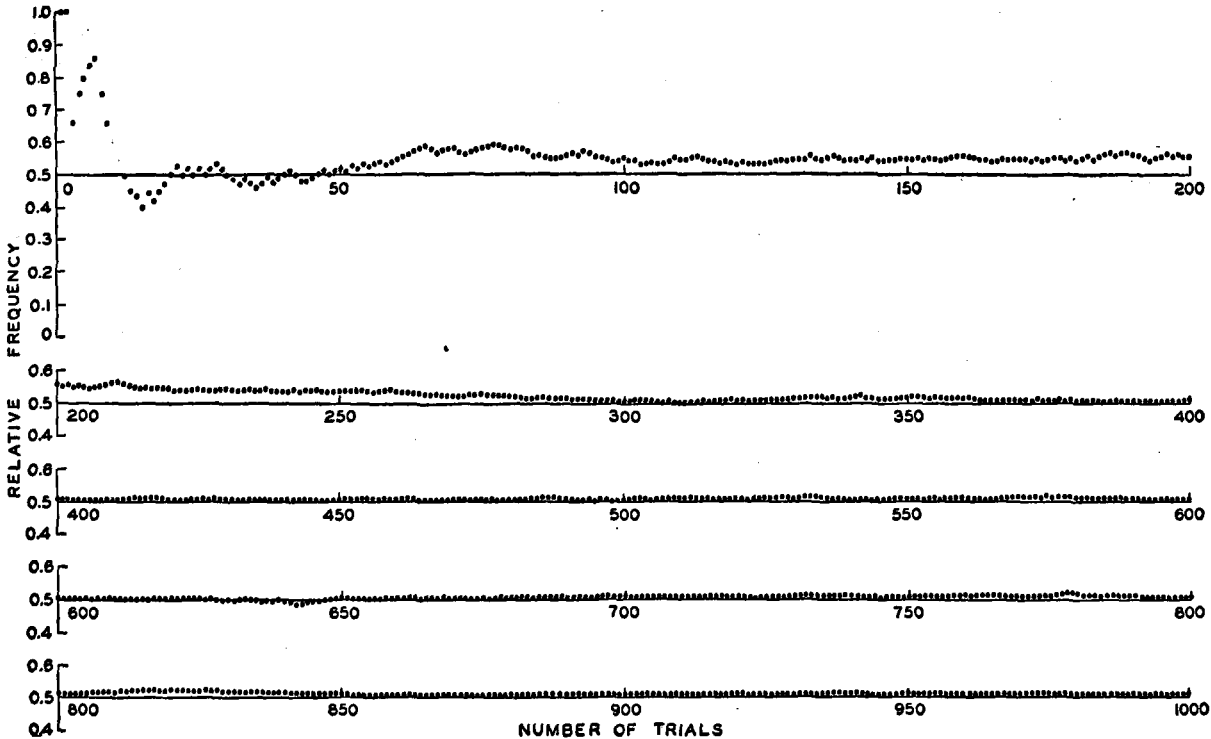


FIG. 1.—STATISTICAL APPROACH TO A LIMIT.

have shown how they can be used in checking the results of the mathematical theory of distribution, and in certain other instances, in indicating the probable character of some distribution function not yet determined *a priori*. Most of this discussion was limited to the statistics of samples of four. Often, of course, we wish to investigate in a similar way the nature of the distribution functions for sample sizes other than four. This can readily be done for the three types of universes through the use of the data in Tables A, B, and C.

These data have been used in many ways other than those mentioned in the text. For example, they have been found to be of great use in the experimental determination of the correlation between the average and range, which correlation is sometimes required in the establishment of an efficient inspection method where it is not feasible for one reason or another to calculate the standard deviation.

In this connection it is perhaps worthwhile to illustrate the use of these data in indicating in a somewhat more concrete manner than was done in the text the nature of the statistical limit involved in the statement of the law of large numbers. For example, suppose we consider a thousand drawings from any one of the universes, let us say the normal one. It will be recalled that half of the 998 chips were of one color¹ and half of another. If we let p represent the ratio of the number of chips observed to be of one color in a series of n drawings to the number n of drawings, then this fraction p should obey the law of large numbers and approach $\frac{1}{2}$ as a statistical limit; that is,

$$\lim_{n \rightarrow \infty} p = \frac{1}{2}.$$

Fig. 1 shows the statistical approach of the fraction p in one such series of 1,000 drawings.

Obviously, as a result of the first drawing, p will be either zero or unity. In fact, p will continue to remain zero or unity until a chip is drawn which is of a color different from that of

¹ Colors used instead of plus and minus.

the first one drawn. Thereafter p will never become equal to 0 or 1, but will always lie somewhere within this range. In the definition of a statistical limit, it was pointed out that there is no value of n such that for n greater than this value, the absolute value of p always becomes and remains less than some preassigned quantity—characteristics which belong to a mathematical limit.

The experimental results shown in Fig. 1 illustrate how the fraction p oscillates back and forth. A student of the theory of control can well afford to carry out similar tests of this nature until he has gained a clear picture of the significance of the statistical limit.

TABLES

TABLE A—4,000 drawings from a normal universe consisting of 998 approximately identical chips marked as indicated in Table 22 of the text.

TABLE B—4,000 drawings from a rectangular universe of 122 approximately identical chips marked as indicated in Table 28 of the text.

TABLE C—4,000 drawings from a right triangular universe made up of 820 approximately identical chips marked as indicated in Table 28 of the text.

TABLE D—Observed distribution of arithmetic mean \bar{X} , median, $\frac{\text{Max.} + \text{Min.}}{2}$, mean deviation μ , standard deviation σ , and ratio $z = \frac{\bar{X}}{\sigma}$ for 1,000 samples of four from the normal universe.

TABLE E—Observed distribution of arithmetic mean \bar{X} , standard deviation σ , and ratio $z = \frac{\bar{X}}{\sigma}$ for 1,000 samples of four from the rectangular universe.

TABLE F—Observed distribution of arithmetic mean \bar{X} , standard deviation σ , and ratio $z = \frac{\bar{X}}{\sigma}$ for 1,000 samples of four drawn from the right triangular universe.

TABLE A.—DRAWINGS FROM NORMAL UNIVERSE

1.7	.8	.4	-1.8	.5	-1.1	-.7	.8	-.5	-1.1	1.0	-.9	-.4	2.2	-.4	-1.1	-.2	-1.1	-.9	-.5	-.5	1.1	-1.6	-.2	1.2
.8	.8	.4	-.9	-.7	.7	1.6	-1.6	-.8	.8	-.1	-1.8	-1.8	.8	-.1	-1.0	-.8	-2.0	-.4	-.5	-.5	1.1	-1.6	-.2	1.2
1.4	.4	1.1	-.6	.8	1.1	-.4	.7	0	.7	0	.6	.1	-.9	0	.9	0	.9	-.6	.8	-.7	1.6	1.1	1.6	-.6
.8	.4	.4	1.7	1.0	-.8	.7	1.8	.8	-1.7	-1.9	.4	-.1	-1.2	-1.0	0	-1.5	0	-.8	.5	-.9	-1.8	1.2	-.8	.4
-1.0	0	-.2	.8	2.1	-.4	.2	-1.5	-.5	-1.2	-.9	-1.2	.6	-.5	.8	-.9	1.0	-.7	-.7	.6	.5	.5	-1.2	-.7	1.2
.8	-.6	-.2	0	-1.7	-1.1	-.2	.1	1.4	-.8	.1	1.4	1.6	.1	-.9	-.8	1.4	-1.5	1.6	.7	2.2	-.7	-1.5	0	0
-.8	1.8	.8	.7	1.5	-1.9	1.1	-1.0	-.1	-.9	.9	2.4	-1.1	.8	-1.0	1.4	-.9	-.6	1.4	0	-1.9	1.0	-.8	-1.0	0
.8	1.5	.8	-.4	2.5	-1.4	1.0	.8	-.5	.8	-.5	-1.7	1.1	0	.4	-1.1	-.1	-1.2	-.1	.4	-.2	-2.5	-1.1	-.5	-1.1
-.2	-.1	-.1	.6	.8	-1.9	-.1	-.8	-.1	1.2	-.1	-.7	.4	-.5	.4	.9	1.2	0	1.2	-1.3	1.0	-.6	0	1.1	-.2
.8	0	-1.6	.7	-.1	1.4	-1.2	1.7	-.6	-.4	1.0	-.8	1.0	-.8	1.0	-.8	-.8	-.1	1.9	.9	.9	.4	.7	-1.0	-.4
-.8	.9	.4	.9	-.5	-.1	.1	-1.5	.8	.8	1.8	-.7	2.2	-.7	-1.4	.9	-.5	.8	-2.0	-2.0	.8	-.4	.4	-.5	1.3
.8	-.1	-.5	.8	.9	-.1	-.5	-.5	1.4	-.5	-.1	.9	-.2	-.6	-.2	.2	1.2	.9	-.2	-1.4	.7	-1.2	-1.2	-.2	-.4
.8	-.8	-1.0	-.1	-.5	1.2	-.6	.8	-.6	1.6	-.5	.1	.2	.5	2.5	-.8	-1.6	.6	-.1	.5	2.2	-.7	-.2	-.7	-.7
-.4	.8	-.7	-.1	.6	2.9	.8	1.0	2.2	.8	-.1	.4	1.6	-1.0	-.8	1.6	-.6	2.2	-.9	.1	.4	1.1	-.8	-.2	-.7
-.8	1.0	-.2	.4	.7	.8	-.8	.1	.8	-1.0	-.6	.4	0	.4	.8	2.2	-2.5	-1.1	-1.3	.2	-1.3	-.9	1.5	-1.4	-.3
-.5	.8	.8	-.1	1.2	-.2	-.8	2.2	-.3	2.0	-1.9	.5	.2	1.6	2.4	1.2	1.3	2.0	-2.1	-1.2	-2.3	-.1	-.9	0	.6
.8	-.6	.5	1.2	-.5	-1.5	.7	1.2	-.5	-1.9	-1.5	1.4	-.7	-1.2	2.3	.1	-.4	-.5	-.4	.7	.4	.9	-.2	1.8	-.3
-.4	2.0	-.4	-.4	-1.4	1.5	-1.1	2.2	-.9	-2.7	2.2	.5	.8	.8	.8	0	-1.0	1.4	.6	-.1	-.2	.2	1.0	.4	.4
1.1	1.5	-.1	1.0	1.4	.6	1.7	-.6	0	-.5	-2.2	-.7	.6	1	.7	.5	0	.4	-.7	.5	1.0	-.1	-1.3	-.6	1.0
-.2	.8	0	.8	0	-.8	-1.6	-.5	-.9	-.1	-1.0	.9	1.9	.7	.8	1.6	1.7	1.7	-1.0	-.1	.8	-.2	-.1	-.6	-.2
.4	-.8	1.5	.1	0	1.0	.7	-1.6	-1.9	.8	0	-.9	-.5	-1.5	-1.5	.1	-2.6	.7	-1.0	-.5	-.2	0	1.5	.5	-.3
-.9	-.7	-.5	-.2	1.2	.8	.2	.1	-.4	.2	-1.5	-.5	1.1	-.8	.8	-.4	-2.0	-2.2	1.7	-1.5	.7	-.5	1.4	-1.7	-.6
.8	1.0	-.8	-1.5	-1.0	-1.9	-1.8	.8	-.8	-1.6	-.6	-1.3	-.8	-.6	-.9	.9	.9	-.7	0	.7	.7	1.9	-.2	1.3	-.4
.8	-.5	-.5	.8	.8	.8	2.7	1.2	1.2	.8	-.2	-.4	-.7	-.9	.9	0	.9	-.7	-.7	-.8	.9	.8	-.6	-1.2	-.4
-1.1	.8	.8	1.5	-1.6	.2	0	-.2	.7	2.2	1.5	.6	1.1	1.1	1.1	1.9	-1.2	1.1	.6	-.9	1.8	-.5	.8	1.7	-1.1
-1.1	.8	.8	2.6	-.4	-2.5	-.5	-.1	-.4	-1.6	-.4	-.7	.2	-.5	.1	1.5	-.6	.8	-.2	.1	0	1.1	-.2	1.8	.4
1.2	-.2	.6	-.2	-1.0	0	1.0	1.7	-.6	-1.8	.8	-.1	1.8	.8	1.1	-.6	-.1	-.4	-2.0	.3	-.6	-.8	1.2	1.1	-.3
-.9	-.4	1.0	-.9	0	-1.6	0	1.6	1.1	-1.6	-.8	-.7	-1.8	.8	2.6	0	-.7	-.1	1.9	2.1	-1.4	-.1	-.7	1.8	-.5
-.9	-.4	.6	-.9	-1.0	.8	2.0	.8	.7	-.8	2.1	-1.5	1.1	.2	.8	1.1	.5	1.0	-.5	1.3	-.8	.1	-.9	2.1	-1.1
-.2	1.2	-.1	-.2	-.4	-1.1	-.9	-.1	-.7	.6	.8	-1.1	-.9	.8	1.2	-.5	1.5	.6	2.5	.4	-.5	.2	.5	2.0	.5
.6	-.1	-.8	.5	.1	-.2	-.2	-.5	-.1	1.5	-1.6	.9	-.6	-.1	1.5	-.8	-1.1	1.2	-.3	1.9	.8	1.1	.8	.1	1.1
0	.1	.8	2.1	1.4	1.4	.1	-.8	-.1	-1.8	1.1	-.8	.6	-.1	-.1	0	-1.1	.7	-1.9	-1.0	-.9	.4	1.4	-.1	.8
2.0	.9	.4	-.9	-.7	.8	-.7	-.8	-.2	1.4	.4	-1.0	-.9	-1.4	-.4	.5	0	.4	-.5	-.9	-.1	-.2	-.2	-1.0	1.1
1.1	2.0	.9	1.0	.1	-1.9	-1.2	.8	-.6	.7	-.8	.4	-.2	.5	1.4	-1.0	-.4	-.6	-.5	.2	-.9	-1.0	-.1	-1.8	1.1
-1.8	-.1	.2	-1.0	.9	.8	2.4	0	1.7	1.8	-.6	.8	.2	-1.4	-1.0	-1.0	-.1	1.1	.6	.1	-.6	1.5	-.1	-1.1	1.1
-.8	.9	1.1	1.8	.8	.8	1.2	1.1	.6	1.1	-.1	-.4	.8	.8	1.1	.6	-.9	1.5	.7	2.4	1.0	.1	-.5	-.2	1.5
1.1	.8	-1.2	.8	.1	.7	2.0	.4	.7	-1.4	.7	.6	.8	1.7	.8	-.2	.1	-.2	.7	-.6	.8	-1.0	.4	1.0	1.2
-.2	.4	1.1	-.8	-.7	-.4	1.1	-1.5	-.1	.6	1.6	.6	.8	-.3	-.3	-.8	-.5	-.2	1.4	-1.9	-.9	1.4	-1.9	-.1	.7
-.8	1.2	-2.2	.9	1.1	-1.0	1.0	-.1	.4	0	.2	-1.1	.2	1.2	1.1	-.6	.2	-.5	-.5	-.7	-.5	-.1	-.2	-1.0	1.4
.1	.7	-2.0	1.9	-.8	.9	.9	-.6	-1.7	-.8	2.6	1.0	.2	.8	.8	-.2	.6	-1.5	.6	-1.2	-1.1	.6	1.2	.8	.4

TABLE A.—DRAWINGS FROM NORMAL UNIVERSE—(Continued)

.9	1.4	-.9	-1.2	-.7	0	2.2	-.6	0	1.4	-.9	-.1	.6	-.1	2.7	-.4	.8	1.9	1.8	1.5	-.5	-2.0	-.1	.1	-.2	
-.5	2.7	-1.3	-2.5	.4	-.8	-1.2	-.1	-.9	-1.1	-.4	1.2	.1	1.2	-.8	0	-.8	1.6	.6	-.6	-.5	.2	-.5	-.2	-.2	
-.8	.8	0	-1.0	1.1	.4	.4	.4	.4	-.2	1.0	-.2	0	-.7	1.7	-.1	-.6	-.7	.8	-.2	-.6	-.4	1.8	-.8	2.6	
1.0	-1.0	-.8	1.1	1.4	-.1	-.1	-1.1	.1	.1	-.7	-.2	1.6	.7	.6	.6	0	-1.5	.4	-1.7	-1.4	1.9	-1.3	-1.0	.1	
-1.8	-.2	.7	1.4	0	2.0	1.1	-.9	.6	-.7	-1.1	-.4	-.2	-.4	.6	-1.4	-1.5	2.2	.7	.6	1.4	.7	-.4	-1.6	-.2	
-.5	-.5	-.9	-1.1	.8	-.8	-.1	1.1	-.8	-.6	.6	.6	-.4	0	2.3	-2.5	.2	-.6	-2.4	1.3	.9	.6	.6	1.6	.3	
-1.2	.9	.9	-.1	-1.5	1.7	.9	1.0	-.5	-.7	-1.2	1.0	-1.3	-.5	.7	-1.5	1.1	.2	1.2	1.3	-.3	-1.0	-1.5	1.5	-.8	
1.4	1.8	1.9	-.7	-1.8	-1.7	1.0	.4	1.2	.9	1.7	.1	.3	-1.7	.4	-.5	.1	0	1.5	-1.6	.7	1.0	-.6	.3	.3	
-.2	-.9	1.5	-.9	-.2	-.4	2.0	.6	.5	.1	-.3	-.7	1.6	.2	.3	-.5	-.5	-.1	1.6	-.5	-.6	1.6	1.7	.1	-.2	
-.6	-.6	-.8	-1.5	-.5	-.6	-.4	.4	.4	-.9	2.1	1.4	1.1	1.2	.1	-.5	-1.3	.7	.2	-.2	-.6	.2	2.6	0	-.7	
-.5	.6	1.2	-1.2	-.3	-1.6	-.9	-.4	-1.9	-.0	-.7	-.7	-1.1	-.4	-.4	-2.0	.3	-2.1	1.6	-.9	-.6	-1.2	-1.6	-.5	-1.4	
-.5	.8	-.0	.1	-1.4	.1	1.6	-1.8	.8	-.5	.2	-1.0	-.0	-.2	-1.3	-1.0	-1.2	-2.1	1.3	-2.4	-.1	-.9	-.9	-2.4	.5	
-.1	-1.1	.2	.2	.2	-.4	1.3	0	.1	.7	-.2	-2.0	-.2	-1.0	0	-1.3	-1.4	0	-.9	.1	.8	.2	.1	1.1	1.1	
-.1	-.8	.7	.4	.4	-.5	.2	.3	1.0	-.4	.5	-1.5	.2	-1.4	-.1	0	-.6	-1.1	-.6	.1	-1.6	-.9	1.8	-.6	-2.0	.4
.7	-1.3	-.2	-1.7	1.0	.6	.6	.7	1.6	-1.2	-.5	.9	.2	.2	-2.5	-.2	-.2	-.5	1.0	.9	1.1	-.2	0	-.5	-.9	1.5
-.6	.9	-.5	.2	-.2	1.1	.2	1.2	-.2	.6	-1.4	.7	.2	.2	-.7	-.6	-.7	-.6	1.1	-.2	-.2	-.4	-.2	-.4	.2	.2
1.3	-.2	-.2	-.2	-.7	0	1.1	1.1	-.5	-.5	-.6	-.3	.4	-1.7	-1.0	-.4	-.2	-1.2	.1	1.5	-.4	.3	-1.5	-.7	-.5	
-.2	-.7	1.1	.5	-.2	-.8	-.9	.6	-.7	-.5	-.6	-.5	-1.9	.5	1.7	.7	.3	.3	.7	-.3	.7	.4	-.2	.5	-.4	
-.4	-.9	1.4	1.2	-.4	.9	1.4	-.4	-1.4	-1.3	-.9	-.7	.6	2.0	-.1	-.2	-1.3	-1.3	0	-.8	-2.6	0	-.7	-2.1	2.8	
-.6	-.5	.4	1.2	-.9	2.2	-1.2	.6	1.2	.7	.6	-.2	-.2	-1.0	.9	-.9	1.2	.9	0	-.2	.2	-.1	-.1	0	.9	
.9	-.8	1.8	.7	-.4	-.6	.9	-.1	-.6	-.4	-.2	.1	-.2	0	.9	.4	.7	1.7	-.4	.3	1.0	-.6	-.7	-.4	-.4	
.8	1.1	1.2	1.2	2.2	-.2	1.0	-2.9	.7	-.2	-.5	2.5	.6	0	.7	-.7	2.1	.5	-1.9	-.9	-1.2	-1.2	-2.1	2.0	-.4	
.5	1.4	-1.0	-.7	1.6	.5	.2	2.1	-1.1	-.6	.6	1.1	-.7	.5	.2	-1.6	-.9	2.2	.4	-1.4	-1.2	-.4	-1.0	.4	-.4	
-1.1	-.2	-.6	-1.6	.4	2.1	.2	.1	-.6	.2	1.4	-.2	-.1	-.2	-2.5	-.6	.2	.6	-.4	-.5	-.7	-.4	.2	-.2	-.2	
1.5	1.7	-.7	-1.1	.5	.4	-.7	-.6	1.0	0	-.8	2.1	.2	-1.7	.1	-.7	.5	-.1	-.5	.9	.4	.2	-.1	2.2	-1.8	
-.5	-.5	-.8	2.2	1.8	-1.1	-1.0	.4	-1.6	-1.6	-.8	-.1	1.1	1.7	.5	-.2	.5	-1.0	.1	.6	.2	2.1	-.7	-.9	-.9	
-.4	.9	1.0	-.6	.6	-2.2	.2	-.9	-1.0	2.0	1.1	.1	-.7	-1.5	-.7	1.4	.7	1.4	-1.4	-.9	-.6	.7	-.6	1.3	.9	
-1.0	-1.4	-.8	-.6	1.1	-.4	-.9	.1	-1.2	-.4	-2.0	2.3	1.7	.5	.6	-.5	-.9	.4	1.2	.8	0	.9	1.1	-.9	.9	
1.2	-.1	.6	-.9	-.1	-1.4	1.5	-.5	1.5	-.2	-.2	-.2	.1	.8	.8	.5	.7	-.1	.6	.6	-1.1	1.0	.5	.5	-.9	
-.2	-.6	.2	1.0	-.1	.2	.2	1.0	-1.2	.5	1.6	.7	-2.2	.4	.7	-.9	.2	-.5	-.5	-.5	-1.0	-.7	-.5	-.4	-1.0	
.7	.8	1.0	.5	1.2	1.1	-.4	.2	.5	.9	-.6	1.2	.7	1.2	2.0	-.7	.2	-.1	-1.1	-.7	-.9	-.6	-.6	.1	.1	
-.2	-.1	2.5	-.2	-1.4	-.7	.2	1.1	-1.4	-.1	-.7	-.2	2.2	.9	-1.3	.5	.1	1.9	-.5	1.2	.5	-.9	-.5	-.5	-1.9	
-.1	.2	.7	-1.2	.8	-.5	1.2	-.2	-.7	-.6	0	1.0	-.1	-.2	-1.2	-.6	1.0	.4	2.7	.2	-1.5	.9	1.1	1.7	-.8	
-.6	.2	-1.2	1.2	2.5	.5	1.1	-.4	-.3	.2	-.7	-.9	.1	-.2	-1.6	-.4	.4	-.2	-1.2	.6	.2	1.9	-.4	-1.0	1.0	
1.5	1.6	1.6	-.1	1.0	-.2	-1.4	-1.2	-.9	-.6	-.5	.9	.1	.4	-1.4	.8	-.9	.5	1.1	-1.2	.8	.6	1.9	.7	1.7	
-.1	-.6	.9	-.7	-1.7	1.2	-.9	.4	-1.4	.6	.3	.1	.5	-.4	-1.6	-1.2	-.9	-1.3	0	0	1.4	.4	-1.5	-.7	.9	
-1.0	-2.2	.6	-.7	.1	.6	.7	-.9	.6	-.9	.4	-.9	.2	1.4	-1.1	1.2	.5	.7	.2	.2	-.2	-.4	.6	.6	-.6	
-.1	-.4	.5	-1.2	.4	-.6	-1.5	-.4	.7	1.6	-1.4	-.2	-1.2	1.9	1.2	2.0	-.7	.2	.1	-1.2	-1.6	-1.1	-.2	-1.4	-.2	
-.1	.1	-.2	1.5	-1.2	-.2	.2	-.2	.2	-.2	-.2	-.2	-.2	.1	.4	-.7	1.7	1.6	-.8	1.6	-2.5	-.4	-1.1	-.7	1.6	.2
-.1	1.3	-.7	-.2	-.4	2.5	1.6	-.2	-.9	1.2	-1.1	-.4	.2	-1.8	1.5	-.2	.4	-1.2	-1.4	.6	.2	.4	-.4	-1.9	1.1	1.1

TABLE B.—DRAWINGS FROM RECTANGULAR UNIVERSE

-0.7	-2.5	1.7	.8	.9	-1.9	-2.5	-1.2	-3.0	-2.1	1.6	-2.7	-.8	2.7	-1.2	-1.1	-2.9	2.1	.2	1.7	-.7	2.4	-1.6	1.5	5.0	
-1.4	2.2	2.1	-2.7	-.9	1.0	.7	1.8	2.5	1.1	-1.1	-1.2	-1.1	1.2	-2.4	-2.5	.7	1.0	2.2	-.6	.5	1.2	-.2	1.7	-1.0	
.5	2.7	1.6	2.0	-1.2	2.4	-.5	-1.5	1.6	-.2	-.2	-1.5	-2.6	-2.5	1.2	-1.5	.8	.8	-1.1	-.5	-.4	2.7	1.1	-2.5	.6	
1.5	.2	1.2	.6	.2	1.7	-2.6	.2	.4	-.6	2.5	-1.2	-1.5	-.2	-1.6	2.7	-1.0	.4	-2.2	-1.5	2.9	.9	2.5	.5	-1.7	
-.8	2.1	-2.0	1.4	2.0	2.7	-1.7	.7	-.1	2.1	-1.6	-2.2	.5	-2.5	-1.2	-2.6	2.0	-2.5	-1.4	2.0	-.7	1.4	1.5	1.5	-1.1	
2.0	2.5	-1.2	-.6	-.7	2.1	2.4	1.7	-.6	2.1	2.5	.2	1.5	1.6	-1.0	.5	-.6	1.4	2.6	-1.6	-.7	1.4	1.5	1.5	-1.1	
1.1	-2.7	-.2	2.4	2.0	-1.0	-2.5	-.9	-2.2	-.4	2.0	-.7	.5	-1.1	.1	-1.1	1.0	-1.2	2.1	1.1	.8	-2.1	-2.9	1.6	2.1	
-.2	-.5	-2.6	1.0	1.7	-1.2	-1.4	-1.4	1.5	-2.2	.2	1.0	2.2	1.6	1.4	1.9	.9	.8	2.5	-2.6	.6	-2.9	1.5	.6	2.7	
2.2	1.1	-.6	.7	-.7	-1.7	.2	2.4	1.6	1.2	2.2	-.2	-.5	-1.4	-.2	-.2	-.2	2.0	-2.6	.8	.4	1.0	-.6	-.2	1.2	-1.1
2.2	1.5	-1.7	.9	-2.0	2.9	.2	1.1	.7	2.2	2.2	-.1	1.5	-2.1	-2.7	2.5	-.8	-1.1	1.9	-1.6	1.1	2.2	-2.5	2.2	-2.6	
1.2	1.0	2.6	-.9	-2.6	1.5	-2.5	-2.6	1.2	1.2	-2.9	-2.7	-2.4	1.6	-.9	2.5	.2	-3.0	-.2	-.5	.2	.8	1.3	2.8	-1.4	
-.7	.2	-2.9	.4	-1.5	-.9	-1.5	2.7	1.2	.2	.2	-2.5	1.9	-.1	2.2	-.3	-1.5	2.1	-1.7	-.5	1.5	.6	2.2	-2.5	1.0	
2.2	.2	-1.6	2.4	-2.9	1.9	2.2	-2.0	1.6	.2	-2.6	-1.6	-2.0	1.9	1.5	.7	-1.5	-1.5	-.9	.2	2.2	-2.6	1.7	2.6	2.2	
1.6	2.0	2.9	2.0	2.6	-1.1	-2.0	.6	1.1	2.9	-1.8	-2.6	-.2	-.1	2.0	1.0	-1.6	-2.5	-.7	2.2	-2.9	-1.5	-.9	2.2	2.2	
2.0	2.5	-2.8	-1.1	-1.0	-2.9	1.1	.8	.6	-2.6	-1.5	-2.2	-2.4	-1.7	2.2	.6	-2.0	.9	.2	2.7	-2.5	.6	1.2	2.4	-1.1	
-1.6	-.4	2.2	1.1	-1.5	-1.7	-.5	-1.0	-2.6	2.9	.9	-2.4	.2	.2	1.2	2.7	2.3	.2	.9	.5	.2	-2.7	-2.5	-1.1	2.5	
1.7	-.7	2.4	-1.6	1.5	2.0	-.6	2.1	.2	-1.9	.1	-1.7	.7	-1.3	2.0	-.5	1.7	-2.9	1.0	-.4	-.7	-.1	.5	-.5	-.6	
-.6	.2	1.2	-.2	1.7	-1.0	2.0	2.2	2.7	1.2	-.7	2.2	1.1	-.2	2.2	1.0	.6	1.1	2.0	-1.9	.7	.4	1.6	2.2	-1.9	
-.2	-.4	2.7	2.1	-2.5	.2	1.1	-2.7	2.1	.2	1.1	1.1	2.2	-1.2	.7	-2.5	1.9	2.6	-1.6	2.7	-1.7	2.5	-2.2	-1.9	-.4	
-1.2	2.9	.9	2.2	.2	-1.7	-.2	-.9	-.9	-.9	-2.2	.1	.1	-.2	-2.0	1.7	2.1	1.1	-2.2	-3.0	-2.1	1.9	-1.6	1.7	2.7	
-.7	-1.6	2.4	.2	2.0	-2.5	-1.1	-2.2	-2.1	.2	.4	1.2	2.1	2.0	2.4	-2.0	-3.0	2.2	1.2	.6	-2.4	1.2	.1	2.1	.3	
-2.2	2.0	2.1	-1.9	-2.2	.1	1.2	2.1	.9	-1.2	.1	-1.2	1.0	-.4	1.9	-1.1	1.7	1.2	.7	1.0	-.1	-.9	.2	1.0	-.7	
-.4	-.6	-2.1	.2	2.2	1.5	-.2	-1.2	-2.9	1.2	2.5	-2.2	.2	.4	-.4	-2.2	-1.2	-1.4	-2.2	-.2	-.9	1.7	-1.9	.2	1.2	-2.9
-.2	2.0	-2.2	2.2	2.1	.2	-.2	2.7	.1	2.4	-1.2	.2	1.7	1.6	-3.0	1.5	-.2	-2.7	2.2	2.2	2.2	-.2	-.2	1.1	.5	
-2.7	1.7	-.4	-2.2	2.2	-1.0	2.9	.4	2.0	-2.6	1.4	1.4	-1.9	-1.9	-2.2	-2.7	-1.1	.2	2.0	-.6	1.1	-.5	.5	2.2	.2	
1.2	-2.0	-1.7	.2	1.2	-1.5	1.2	2.2	1.2	.7	.7	2.7	2.7	-.2	-.2	1.2	-2.2	2.2	.2	.1	2.7	2.5	-1.0	.2	-2.0	.2
-2.2	2.7	-2.1	.4	-2.0	2.2	.2	-.4	.4	2.2	-.2	-2.2	-2.2	1.2	2.0	2.9	2.7	-.6	2.1	-2.9	-2.4	-2.0	2.2	-2.2	.2	
1.2	-1.1	2.2	.2	.2	-2.4	-.2	-.2	1.2	-2.4	1.2	2.9	-.4	-1.7	2.7	-2.2	-2.2	.2	-.9	1.2	-1.2	1.2	-1.0	2.2	-.9	
2.1	.4	.7	1.2	.2	2.0	-1.2	-1.2	-2.2	-2.2	-1.0	-.2	-.3	-1.2	-.4	1.2	1.4	-.2	2.0	.4	-.7	-1.0	-1.6	1.2	-2.2	
1.7	-2.2	2.2	1.2	.9	-.1	-1.6	-2.2	-1.0	-.2	-2.2	-2.9	-2.0	1.0	-2.4	2.2	-2.7	.2	1.2	2.2	-2.6	-2.9	-.1	-2.0	-1.1	-.9
-.1	.1	-.6	-1.1	1.2	-2.2	1.2	-.1	1.2	2.4	-1.9	-1.2	1.7	-.7	-.2	2.4	.1	1.1	-1.2	-.9	.9	.2	.9	-2.1	-.2	
-.2	-1.9	2.9	-1.2	-2.4	-2.7	.2	-2.9	1.2	1.5	2.9	-.2	2.2	.2	.2	2.1	.1	2.9	2.2	-2.2	-.2	-1.6	1.2	1.4	.5	
-2.6	-2.2	-1.2	-1.1	.2	-2.0	2.2	-1.1	-.2	-1.1	-.2	-.7	-.9	-.2	1.6	.9	.1	1.7	2.7	-.6	2.2	2.7	.1	-.2	-1.0	
.2	.2	2.2	2.0	-2.7	2.2	-2.0	.2	-1.2	-1.0	1.2	2.6	-1.9	.4	2.4	-1.2	.9	-2.6	-.1	.6	-.2	1.2	2.9	-1.2	-1.2	
-1.9	1.2	-.9	.7	1.4	2.0	-.9	-2.4	-2.4	2.2	-1.1	-2.4	.7	2.2	2.0	2.9	2.2	.2	2.2	2.7	-2.2	2.2	2.0	2.0	-2.2	
-.9	.7	2.2	-.2	2.0	2.0	-1.7	-2.0	-1.2	.2	-.2	-1.4	2.9	2.1	1.6	-1.2	-2.2	-1.2	-.9	-2.0	.7	2.2	-2.2	-.4	.2	
-.2	.9	-.4	2.0	.2	-.2	1.7	1.2	1.1	-.2	1.2	2.4	-.7	-2.2	2.2	-2.0	-.9	2.7	.9	-.6	1.2	-2.1	-.2	-1.0	-2.0	
-.2	-.4	-2.9	2.1	1.2	1.2	-.7	-1.2	-2.9	2.1	1.6	1.4	-.2	1.1	-1.1	-.1	2.9	1.2	-1.2	1.2	-2.0	-1.2	-1.6	2.2	1.1	
.2	-2.9	-2.1	1.0	2.4	1.7	.4	-.2	2.0	.2	-.6	-1.2	-.2	-.1	-2.2	-1.0	2.2	.2	.2	-2.4	-1.9	1.6	-.2	-1.9	2.0	
-1.2	.4	.6	.2	.7	.2	1.2	-1.9	2.2	-1.2	-.2	-.2	-.4	-.2	-2.6	2.0	-.2	-.7	-.2	2.9	-2.2	1.2	-2.2	1.1	-2.1	

1.2	-1.1	.2	-1	-2.2	-.2	-.4	-2.1	2.0	-.4	-1.2	-1.4	-1.1	-1.0	-1.1	1.7	-.1	2.2	-2.0	.2	2.2	-2.2	-1.2	-.4	.2
-1.9	1.2	2.5	.7	-1.2	2.0	2.7	2.9	-2.2	-.2	-.2	-.2	-1.2	-1.2	1.2	-2.2	-1.1	-.9	1.2	2.4	-.2	2.2	-1.1	-.2	2.2
2.2	-.2	2.0	-2.1	.2	2.0	1.4	-.7	-.1	1.2	-2.4	1.0	1.2	-2.1	.7	.9	-.2	2.2	-1.2	-1.2	-.2	-2.2	-2.2	2.0	-2.2
.9	2.2	1.2	1.2	-1.2	-1.2	-.2	-.2	2.2	-2.2	-.2	2.2	1.4	-2.2	2.2	.2	1.2	2.2	1.2	2.2	1.2	1.2	1.2	1.2	2.2
-2.7	-.2	-1.2	-1.2	.2	-.1	-2.0	1.2	-2.2	2.1	-.1	1.2	-.2	.2	2.2	2.0	-.2	.2	.2	.2	-.2	-.2	-2.2	2.2	-2.2
2.0	-.1	2.1	-.7	.2	-.9	1.4	-2.2	-.9	-2.0	2.2	.2	2.2	2.0	1.2	1.2	-.2	2.2	1.2	-1.2	-2.2	2.2	2.2	-2.2	2.2
2.7	1.1	2.1	-2.7	-2.2	2.7	2.7	-.1	1.4	2.0	-.4	1.4	-2.0	2.0	.2	-1.2	-.2	1.0	.2	2.2	-2.0	-1.4	2.2	-1.0	1.2
.9	.2	.2	.2	-1.0	2.2	.2	.2	-.2	-.2	-.2	-1.2	-1.2	-1.2	-.7	-.7	.4	.1	-1.2	-2.7	1.0	-.2	.2	2.1	-.2
-1.2	2.0	.4	1.0	-.4	-.7	2.2	1.4	1.2	-.7	-1.2	1.0	-1.2	.9	.7	2.1	-1.2	1.2	-.2	2.2	.9	-.2	-.9	1.2	-2.2
.2	-2.1	2.2	2.2	2.2	1.1	2.2	1.0	2.2	-.4	2.0	2.2	2.0	2.0	.9	2.2	2.2	-.2	1.7	-.2	-2.2	-2.2	-2.7	-2.2	-1.2
2.2	1.0	1.7	2.0	1.2	.2	-.2	2.2	-1.0	-2.0	-.2	-.2	-.2	-.2	-.2	-.2	-.2	-.2	-.2	-.2	-.2	-.2	-.2	-.2	-.2
-1.2	-2.2	1.0	1.7	-1.2	-2.7	-1.2	.7	.2	2.0	-2.2	-2.0	-2.2	1.2	2.2	-.2	2.0	2.2	1.2	1.2	-1.4	-.7	.4	1.7	1.2
-.2	.2	1.2	-2.2	-2.2	2.2	1.2	-1.2	-.7	-2.0	-.4	1.2	-1.2	.7	1.2	2.2	-.2	-2.2	-2.2	-2.2	-2.2	-1.2	-.7	2.2	2.2
2.2	-1	-2.7	1.0	2.2	2.2	-1.1	2.1	-1.2	2.2	1.4	-1.2	-2.2	-2.4	-1.2	1.0	-.1	-1.2	-2.2	2.7	-.2	-1.2	2.2	1.2	-1
-2.7	2.2	-1.1	.2	1.2	1.1	2.4	-1.0	-2.0	-.2	-2.7	1.2	1.2	-.2	-2.2	-.2	1.2	1.7	2.1	-2.1	1.2	2.2	2.0	-1.4	2.2
-1.2	-1	-.2	1.2	-.2	2.2	-1.7	1.2	-2.2	-2.0	-.2	-2.2	-2.2	-2.2	2.2	.9	2.2	1.2	-1.2	1.0	-2.0	1.7	2.0	.7	.2
-2.2	-1.4	2.0	2.2	1.4	1.1	1.2	-1.2	2.7	2.0	-1.2	.2	2.2	-2.0	2.2	-.1	-.2	-2.2	2.4	-.2	-2.2	-2.2	-2.7	-2.2	2.2
2.7	-1.2	.2	.4	.2	1.1	2.2	1.2	2.2	-.7	-1.1	-.2	2.2	-1.2	-1.2	-1.2	-1.2	-1.2	-1.2	-.2	-.2	-.2	-.2	-.2	-.2
2.4	2.7	-1.9	1.7	-1.2	.1	-1.1	.2	2.2	-.7	-1.1	-.2	2.2	-.2	-1.0	2.0	2.2	-.1	-1.2	-1.0	2.2	2.2	-2.2	2.2	-2.2
-.2	2.0	-2.2	.7	.4	.1	2.2	-1.2	.7	.2	1.2	2.2	2.0	2.2	-2.2	-1.0	.4	-.2	2.0	-.2	.4	1.2	2.2	.2	-.7
-2.2	1.2	-1.2	-1.0	-.7	.2	-.2	.2	.2	-.2	-1.0	-1.2	-.2	-.2	-.2	-.2	-.2	-.2	-2.2	2.4	-.2	-2.2	-2.2	-2.2	2.2
1.1	-1.2	1.2	-2.2	2.2	2.2	-1.2	-2.7	-.2	-.4	2.2	2.2	-2.2	2.7	-2.2	.7	-.2	-.1	.9	-2.2	-1.2	-.2	-.2	2.2	1.2
-1.0	-.1	1.4	-2.7	-.2	.2	1.7	-1.7	-.2	-2.1	-2.0	2.1	.2	2.4	-.2	1.2	2.4	2.1	1.2	-.7	-.2	-.2	2.2	1.2	1.7
1.2	-1	2.0	2.2	-.4	-1.4	2.4	-2.7	1.2	.2	-2.2	-.2	-.2	1.2	2.2	2.7	1.2	-.7	-.9	2.0	-.1	-2.2	-.4	-1.2	-2.0
-2.2	1.2	.9	1.2	1.2	-2.2	1.1	1.2	1.2	1.2	-2.0	-1.2	.2	2.2	2.2	-.2	.2	1.2	2.0	1.7	-1.2	-1.2	2.2	1.2	-2.2
.2	-.4	-1.1	-2.2	-2.7	-.2	-1.2	-2.1	1.4	-2.0	-2.2	1.2	2.2	-1.2	-2.2	-.2	2.0	-2.2	1.2	-.4	.2	.4	.2	1.2	1.2
-.1	-.2	1.2	.1	-1.2	-2.1	-.1	-2.2	-1.0	-.2	.2	.7	2.2	1.7	-.4	-2.0	-1.0	1.1	-1.2	-2.2	-2.2	1.2	2.2	1.2	1.2
-.2	-1.2	-1.2	1.2	1.2	-.2	1.1	1.1	-.2	2.0	.2	2.2	-2.2	-.2	.9	-1.2	1.2	-2.1	1.2	1.0	-1.2	-.2	-.2	-1.2	2.2
-2.7	1.4	-1.2	-.7	1.7	-1.2	1.2	.2	-.2	1.2	-2.2	-2.2	-1.2	2.2	-.7	2.2	-2.2	-.4	-.7	1.2	-1.1	1.7	-2.4	2.7	1.0
1.2	-.4	-2.4	2.2	1.1	2.1	-2.0	-2.2	.2	2.4	1.2	-1.7	-2.2	-.2	-2.2	1.2	-.4	2.2	2.2	2.2	2.2	-.2	-.2	-1.0	2.2
-2.2	-2.1	1.7	-2.2	1.2	2.2	.2	-2.0	-1.0	-2.0	2.0	-.2	2.2	2.2	1.7	2.2	2.2	-1.4	-1.2	2.2	2.7	-1.7	-1	-1.2	-1.2
2.7	-2.4	-2.0	.2	2.2	2.2	.2	-2.4	-2.1	.4	-2.0	.1	-2.2	1.2	1.0	2.2	2.2	-2.0	-1.1	-2.4	-2.2	-2.0	1.2	1.1	-2.7
2.1	-1.2	-2.2	1.2	2.2	2.2	2.2	1.7	-2.2	-.2	-2.2	1.2	1.4	-.2	2.0	-1.2	-1.2	-.2	-.2	-1.2	-.2	-.2	-.2	-1.7	2.2
-1.2	2.2	2.4	-1.2	-2.2	-.2	-2.0	-.2	2.2	2.2	2.2	2.7	-2.2	-2.2	-2.2	-.2	-.2	-.2	-1.1	1.2	.2	-.2	-.2	-2.2	-1.4
.7	-1.7	-.4	1.2	2.1	1.2	.2	-.2	-2.2	-.2	1.2	-2.0	1.2	2.7	.2	2.2	2.2	-2.2	-2.1	2.1	2.0	-1.0	1.2	-.1	2.2
1.2	1.2	-.2	-.9	1.2	2.2	-1.7	2.1	-.7	-1.2	-2.7	1.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
2.4	-.4	-2.2	.2	1.2	2.2	-.4	-2.0	1.2	1.2	1.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
-.2	1.7	-.2	-2.4	-2.1	.2	-2.2	-2.4	1.2	1.7	-1.1	2.0	-.7	.2	1.0	-1.2	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
-2.2	-1.4	-.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2

TABLE B.—DRAWINGS FROM RECTANGULAR UNIVERSE—(Continued)

-2.0	3.0	.5	-1.7	-.4	-.4	2.8	-1.2	-3.0	1.5	-1.4	-2.0	.3	1.5	-2.7	-1.4	1.3	1.7	1.2	1.1	2.9	1.0	-1.9	-3.0	-2.4	
-.1	2.0	-2.4	2.2	-2.7	2.8	-1.5	-.1	-1.2	-2.2	-.8	.8	2.3	-2.7	-.4	1.7	-2.6	-1.4	-2.3	-1.0	2.4	2.2	1.9	-.3	-2.6	
-.6	-1.8	1.9	.6	-.8	-1.0	2.0	-2.7	-.1	1.5	-.7	-2.7	.7	1.5	-3.0	.1	-1.2	-3.0	.9	-1.1	-1.1	-.1	2.7	1.4	-1.3	
-2.3	-2.9	-.5	2.9	-1.7	1.7	2.2	.2	3.0	.3	-1.1	2.5	-1.4	-.2	-1.1	1.0	.2	.7	2.1	2.0	-.4	-.4	1.7	1.8	1.7	
1.4	-5.0	-.6	-1.4	1.3	-2.9	-1.0	1.3	-1.0	-.6	-.8	-.3	2.8	-.7	2.0	1.2	1.8	1.8	-1.1	2.9	2.4	-.6	2.8	-.5	2.7	
3.0	.0	-2.4	-.3	1.5	2.0	-1.3	1.9	-1.3	1.2	1.9	2.1	2.9	.3	.7	-2.1	-.8	2.2	-.8	1.6	-2.4	-1.1	.8	-2.1	-2.0	
1.3	-2.4	-1.7	0	1.2	2.5	-1.6	-1.3	1.1	2.2	1.3	1.6	-1.9	.5	0	2.6	-.4	-.8	-.9	1.6	.2	1.4	1.6	-.7	-1.1	
3.0	-2.0	-3.0	-2.3	-2.0	-2.0	2.7	1.7	-.1	-.6	-1.2	1.6	2.5	-1.3	-.3	.5	-.8	2.4	2.6	.3	1.1	-.5	1.7	-2.6	2.0	
0	-1.5	-1.1	-2.4	1.7	-.1	.6	.8	1.1	1.7	1.9	-1.4	-3.0	2.0	-.5	-1.7	-1.3	2.7	-1.8	2.1	2.1	2.9	2.9	-.6	-2.7	
-.8	2.1	.6	-1.0	0	-.2	2.3	.1	-2.8	-2.7	-1.3	-.7	-.4	-.1	2.5	-.3	-.6	1.2	2.3	1.1	-1.5	-1.5	1.4	-2.5	.5	
-1.6	1.5	-1.2	-.9	-2.9	-.1	3.0	-2.5	-2.3	-1.8	1.0	-2.5	1.5	1.2	-.2	-1.2	2.3	.3	-1.8	-.9	-2.9	.8	.9	1.6	1.2	
1.7	-1.4	-.7	2.9	3.0	.8	1.3	-.9	2.2	.3	-2.4	-2.4	2.2	-.7	-.7	-.1	.3	1.9	1.4	1.8	-1.2	-.2	.4	2.5	-.4	
-1.7	-.6	-2.0	-2.1	-.3	-2.2	1.9	-.8	.9	3.0	-.7	1.6	-.9	-1.7	.9	2.6	1.6	2.6	.5	2.1	.4	-2.5	-.5	-2.9	2.5	
1.2	2.1	-1.0	-.3	-2.1	-2.3	-.3	-1.9	.3	2.7	-.5	2.5	.6	2.3	-2.5	.4	-1.0	-1.5	.3	1.7	2.8	1.9	1.3	-.1	2.0	
-.7	.8	-.8	1.8	.1	-2.4	.9	2.0	2.3	-2.4	-1.3	-2.4	1.4	1.8	2.7	2.2	-1.7	2.3	-1.0	-1.0	-.4	-1.3	.1	2.8	1.8	
1.7	-1.4	.5	2.7	-.3	-3.0	-.2	-2.7	3.0	-1.3	-.5	-1.6	1.3	2.0	2.8	-1.1	2.6	-1.1	.8	-.8	.3	-.8	1.7	-1.4	-2.9	
-1.6	-.1	-.7	2.8	-1.9	1.6	-1.3	1.5	.5	-.3	.1	2.9	0	-.7	-.4	-.5	-.7	-2.8	.4	-2.5	-2.8	-.5	1.0	-.5	-3.0	
-2.1	2.1	-1.4	.4	-2.8	-1.2	-.3	.8	-2.1	.6	.4	1.1	1.6	-2.8	-.5	-.1	.4	-2.9	2.8	-1.0	-.2	-2.2	1.7	-1.7	-.4	
-1.1	1.3	.3	1.9	1.3	.6	-1.3	-2.5	-2.3	-2.7	2.5	.7	-1.1	2.2	-2.3	-1.1	-2.9	.6	.4	1.1	.3	-2.3	1.3	1.4	1.5	
1.2	2.5	1.9	-1.7	2.7	-2.0	1.4	-2.4	-.7	2.9	1.3	2.3	.3	-.8	-1.6	.9	.8	-1.4	-2.6	2.2	1.1	-.2	2.0	2.9	1.6	2.4
1.8	2.0	.5	-1.4	2.7	-1.4	-1.7	-1.3	-3.0	1.6	.3	-1.8	-.5	-2.7	1.9	2.7	1.2	-2.7	2.8	1.9	2.5	1.7	-.1	-1.6	-2.1	
-2.7	2.9	-2.1	-.7	-.8	-.2	2.1	-.6	.9	-.5	-.7	-1.4	-.8	-.1	2.7	2.6	1.2	2.5	-2.3	1.6	-2.1	1.6	-2.0	.9	-1.4	
2.2	-1.0	-2.6	-.8	-.7	-1.9	-.6	-2.9	-1.8	-2.3	-.9	-2.6	.6	2.8	1.3	-2.4	-2.8	-2.5	1.5	2.2	-1.9	3.0	1.2	-2.8	.9	
2.2	-2.3	-.7	-2.9	-2.1	-2.2	-2.6	1.4	-.6	.6	-.2	-1.3	-.6	2.6	-2.8	-1.9	-1.9	-.8	3.0	.5	-.4	-2.1	-2.2	-2.1	2.5	
-.2	1.6	2.5	1.2	0	-.7	-2.1	2.9	-2.6	-2.0	.5	-3.0	.8	2.6	-1.3	-1.9	-1.3	-2.1	2.9	-1.2	.5	.1	-1.8	-1.4	2.6	
-.6	.7	-1.5	.1	-2.9	-.9	2.4	-2.7	1.6	-1.4	.1	2.6	-2.6	-2.1	-1.0	1.6	2.0	-.9	2.6	1.5	-1.1	-.2	-.8	-2.0	-.2	
2.4	1.5	.4	.9	-.1	2.1	.7	2.9	-.1	1.4	1.8	1.9	1.3	-.9	-2.1	-2.5	2.6	2.1	2.1	-2.1	-2.8	2.3	-.3	2.3	2.3	
1.4	-1.3	-2.2	-.8	-.3	.6	2.6	2.1	-2.9	-2.3	-.9	1.7	-1.9	.2	2.7	.5	2.6	2.5	-.7	2.2	.3	.4	-2.7	.6	-1.4	
-.7	-2.5	-.2	-.4	-.8	2.1	-.7	.2	-1.5	-3.0	2.8	-2.1	-1.4	-1.1	-2.5	-1.7	.2	.2	-.4	2.5	2.5	.5	-.9	-1.9	2.5	
1.4	.6	-.6	-1.4	-.4	.5	3.0	-.2	.5	-2.1	-.6	-.4	-1.0	-2.1	1.2	2.6	.8	1.6	2.4	-1.0	-2.3	1.7	-.2	2.4	1.1	
-2.3	2.3	-.3	1.2	-1.4	-2.6	-2.6	-2.7	2.0	1.6	-2.6	-2.2	.2	-1.1	-1.1	-2.2	-2.6	-.8	-2.3	-3.0	-.9	1.3	-.9	.2	-3.0	
-1.0	-1.5	-2.0	-.5	-2.2	-1.4	2.8	-2.6	1.8	-1.1	1.7	-.2	1.7	-.2	-1.9	.7	-1.8	-.4	1.2	1.0	2.0	1.6	0	-1.6	2.4	
.4	-2.6	-2.2	2.0	.7	.5	1.5	.4	2.2	-1.0	-2.0	1.4	.4	2.7	.1	.9	-1.4	-.2	-2.0	2.4	-1.7	-1.9	2.0	-.4	1.2	
2.2	-2.7	-2.7	-.7	-3.0	-1.1	-1.1	-1.6	-2.9	.8	-1.5	2.6	-.4	-1.5	1.7	.8	1.8	-.9	.1	2.4	2.9	1.5	-2.5	-1.6	1.9	
-.5	-.6	-.1	-2.2	0	-2.2	1.2	1.8	1.6	-2.1	-2.4	.3	3.0	.4	-1.4	1.7	.6	.7	1.3	-.3	2.8	2.5	2.0	2.2		
-.4	-1.0	-2.5	-.3	1.4	.7	-1.1	2.2	.6	2.4	-2.1	2.4	1.3	2.8	-1.6	.8	1.3	-3.0	1.8	2.4	1.2	-1.7	1.9	.4	2.9	
1.0	.6	-.5	2.5	2.3	.4	1.0	1.9	2.4	1.6	-.2	1.7	-.8	1.7	-5.0	-1.6	-2.2	.7	-1.8	-2.0	2.0	-2.8	2.7	-1.0	.2	
-1.4	2.1	-3.0	2.0	-1.9	-1.8	2.1	-2.3	-2.0	-1.9	-1.9	-1.4	-.9	-.8	-1.1	1.8	1.3	-2.4	-.9	.3	1.3	.6	1.0	-3.0	1.1	
-.2	1.7	1.9	1.7	1.6	2.5	1.3	-2.7	-.5	.5	1.2	-1.9	1.3	-1.6	-2.2	3.3	-1.3	2.7	-2.6	1.7	3.0	-1.0	-1.5	2.9	-.2	
-2.9	-.4	-1.6	-1.1	-.2	1.9	1.0	-2.3	.3	1.5	1.5	-1.6	1.7	1.8	1.2	1.2	2.3	.6	-1.3	-2.7	-2.9	-2.8	1.1	-.1	1.3	

2.0	1.8	1.4	2.1	1.4	-1.1	2.2	1.8	-2.2	2.2	1.4	-4	-2.0	-2.1	2.3	-2.2	2.2	1.8	-1.4	-1.4	-1.4	.4	.7	-4	2.0	-2
-2	-1.2	.2	-2	-2.2	-2	.9	-1.2	2.2	1.2	-1.2	-2.0	.2	2.2	-1.2	.2	-4	-2.2	1.2	-2.2	1.2	-1.4	-2.2	-2	2.2	1.2
-2	-2.2	-2	.2	-2	.2	.2	.2	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2
-4	.4	-2	-2	-2	2.2	-1.4	-2.1	-2	.7	2.2	.7	-1.1	-1.2	0	-1.2	-1.4	2.7	2.7	.2	.2	-1.2	-1.1	-2.7	2.2	2.2
-2.2	-1.4	-2.7	-1.2	1.2	-2.0	-2	-2.4	-2	-2.2	-1.2	-1.4	.2	2.0	1.2	1.4	-1.2	-1	-2.0	2.0	.9	-2.2	.7	-2.2	-1.2	
-4	-1.2	-2.1	-1.2	1.1	2.2	0	.2	1.7	-2.2	1.2	.2	1.0	-2	2.2	-1.1	1.2	2.4	-1.7	-2.2	.2	-2	1.0	2.0	-2.0	
-2.7	.2	1.0	-1.2	-1.2	2.1	-4	-1.2	-2.2	2.0	.2	.2	-1.2	-2.2	-1.2	1.2	-1.2	1.2	-1.1	1.4	-4	.7	2.2	-2.1	-1.2	
-1.2	-1.2	.2	1.7	2.1	-1.2	.2	1.1	1.7	-2.1	1.2	-2.7	-1.7	-2.2	2.1	-2	2.1	-1.0	-2	.2	.2	-2.1	-1.2	1.2	-1.2	
0	-2	2.2	1.1	2.1	1.2	.2	2.2	-2	-1.4	-1.2	2.1	-2	-2.2	.2	0	1.4	-2.0	-2	-1	2.2	-1.0	.2	1.2	2.2	
-1.0	2.1	2.0	-4	2.2	-4	-2.2	2.0	1.2	.2	-2.1	-1.2	.2	-2	1.7	2.2	-2.2	-1.4	.2	-2.1	-2.2	0	-4	-2	.2	
-2.2	.7	-1.4	-1.2	1.1	-2.2	1.2	.2	-1.2	1.7	-1.2	.2	2.2	-2	1.4	-2.0	-2.0	-2	2.2	-1.2	2.0	-2.1	-2	1.2	1.2	
-2.2	.2	2.0	1.2	2.2	-2	1.4	-1.7	1.2	-1.0	-2.2	-4	.4	-2.2	2.0	-2.2	1.0	-2	2.2	.2	1.4	1.1	.1	-2.2	1.2	
-2.2	-2	1.0	.2	2.2	-1	2.2	1.0	-2.2	2.2	.2	1.1	1.4	2.2	.9	1.1	-2	-2.1	-1.2	1.2	2.0	1.2	-2	1.2	1.2	
-2.2	-1.2	.2	-2.2	-2.7	1.2	1.0	-1.2	-1.2	-1.2	.2	1.1	1.4	2.2	.9	1.1	-2	-2.1	-1.2	1.2	2.0	1.2	-2	1.2	1.2	
.2	1.2	-2	-2.0	2.2	-2.2	-2.0	-2.2	-2.2	1.0	2.7	.2	-1.4	-1.2	.2	-1.0	-1.2	2.2	-1	-1.1	1.2	-2.2	-2.2	2.2	1.2	
-2.2	1.2	2.0	-2.2	2.0	-1.2	-2.2	-2.4	-2.0	-2	.2	2.2	1.2	2.2	2.2	-1.0	1.2	-4	.7	-1.2	-2.7	2.2	.2	2.2	2.2	
-2	-2.4	2.2	-2.2	2.2	1.2	2.2	-1.2	1.4	-1.2	.2	1.2	.7	.2	-1.7	-2.2	2.0	-1.2	2.2	.2	-2	-1.2	-2.0	2.2	2.2	
2.0	-2.1	1.1	-2.7	-2	-2.2	.2	-2.2	-1.2	1.1	2.0	-1	-2.0	-1	-2	-1.1	.2	2.2	-2.7	2.2	-2	0	.4	1.0	2.2	
.2	2.2	1.2	-1.1	2.2	-2.2	2.2	-2.2	.2	2.2	-2.2	.2	2.2	-2.2	1.2	2.2	2.2	-1.2	-2.2	.2	1.2	-1.2	-1.2	1.7	-1.2	
.2	.2	1.2	1.2	-4	-2	-2.2	-2.0	-2	.7	-2	1.2	2.2	2.2	2.2	-1.2	2.2	-2.2	-2.2	-2.2	-2.2	-2.2	1.7	-2	-2	
-2.2	1.2	-1	.7	.2	2.7	-1	.2	-1.2	-2.2	.2	-2.2	1.1	-1.7	1.2	2.0	-1.2	2.2	-2	-1.1	-1.4	.2	0	-1.2	-1.0	
1.2	.2	-1.0	.2	-2.2	2.4	1.2	.2	-2.0	-4	2.2	-2	-2.2	-1.2	.2	2.7	2.0	-1.1	-1.2	-2.4	1.1	-1.2	-2.0	1.4	1.2	
1.2	-2	-1.1	0	.2	2.2	1.0	-1.2	2.2	-1.2	2.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	
1.1	.7	.2	1.2	1.2	-2.2	-2	1.2	0	-1.2	1.1	.2	.2	2.2	-2.2	1.2	-2.2	2.2	.2	.2	1.4	1.0	-2.0	.9	2.0	
.2	2.7	2.2	1.7	-1.1	.2	-1.2	1.4	-2.2	-1.1	-2.7	2.4	-1.2	-1.2	-1.2	-2.1	2.0	.2	1.4	-1	.2	.2	-1.7	-2	1.2	
2.2	-1.0	1.4	2.0	1.2	1.2	-2.2	-1.2	1.2	2.2	-2	-2.2	-2.2	-2.2	1.0	1.2	-2	-2.2	-2.2	.2	.7	-2.2	-2.2	2.2	1.2	
.2	1.7	1.2	2.2	-1.0	-4	-2	-2.4	1.2	1.2	-2	.2	-2.2	2.4	.2	1.1	-2.0	-2.2	1.2	-1.4	2.2	2.2	-1.4	-1.2	1.2	
1.2	1.2	-1	-2.2	-2.7	2.7	-2.2	-2.7	.2	2.2	2.2	0	-2.2	-2.2	0	-2.2	-2.2	2.2	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2	1.2	
-2	0	-2.2	2.2	.2	-1.2	.2	-1.2	-2.2	.2	-2.2	-2.2	0	-2.2	-2	-1.2	.2	-1.0	-1.0	2.7	2.2	-2.0	.2	-2.2	.4	
-1.0	.2	1.2	-2	-2	-2.2	-2.2	-1.1	1.2	1.4	-1	-2.0	-1.2	.2	-2.2	-1.2	2.2	-2.2	1.2	2.2	2.2	2.2	2.2	2.2	2.2	
-2.2	-2	2.2	.2	.2	-1.2	-1.0	-1.2	-2	-2.7	1.2	-2	2.2	-1.2	1.1	-2.2	-2.0	2.0	-1.2	-2	1.1	-2.2	1.4	2.0	-2	
-2.2	-2	.2	-1	-2.2	2.0	-2	2.0	2.0	1.2	-2.2	-1.1	.2	-2.2	-2.4	-1.2	2.4	-2	-1.0	1.2	-1.2	-2.0	-2	2.2	2.2	
1.1	1.4	1.1	1.4	-2.2	-2	1.0	2.2	1	-2.2	-4	2.2	1.0	.2	.2	2.7	-2.0	-2.2	-4	-2	1.2	1.2	-2.4	-1.2	2.2	
1.2	2.2	-2.2	.2	.2	-1.2	-4	1.2	2.2	-1.2	2.2	-1.2	2.2	2.2	-1	1.2	2.2	-2	-1	-1.7	2	1.0	-1.2	-1.2	2.2	
2.2	-1.2	-4	2.2	-2.0	1.4	2.0	.4	-2	-1.2	-1.2	-1.2	.4	1.2	-1.4	-2.1	-1.2	2.1	-4	-1	-2	2.7	1.2	-2.0	1.2	
-2	-2	-2	-1	-1.1	.2	-1.2	-1.0	1.2	-2	.2	-2.2	-2	.1	2.1	-1.2	2.0	-1.4	.7	-1.2	2.4	.1	1.2	2.2	-2	
-2	-2.2	1	-2	-2	1.1	-1.2	2.2	1.2	.2	1.2	2.2	2.0	-1.2	2.0	1.2	-2.2	-1	-2	-1.2	1.1	-1.2	1.2	-1.2	-2	
-1.2	-2	-2.2	.2	.2	-2.2	2.2	-2.2	2.2	1.4	-2	1.4	-1.2	-4	-2	-2.2	-4	2.2	1.4	.1	-1.1	-1.2	.2	2.2	2.2	
-1.2	2.7	-2.2	1.2	-2.2	-2.4	2.4	-1.7	1.4	-2.7	-2	-2.7	2.7	-1.2	-1.4	-2.1	.1	2.2	-2.4	-1.4	1.2	-1.4	1.2	-1.2	-2	
-2.2	2.1	-4	-2.7	0	2.4	-2.4	0	1.2	-2.2	.2	.2	-2	-1.0	-2	-1.1	2.2	2.4	2.7	-1	-2	-1	-2.2	-2	2	

APPENDIX II

TABLE C.—DRAWINGS FROM RIGHT TRIANGULAR UNIVERSE

-1.1	1.7	.1	.1	.7	-.8	.8	1.4	-1.1	1.3	-.2	-.6	1.5	-.1	-1.0	-1.0	-1.0	-1.1	.1	-.7	.4	.2	.6	.3	1.2
-.2	-.8	-.4	-1.4	-.6	1.7	-.8	.6	-.7	-1.3	-1.2	.5	.6	.5	1.4	-.8	1.5	.3	.5	.9	.7	-.2	.5	.2	1.0
-2	0	-.6	1.4	-.6	-.3	-.1	-1.1	1.4	-.4	.5	1.4	-1.0	-.2	-1.2	.3	.2	-.8	-1.0	.9	-.8	.4	.7	.4	.2
1.4	.1	1.9	-.7	2.0	-.8	-1.7	-.7	.2	1.2	1.4	-1.2	-1.1	1.6	.1	1.6	-1.1	.4	.5	0	.5	-1.1	-.8	-1.1	1.3
.8	.1	.6	0	.2	.5	1.2	.5	-.7	0	-.7	.7	1.9	.1	-1.3	-1.3	1.3	.3	1.8	-1.1	1.8	1.9	-.1	0	-1.0
0	.7	-.6	.5	-1.2	1.5	.5	-.6	.4	0	.4	-1.1	-.6	.3	1.2	.7	1.5	1.4	1.3	1.3	-.6	1.4	1.0	1.5	1.3
.4	.6	-1.0	1.0	-1.3	.9	-.3	.2	.8	.4	-1.1	1.4	.5	1.7	-.2	1.1	-.5	.9	-.8	.8	1.5	.6	-1.1	2.0	1.6
-1.0	-.8	0	1.5	-.3	-.2	.8	.9	.4	-1.1	0	-.6	.4	-.8	-1.2	1.3	-1.1	-1.2	-.7	-1.3	-.6	-.7	1.5	-.6	-1.0
1.6	.4	-1.5	.1	.4	-.6	-1.1	-.3	-1.5	-.6	1.6	.3	-.9	1.0	-1.0	-1.1	2.3	-1.1	2.2	-1.2	.7	-.7	-1.3	1.5	-1.0
-1.0	1.5	.3	-1.0	-1.2	-1.2	-1.1	2.2	-1.1	1.4	-1.0	.3	-1.2	.1	-.9	.9	1.7	1.5	1.1	-.1	-.5	.7	-1.1	0	-1.3
-.3	-1.1	1.3	.6	-.7	-.4	-1.0	-.4	1.3	-.8	-.5	-.1	1	-.3	.3	-1.1	-.3	.4	.2	1.4	1.4	1.4	-1.1	-.6	-.2
1.5	.5	.3	2.0	1.4	-.4	1.5	-.2	-1.5	-1.2	-.8	1.2	-.8	0	-.5	1.5	.2	-.6	-.4	.7	-1.2	-1.2	1.3	-1.1	1.5
-.6	.1	-.6	2.0	-1.0	-.6	-.3	2.3	-1.1	.1	.7	2.0	-.8	-.6	-.9	-.4	2.2	-.1	-1.0	-1.2	-.3	-1.0	-1.3	1.9	1.9
-.8	-.8	1.2	-.9	1.9	1.0	1.4	-.6	1.6	-.6	-1.0	-.9	-1.2	-.4	-.4	1.9	.6	.1	-1.1	-.3	-1.2	1.7	1.6	1.6	-.2
-1.5	1.8	.4	.7	-.8	-1.2	2.1	0	-.2	1.1	.6	1.7	-1.1	-1.3	-.6	2.3	-.7	-.4	1.9	1.7	-1.2	-1.1	-1.0	-1.0	1.0
1.4	2.1	2.5	1.3	1.2	1.7	-.8	1.6	-.3	1.7	1.9	1.2	.9	1.6	1.6	-1.0	-.1	.5	1.6	0	-.2	-.6	-.2	-.5	-1.0
1.5	.3	.2	.6	-.4	.7	.5	.3	0	-1.3	-.2	1.9	-.8	-.6	.5	-1.1	.3	-.1	1.6	.1	-.8	.6	-1.0	-.9	1.1
.1	-.5	-1.1	.8	1.0	.8	.8	-.2	-.5	0	.7	.4	.4	.2	1.0	.2	-1.1	.1	.4	-.1	-1.2	-.9	-.3	.1	1.4
.1	-.8	-1.2	-.6	.9	-.6	-.8	-.7	-.8	-1.0	-.8	-1.0	-.8	-1.3	-.2	-.4	.1	-1.3	1.3	-.3	.5	-.7	.5	.3	.4
.8	-1.1	.2	.8	0	-.4	-.5	-1.0	.5	-.5	-.6	.1	-.6	-.3	-.4	.3	.2	.6	1.6	-1.3	-.9	-.4	-.5	-1.0	.7
-1.0	-1.0	-.7	0	.1	-.6	.4	-1.1	.3	-.1	.4	-.8	.3	-1.0	-.6	-.1	-.2	-1.0	-1.1	-.5	-1.2	-.4	1.2	.2	-.2
-1.1	-.7	-.4	-1.1	1.4	.6	-1.1	-1.3	-.6	-.9	-1.0	-.8	-.5	.2	.5	1.2	-.1	-1.1	1.5	1.6	-.5	1.4	1.4	1.4	-1.7
-1.2	-.9	.6	-.6	.3	1.0	-.2	-.9	-.4	.6	-.3	.7	-.6	-.1	.9	-.1	.4	-.7	-.8	-.2	-1.3	-1.1	-.4	-1.2	-.5
-1.0	.3	-.4	-1.5	.1	-.2	-.6	.2	-1.2	-.6	-1.1	.7	-1.2	-.5	.1	0	-.5	1.6	-.3	-1.0	1.5	-1.2	.2	-1.1	-.9
.6	.7	-.1	.2	.5	-.4	-.7	-.3	.9	-.4	-.9	-.2	1.4	.4	-1.2	-1.1	.4	-.1	-.7	1.1	-1.3	-.7	-.4	0	0
-1.2	0	-1.3	.5	-.8	-1.3	.5	-1.3	.2	-.7	.8	.2	1.1	-.3	-.5	0	-.7	0	-1.2	.4	.2	-.2	1.1	-.2	-.2
-.6	1.8	-.8	-.9	.4	-.2	-.6	-.1	1.1	-1.0	.8	-.2	.8	-1.2	-.1	0	-.1	-.6	-1.0	.5	-1.0	.2	-1.2	-1.1	-.2
-1.1	.3	-.6	-.6	-.1	-.3	-1.0	-.1	.8	1.2	1.6	.3	-.4	-.1	-.4	-1.2	-.5	-.7	-.1	.6	-.4	-.8	-1.3	-1.0	-.2
-1.1	.2	.8	-1.0	-.1	.4	.2	1.0	-1.3	-1.0	-1.2	-.6	.8	-1.3	.1	-.1	.3	1.7	-.8	-1.3	-1.2	-.4	-1.1	-1.1	1.3
-1.1	0	.5	-.6	-.6	-.8	.5	1.1	-1.3	-1.1	-.8	-1.3	1.7	.4	.2	.6	-.1	2.5	-1.1	-.8	2.3	.2	1.3	1.9	-1.0
-1.2	-.6	-.4	-.8	-.6	-.4	1.2	.5	.7	1.5	.6	1.6	1.1	-.8	-.8	-.7	-1.0	1.0	1.6	-1.1	-1.1	-.5	0	-.4	-.8
-1.2	.6	-.4	.2	-1.3	-.1	2.2	-1.2	1.3	-1.1	1.3	1.0	-1.0	.2	.3	-.2	-.8	-.7	-1.0	-1.0	-.9	-.7	-.8	-.2	1.1
-.4	-.4	-1.0	-.1	-.4	-.6	-1.0	.9	.9	-.8	1.0	.1	-1.3	-1.3	0	.5	-.8	-.2	-.6	.9	-.6	1.1	-.2	2.0	-.5
-.3	-1.0	-.4	-.8	-.9	1.1	-.4	.9	-.9	-.8	-.9	1.0	-1.2	-.8	.3	-1.1	-.7	-.3	.6	-.9	-.3	-.3	-.1	1.0	-.1
1.6	.9	-.4	1.4	.5	1.2	.8	-.8	-.5	-.2	.8	-.9	-.3	-.7	.4	-1.3	.9	-.3	-1.0	-.7	0	-.8	-1.2	.1	-1.2
1.5	.8	.7	.5	-1.2	0	.8	-.8	.9	1.0	.7	.1	.6	.6	1.8	-1.1	-.9	1.5	-1.2	-.3	1.2	-1.1	.7	1.2	.7
.2	.8	-.8	-1.2	1.0	.4	-1.2	.7	-.4	1.1	-.2	.6	.8	0	.9	-1.3	-.1	-1.1	-.8	-1.0	-.7	.4	-.7	-.9	-.4
-.9	-.9	-.9	-.9	-.9	-.5	.7	-1.0	.6	.3	-1.0	1.7	-1.1	1.4	.5	.4	-1.2	.5	.8	-.2	-.1	-1.3	-1.2	.8	-.8
1.0	1.0	0	0	.1	.9	-1.2	-1.2	-1.3	1.5	.5	.2	-.7	-.5	-.5	.3	.5	.5	.9	.7	.4	-.7	.5	-.8	1.9
-.4	-.7	-1.1	.9	-.5	-1.0	.2	.2	-.4	.9	2.1	.4	1.0	-1.0	1.0	1.0	.2	.4	.6	0	.2	-1.3	-.1	0	-.5

TABLE C.—DRAWINGS FROM RIGHT TRIANGULAR UNIVERSE.—(Continued)

1.1	1.3	1.7	1.8	1.8	-0.8	1.1	2.0	1.4	-0.9	-1.3	-0.6	.8	.1	0	.5	.8	.5	-1.0	0	1.2	-1.0	-1.2	1.5	-0.6
1.2	-1.0	-1.1	1.3	1.6	-0.9	.8	-1.0	-0.6	1.1	0	1.8	-0.6	1.1	.5	-1.2	-1.2	1.4	2.4	1.2	-1.1	-0.9	1.5	0	1.8
-0.4	-1.1	1.6	-0.6	.8	.7	1.6	-0.8	1.2	-0.8	1.6	-0.9	1.6	-0.8	-1.5	-0.8	1.2	.7	1.0	.4	-0.2	-0.5	-0.9	-0.7	-0.7
-1.2	1.2	-0.6	-0.4	-0.6	1.3	-1.3	-0.4	1.0	1.5	.8	1.3	.8	1.1	-1.3	1.1	1.2	-0.6	-0.8	.6	2.6	1.4	1.3	-0.5	.1
1.1	-0.5	1.4	0	-1.1	1.2	-0.7	-0.6	1.4	2.0	1.2	-0.8	.2	-1.1	-1.2	-0.6	.9	-1.3	-1.2	2.0	.4	-0.5	1.1	1.0	1.2
-1.5	1.2	.2	1.2	-1.1	-0.4	1.3	1.3	-1.0	0	-0.9	-0.6	-0.5	.4	1.2	1.8	-0.1	1.1	-0.7	0	.5	-1.3	-0.6	1.4	-0.8
-0.7	-1.2	-0.4	-1.2	.1	2.0	-0.9	-1.1	-0.8	.4	-1.2	-0.5	-1.3	-1.0	.3	.5	1.6	-0.8	-0.9	.2	1.0	.5	.6	.6	.6
-0.5	-0.9	-1.0	-1.1	1.3	1.2	-0.7	-1.1	-0.6	-0.3	-0.8	1.6	1.1	1.3	-0.9	.3	-0.6	-0.2	1.1	2.1	-1.3	0	-1.2	-1.1	-1.1
.7	1.0	1.6	-1.0	.2	-1.0	-0.9	-1.2	-0.3	-0.3	-1.3	1.1	.4	1.0	-0.5	1.2	-1.3	-0.9	-0.2	1.4	-0.5	-0.6	-1.0	-0.5	-1.0
1.2	-1.0	-0.3	-0.7	1.2	.2	.8	0	-1.3	.8	-1.1	.4	-1.2	.3	1.1	.5	1.0	-0.6	1.4	-1.1	-1.1	-0.5	1.3	1.8	-1.0
1.0	.4	-0.7	1.3	-1.1	-1.1	.1	-1.3	1.0	1.6	1.0	-1.2	.4	-0.5	.4	-0.9	-0.7	0	-0.1	-0.4	1.2	1.1	-0.5	.2	1.3
-1.0	1.3	1.3	.5	-1.0	1.2	1.4	-1.1	-1.1	0	1.1	-1.5	-1.2	-1.1	-0.4	1.4	-0.9	-0.9	-0.9	-0.9	-1.2	-0.9	-0.8	-0.4	-0.4
-1.1	1.7	-0.3	1.5	-1.0	1.2	-1.5	1.0	.9	.4	.6	.9	.6	1.5	1.0	-0.6	1.1	-0.6	-0.1	.5	1.1	1.5	-0.8	.3	-0.7
-0.6	-0.6	-0.4	1.3	-1.0	-0.9	1.5	1.4	-1.0	-1.2	.6	-1.3	-1.1	.6	-1.1	.6	-0.1	-0.6	1.6	1.2	1.7	-0.9	.3	1.0	-0.6
-1.0	-0.9	1.5	-0.2	-1.0	-1.1	-0.6	-0.4	.8	1.0	-1.3	-0.4	1.8	1.1	.2	0	1.6	-0.6	-0.4	-0.5	-0.6	1.4	-1	1.5	1.5
1.2	-1	-0.4	-0.7	.5	-1.1	1.0	-0.7	-0.8	1.2	-0.6	-0.5	.9	-0.4	2.1	1.6	2.1	.6	1.0	1.2	-0.8	.2	-0.5	-1.2	.6
-1.0	-0.2	0	-0.6	2.3	2.0	.3	1.7	.5	-1.1	.8	-0.7	-0.5	1.1	-0.5	-0.1	-0.7	-0.8	0	1.2	-1.5	1.9	-1.1	1.7	.2
-1.1	-1.1	-0.5	-1.1	-0.6	-1.1	-1.2	-1.1	-0.4	-0.1	-0.4	.3	-0.3	-1.5	2.1	2.2	.7	.6	.1	-0.4	1.8	-1.2	1.1	-0.5	1.2
-0.2	-1.0	.4	2.0	-0.8	-0.8	1.8	-1.0	.8	.1	.1	-0.5	.5	-0.6	-1.0	-0.9	-0.5	2.3	1.2	2.4	.8	.7	1.9	.7	.8
-0.5	-0.5	.3	1.2	-0.6	-0.5	1.0	-1.5	.6	-0.7	.5	.7	1.8	.8	.6	2.4	.2	-1.3	-0.7	1.0	1.1	-1.2	1.0	-1.0	
1.4	1.6	-0.5	-0.8	-1.1	.2	-0.7	-0.7	-0.6	.6	1.5	-0.9	.1	-0.6	-1.1	-1.2	.1	1.1	-1.3	.5	.4	-0.8	-0.1	-1.2	-0.4
-0.8	.9	1.1	-0.2	-0.5	.1	-0.5	1.1	-1.1	2.4	-0.4	-1.3	-0.3	-1.0	-1.3	1.1	-1.0	.2	.9	.4	.5	2.1	-0.6	-1.2	0
.7	-1.1	-1.1	1.4	1.1	.6	-0.7	-0.7	.6	.8	-0.1	-1.0	-0.3	-0.5	1.0	-1.0	1.0	-1.2	.8	-0.5	-0.1	-0.6	-0.8	-1.1	-0.8
0	-0.6	-0.6	-0.7	-0.6	2.3	1.6	-1.1	-1.3	.7	-0.2	.6	1.6	.9	-1.1	-0.2	-1.3	.1	.8	-0.2	-0.4	1.2	.3	-0.5	.3
1.1	-0.8	-0.5	.7	.1	-1.0	-0.3	-0.8	-0.2	-0.5	0	-1.1	-0.1	-0.2	.9	-1.0	-0.5	-0.5	-1.0	-1.0	-0.8	.4	-1.1	.2	-1.0
-0.2	2.1	.1	.7	.3	-0.7	-0.2	.3	-0.7	0	-0.2	-1.2	-0.3	-1.1	2.3	-0.6	-0.1	-0.7	-0.2	-1.0	.6	-1.0	-1.0	.5	-0.4
-0.7	-1.0	-0.7	-0.1	.7	.5	-0.7	.2	.4	-0.7	-0.5	-1.1	-0.5	-1.3	1.3	-1.0	.9	.7	.4	.4	-0.5	-0.3	.3	-0.2	-0.9
-0.7	1.4	-1.1	-0.5	1.5	-0.7	-1.3	-1.1	.5	-1.1	.5	-0.6	-1.2	.1	.9	.4	-0.4	.1	-1.0	-0.7	-0.6	-0.7	-0.9	-0.4	-1.1
-0.6	.5	.1	-0.5	-0.2	.3	-0.2	.6	-0.4	1.2	-0.7	-1.0	.1	-0.3	-0.5	1.1	-1.0	.1	-1.3	-0.2	-0.2	-1.2	.7	.1	0
.1	.9	-0.4	-0.6	-1.0	.6	.1	-0.8	-1.1	.5	.2	-0.8	-0.8	.6	-1.0	1.0	-0.5	-0.4	-0.4	-1.1	-1.1	-0.3	1.6	-0.7	2
-0.5	.4	-1.2	.9	.1	.3	-1.3	.3	-0.3	.7	-0.3	-0.4	.6	-0.1	-0.8	0	-0.1	-0.3	-1.2	-0.6	-0.5	-0.5	1.4	-1.1	-0.6
-0.8	-0.8	-1.3	.3	.4	-0.6	-1.0	-0.8	-1.2	.3	-0.7	-1.3	-0.4	.2	-1.1	1.5	-0.6	-0.8	-1.6	-0.2	-0.4	-0.9	1.4	-0.8	.3
-0.8	-0.9	1.2	-0.5	-0.9	1.1	-0.5	-1.2	-0.4	.9	0	.6	.7	-1.5	1.3	.3	1.5	-1.2	-0.8	.1	1.5	-0.4	-0.4	.6	-0.5
-0.2	1.4	1.2	-0.8	.9	0	-1.1	-0.6	.6	-1.2	-1.0	-0.8	1.4	1	-1.1	1.8	0	-1.5	1.2	1.8	0	-0.7	.5	2.6	-0.5
-1.2	1.4	-0.3	1.4	.3	-1.0	-0.1	.9	.2	-0.5	-0.8	1.5	-0.7	.8	-0.7	-0.3	-0.6	-0.8	-0.4	-0.3	.1	.2	-0.2	.4	.4
1.0	-0.2	-1.1	1.5	-1.2	-1.1	1.0	-0.2	1.7	-0.2	1.1	.3	-0.1	-1.2	-0.8	-0.1	-0.6	.8	-0.8	.2	-0.6	1.4	1.7	1.3	1.6
0	1.0	-1.1	-0.3	.2	0	.1	-1.1	-0.7	-1.0	1.1	1.3	1.6	1.4	-0.2	1.6	.9	-1.2	-0.2	1.7	-1.1	1.1	1.1	-0.9	-0.3
-0.5	-1.0	-1.3	.3	1.4	-0.9	1.3	-1.3	-0.8	-0.4	-0.2	-0.3	1.3	-0.4	-0.2	1.0	1.0	-1.2	.3	-1.6	1.3	.5	1.2	-1.0	-0.6
-1.3	.2	-1.1	1.6	.7	1.4	-1.1	.8	.9	-1.0	-0.9	-0.8	2.0	0	0	-0.5	-0.9	-1.2	.7	1.2	-0.5	.4	1.0	.8	1.3
.8	-1.1	.6	-0.3	-0.9	.8	-0.6	-1.0	-1.3	-0.8	1.1	1.6	.8	-1.1	1.3	.8	.9	1.1	-0.4	1.0	-0.9	-0.6	-1.3	1.5	1.5

-0.7	1.8	1.6	-0.6	1.8	1.4	0.9	-0.1	0.9	-0.7	-1.1	0.9	8.8	-1.1	1.8	-0.6	1.1	-0.4	-1.8	-0.7	1.8	-1.8	1.0	0.8	0.8	0.8
-1.8	1.8	-0.6	0.9	1.8	-0.8	0	0.7	0.4	0.1	-0.8	1.0	0.8	0.7	-0.8	-0.9	-0.7	0.7	1.3	-0.7	0.7	1.3	0	8.0	1.8	-1.1
1.4	0	-0.8	0.8	0.8	-0.8	-0.9	1.8	-0.7	0.9	8.8	0.4	-1.8	0.8	-0.6	-0.6	-1.0	-0.8	-0.6	0.8	-0.6	-0.8	-1.1	0.7	0.8	0.8
1.8	-0.8	0.1	-0.6	0.8	0.8	-1.1	-1.8	8.8	1.8	-0.7	0.8	0.4	-1.8	0.8	1.1	-0.9	1.0	-0.7	0.8	-0.8	0.8	0.7	0	-0.8	0.8
-0.8	1.8	-0.8	0	1.8	0.9	1	-1.1	0.8	-1.1	-0.4	0.9	0.7	-0.7	-0.8	0.8	-0.8	1.8	1.1	0.8	0.8	-1.8	0.4	1.8	0.8	1.0
-0.8	0	-0.7	1.1	-0.8	0.8	-1.8	0.8	0.8	0.9	0	-1.1	-0.8	1.1	-0.4	-0.8	-1.1	-0.8	0.8	-1.8	-1.1	0.7	0.8	1.6	0.7	1.1
1.8	0	-0.1	-0.8	-0.8	-0.8	0.8	1.8	-0.4	1.0	-1.1	-1.8	0.8	1.8	0.1	0.4	1.7	-0.8	-1.2	-0.8	0.8	-0.8	0.8	-0.4	-0.8	0.8
-1.8	-1.0	-0.8	1.9	-0.8	0.8	1.9	8.1	1.9	1.1	8.0	-1.8	-0.8	8.0	-0.8	8.8	8.1	-1.1	8.0	8.8	1.8	1.1	1.1	8.8	1.8	-1.1
-0.6	-1.0	8.0	-0.4	8.0	8.8	1.0	8	-1.0	-1.1	0.8	8.0	8.0	0.8	-1.8	0.8	-1.8	-1.8	-1.8	0.4	8.8	-1.8	8.8	1.8	-1.1	0.8
-1.8	-0.8	-1.8	-1.8	-1.8	-0.4	0.8	-0.8	0.8	0.8	-1.8	0.7	-1.8	0.7	0.8	-0.8	-0.1	8.1	0.1	-1.1	-1.1	-1.8	1.8	0.8	8.8	0.8
8.0	8.8	-1.8	-0.8	-1.8	-1.0	-1.8	-1.1	8.8	8.8	-0.8	0.8	-1.8	8.1	-0.8	-0.1	-1.1	-1.8	-0.8	-1.0	8.1	-1.1	-1.1	-1.1	-1.1	-0.7
8.1	8.8	8.8	-0.8	0.8	0.8	8.4	-1.8	0.8	-0.8	8.8	8.8	-1.1	-1.1	-0.8	-0.8	-1.8	-1.8	-1.8	-1.8	1.7	-0.8	-1.1	1.8	1.6	0.8
-1.8	0.1	-1.8	-1.8	8.1	8.1	8.8	1.4	0.8	0.8	-1.1	-1.0	-1.8	8.4	-0.1	-0.7	8.8	1.7	-0.7	8.8	-1.8	-1.8	1.8	1.9	0.7	0.8
-1.0	-0.1	-0.1	8.8	0.8	8.1	-0.1	-1.1	8.8	-1.8	8.4	-0.6	-1.8	8.1	-0.8	-0.8	-1.8	-0.8	-1.8	-0.8	1.7	-0.8	-1.1	1.8	0.8	0.8
-1.8	-1.1	-1.8	-0.1	-1.8	0.8	-0.8	-0.8	-0.8	-1.1	8.8	-0.8	-1.8	-0.6	-1.1	1.7	-0.8	0	-1.8	1.7	0.1	-1.8	1.7	8.0	-0.7	8.8
-0.8	0.7	-1.8	-0.8	0.1	0.8	-0.8	-1.8	0.8	-0.8	0	-0.4	-1.1	-1.8	-1.8	-0.7	-0.8	0.8	-1.8	-0.8	0.8	-0.8	0.8	0.8	-0.7	0.8
-1.8	-0.8	-0.8	8.0	1.4	0.8	-0.9	0	1.1	-0.4	-1.8	-0.7	-1.8	8.8	0.8	-0.8	-0.7	0	-0.7	0	-0.7	-0.8	-1.0	-0.8	-1.0	-1.0
-0.8	1.9	0	-0.4	-0.8	0	1.4	0	1.8	-0.8	-0.8	-0.8	-0.8	-1.1	-0.4	-0.8	-1.1	-0.4	-0.8	-0.8	-0.8	-1.1	0.8	0	-0.4	0
1.0	0.1	-0.9	1.8	-0.1	-0.8	-0.8	0.8	-0.7	-1.1	-1.8	0.8	0.1	-0.4	-0.8	-0.8	0.1	0.8	-1.8	-0.9	-1.1	-0.8	-0.8	-0.8	-1.8	-0.8
-1.8	-1.1	-1.0	0.7	0.8	-0.1	0.8	0.1	0.8	0.8	0.8	-0.7	1.4	-1.0	8.8	8.8	-1.0	8.8	-1.0	-1.8	-0.8	-0.4	-1.1	-1.8	0.4	0.8
-1.1	0	0.1	-0.4	0.1	-1.8	0.8	-1.8	-0.6	-1.1	0.4	0.8	0.7	-0.9	-0.8	0.4	-1.0	0	8.8	8.8	0.8	-1.8	8.8	-0.7	-1.8	0.8
-0.8	0	-0.4	-1.1	0	0.8	-0.8	0.8	0.7	-0.8	0.8	0	0.8	8.4	-1.8	1.1	8.0	-1.1	0.4	1.4	1.8	8.8	-0.4	8.8	0.8	0.8
0.1	0.8	-0.7	0.8	0	1.8	0	-1.1	0.1	0.8	-0.8	-0.8	1.9	-1.1	0.8	-1.8	-1.0	-0.6	-1.1	-0.6	-0.8	-0.8	-0.8	-0.8	0.8	0.8
-0.8	1.8	-0.7	-0.8	-1.8	1.0	-0.8	-0.8	-0.8	-0.8	1.8	0.8	-0.7	1.0	8.0	-1.0	-1.0	0	1.7	-1.8	-0.8	8.8	1.7	-0.1	1.6	0.8
-1.1	1.4	-1.1	1.8	0.8	1.8	0.9	1.8	8.0	8.0	0.7	1.8	1.8	1.8	0.8	1.8	0.8	-1.1	-1.1	1.8	1.6	0.7	-0.8	1.1	1.8	0.8
1.8	-1.0	1.4	-0.8	1.8	0.8	1.8	1.8	1.4	-0.4	-1.0	0.8	1.4	0.8	-1.8	1.4	0.7	-1.8	1.0	0.8	0.1	-1.8	-1.1	8.0	1.8	-1.8
0.8	0	1.4	1.7	-1.0	-1.8	-1.8	0.8	-0.1	0.8	0.8	0.4	1.1	0	-0.8	-0.8	1.4	1.7	-0.7	-0.8	0	-0.8	0.8	-0.8	0.8	0.8
-0.8	0.1	-0.8	1.8	-0.8	-0.4	-1.0	-0.8	1.8	-1.8	-0.8	-0.8	-1.0	-0.8	-0.8	-0.8	1.0	0.8	1.8	-0.8	0.8	1.4	1.8	1.8	1.8	0.7
-1.1	-0.4	-0.1	-1.8	-0.8	-1.8	-1.8	-0.4	-0.8	-0.7	-0.8	-1.0	1.7	-1.8	1.8	1.9	-1.8	1.9	0.8	-0.8	1.7	8.8	-1.8	1.8	1.4	0.8
1.7	-1.0	1.8	-0.8	0	1.8	0.8	1.8	1.8	-0.8	1.8	-1.8	-0.8	-0.8	-1.8	-0.8	-0.8	-0.8	-0.8	-0.8	1.8	-0.7	-1.1	1.8	1.8	0.8
0	1.8	-1.8	-0.8	-1.0	0.8	1.8	0.8	1.8	-1.1	1.8	-0.7	-0.8	-1.8	-0.8	-1.8	1.8	0.1	1.8	-1.8	-1.8	1.8	1.8	0	-1.8	0.8
-1.8	-0.8	0.1	-0.8	0.4	-0.4	1.7	1.8	8.1	1.9	1.7	8.8	0	1.0	1.7	1.8	1.8	-1.8	-0.4	-0.4	-1.0	8.0	0.8	-1.8	-0.7	0.8
1.8	0.8	-0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
1.8	-1.8	0.8	0.8	-0.8	-0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
-0.8	-0.8	0.8	0.8	-0.8	-0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
-1.0	-1.8	1.7	1.4	-0.4	-1.1	-1.0	1.8	0.8	1.8	1.7	-1.8	-1.0	1.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
-1.0	1.8	-0.8	8.8	1.4	0	-0.8	-0.8	-0.8	-0.8	1.4	1.8	-1.8	1.8	-1.1	1.8	1.1	-0.4	0	0.8	0.8	0.8	0.8	0.8	0.8	0.8
1.7	-1.1	-1.0	-0.6	-0.1	-1.0	0.8	0.8	-0.4	1.8	0.8	1.8	1.1	1.7	-0.8	-0.8	0.8	1.8	-1.8	-1.0	1.1	-0.7	-0.7	0.8	0.8	0.8
-0.8	-1.8	-0.8	-1.8	0.8	-0.8	1.7	-1.8	8.8	-1.8	1.8	1.8	-0.7	-1.1	-1.1	-1.8	-0.8	-0.8	-0.8	-0.8	-1.1	-0.8	-1.1	-1.8	-0.8	0.8

APPENDIX II

TABLE D.—STATISTICS FOR DRAWINGS FROM NORMAL UNIVERSE

Sample Number	Y	Median	Max. + Min.	μ	σ	s	Sample Number	Y	Median	Max. + Min.	μ	σ	s
1	.950	.950	.950	.600	.618	1.057	101	-.080	-.080	-.050	.850	.868	-.167
2	.850	.850	.850	.600	.645	7.773	102	.478	.450	.700	1.075	1.098	-.615
3	.885	.400	.850	.115	.150	2.800	103	-.080	-.050	.950	.800	.849	-.801
4	-.400	-.750	-.050	1.050	1.800	-.810	104	.888	.650	.400	.978	.630	.858
5	.400	.650	.150	.800	.660	.608	105	.108	.800	0	1.050	1.111	.090
6	-.150	-.100	-.800	.950	.865	-.850	106	0	.150	-.137	1.050	1.818	0
7	-.978	.150	.600	.828	.875	-.515	107	-.078	-.800	.050	1.975	1.335	-.056
8	-.078	.100	-.850	.875	1.119	-.067	108	.978	.850	.800	1.188	1.178	.468
9	-.078	-.100	-.050	.875	.608	-.128	109	-.978	-.700	-.450	.825	.370	-1.564
10	-.400	-.050	-.750	.850	.788	-.368	110	-1.800	-1.800	-1.300	1.000	1.049	-1.830
11	-.685	-.600	1.025	1.108	-.474	.111	111	-.850	1.150	.080	1.488	1.704	-.323
12	-.978	-.850	-.300	.778	.765	-.350	112	.825	.700	.850	.685	.776	.476
13	.025	0	.050	.878	.827	.075	113	1.850	.800	.600	.978	.980	.591
14	0	-.800	.800	1.100	1.538	0	114	-.050	.600	-.800	.978	1.048	-.478
15	-.600	-.700	-.800	.600	.484	-1.418	115	1.025	.750	1.000	.638	.760	1.348
16	-1.000	-.850	-1.450	1.000	1.185	-.264	116	.700	.650	.750	.430	.568	1.267
17	-.050	.100	-.800	.700	.890	-.061	117	.078	-.800	.350	.818	1.008	.078
18	-.800	-.800	-.800	.250	.855	-1.176	118	.750	.800	.600	.800	.867	.865
19	-.185	-.150	-.100	.978	.618	-.802	119	-.978	-.850	-.800	.468	.608	-.685
20	-.978	-.700	-.450	.936	.667	-.827	120	.388	.850	.300	.825	.335	.970
21	-.828	-.450	0	.978	.698	-.328	121	.478	.850	.825	.625	.497	.955
22	.978	.880	-.100	1.075	1.899	.818	122	.880	.150	.850	.325	.402	.622
23	0	.800	-.800	1.150	1.198	0	123	-.150	-.150	-.150	.600	.614	-.184
24	.385	0	.650	.638	.760	.488	124	.800	.800	.800	.850	.998	.284
25	.800	.400	.800	.850	.714	.430	125	.828	.100	.850	.478	.588	.431
26	-.078	.050	-.100	.978	.661	-.118	126	.150	.450	-.150	.825	.610	-.246
27	.100	.850	.150	.900	1.064	.062	127	-.150	.650	.150	.978	.680	-.81
28	.100	.050	.150	.850	.874	.865	128	.825	0	.450	.678	.804	.280
29	.800	.850	.150	.600	.430	.665	129	-.978	-.050	-.600	.613	.618	-.445
30	1.100	1.800	.600	1.400	1.660	.665	130	.100	.100	.100	.600	.781	.128
31	-1.000	-1.850	-.750	.700	.387	-1.167	131	0.960	.680	.650	.978	1.154	.045
32	.025	0	.050	.825	.756	-.053	132	-.028	-.800	-.800	.888	1.050	-.034
33	-.800	-.450	-.800	.800	.840	-.569	133	-1.485	-1.650	-1.800	.765	.998	-1.427
34	.128	-.800	.450	.638	.780	.107	134	.800	-.050	-.350	.950	1.134	.176
35	-.978	-.900	-.450	.468	.281	-1.151	135	.078	.850	.800	.325	.370	2.830
36	-.100	0	.050	.878	.678	-.147	136	-.978	-.600	-.400	.978	1.015	-.566
37	.800	.080	.950	1.700	1.748	.118	137	-.200	-.820	-.150	.600	.534	-.378
38	.800	.800	.300	.800	1.069	.568	138	-.978	-.450	-.100	.688	.867	-.317
39	.100	.050	.150	.380	.454	.815	139	-.950	-.800	-.400	.878	.519	-.8.978
40	-.880	-.850	-.800	.700	.701	-.356	140	-.400	-.800	-.600	.780	.779	-.978
41	-.350	-.650	.150	.978	1.018	-.848	141	.850	.050	.800	.978	.615	.318
42	-.180	-.350	.080	.850	.897	-.828	142	-1.350	-1.050	-1.050	1.450	1.565	-.864
43	.150	.800	.100	1.050	1.080	.189	143	-.650	-.850	-.850	.800	1.074	-.618
44	.078	-.300	.450	.728	.807	-.028	144	.300	.850	.850	.600	1.007	.298
45	.450	.550	.800	.600	.756	.294	145	-.800	-.600	-.600	.600	.767	-.638
46	.650	.800	1.000	.978	.848	.610	146	-.800	.750	.850	.780	.860	1.074
47	-1.150	-1.300	-1.000	1.050	1.181	-.000	147	.050	-.100	.800	.428	.522	.066
48	-.078	.100	-.850	.728	.618	-.068	148	.800	1.300	.800	.800	.925	.865
49	-.828	-.850	-.600	.978	.628	-1.483	149	-.928	-1.250	-.600	.715	.644	-1.026
50	-.700	-.850	-.550	.850	.650	-1.587	150	-.978	-.850	-.800	.238	.285	-.928

51	-.178	.400	-.760	1.068	1.848	-.140	181	-.475	-1.000	.000	-.888	.971	-.428
52	.828	.000	.600	.828	.996	.968	182	.100	.180	.000	.600	.600	.848
53	-.328	-.000	-.900	.828	.947	-.948	183	.488	.600	.800	.818	.818	.888
54	.800	.840	.800	.800	.828	.888	184	-.600	-.800	1.120	1.400	1.400	-.608
55	-.828	.180	-.600	1.078	1.818	-.180	185	-.960	.800	-.800	.700	.700	-.868
56	-.178	-.100	-.820	.968	1.168	-.180	186	-.780	-.780	.800	.800	.818	-.828
57	-.278	-.800	-.980	.978	.888	-.700	187	.088	-.180	.800	.688	.600	.048
58	-.800	-.860	1.000	1.878	-.828	.880	188	.828	.800	.788	.978	-.804	.777
59	.828	.080	.600	.880	.788	.808	189	-.478	-.800	-.460	.688	.817	-.861
60	.178	-.080	.600	.828	.854	.878	190	-.278	-.880	.800	1.878	1.881	-.180
61	.828	.480	.800	.828	.854	.888	191	.860	.100	.600	.800	.807	.884
62	-.828	-.700	-.980	.818	.707	-.480	192	-.680	-1.100	-.800	.800	.888	-.818
63	.828	.100	.820	.828	1.008	.884	193	.478	.800	.460	.818	.888	1.807
64	-.180	-.480	.180	-.180	.980	-.821	194	.800	-.100	.700	1.100	1.848	.884
65	-.100	.100	-.800	.700	.881	-.180	195	.100	.080	.800	.478	.810	.848
66	.828	.880	-.480	.978	.817	.878	196	.880	.800	-.400	1.820	1.878	.878
67	.880	.880	.800	.880	.880	.818	197	-.078	-.800	-.800	.828	.608	-1.480
68	.800	.600	.800	.800	.877	.818	198	.680	.980	-.080	1.828	1.470	.808
69	.688	-.800	-.880	.978	1.128	-.888	199	.700	.480	.900	.700	.887	.818
70	-.180	-1.080	-.880	.888	.748	-1.488	200	-.700	-.780	-.880	.480	.848	-1.808
71	1.100	.900	.800	.600	.474	.880	201	.100	-.080	.880	.600	.788	.188
72	-.878	.600	-.180	.688	.788	-.478	202	.888	.600	.880	.888	.888	.888
73	-.080	.880	-.800	.978	.898	-.078	203	.820	.800	.800	.880	.788	1.084
74	.828	.480	.600	.978	.884	.808	204	1.128	1.800	.780	.718	.844	-1.388
75	-.880	-.700	-.800	1.100	1.861	-.478	205	-.178	-.880	-.100	.828	.877	-.644
76	.178	.800	.180	.888	.884	.877	206	-.180	-.180	-.180	.480	.840	-.878
77	.480	.880	.800	.620	.808	.898	207	.888	0	-.480	.888	-.648	.848
78	-.828	-.480	-.820	.800	.867	-.618	208	.880	.480	.880	.480	.471	.748
79	.828	-.100	.180	.188	.817	.118	209	-.700	-.800	.800	.800	.817	-.748
80	.478	.600	.880	.688	.818	.748	210	-.188	-.480	.800	.878	.888	-.188
81	1.178	1.000	1.280	.878	1.218	1.088	211	.600	.800	.800	.800	.644	.821
82	-.800	-.700	-.800	.880	.618	-1.817	212	-.888	-.800	-.180	1.878	1.888	-.808
83	1.028	.900	1.080	.888	.784	-1.854	213	-.800	-.880	-.800	.800	.804	-.741
84	.880	0	.700	.988	1.127	.808	214	.080	-.100	.800	.888	.888	.180
85	.700	.800	.800	1.100	1.187	.800	215	-.700	-.480	.800	.800	.878	-1.087
86	-.828	-.480	-.700	.488	.884	-1.148	216	1.228	1.800	.878	.478	.860	.608
87	.180	.880	.800	.848	.680	.807	217	-.748	-.800	-.980	.888	.890	-.814
88	.800	.880	.800	.880	.841	.781	218	.878	.780	.788	0	.870	.888
89	.878	.480	.800	.888	.888	.888	219	0	.080	0	.880	.608	0
90	1.178	1.880	1.000	1.878	1.808	.898	220	.178	.180	.100	.780	.084	.808
91	1.080	1.400	.700	1.178	1.148	.898	221	.888	.880	.100	.878	1.087	.898
92	-.888	-1.100	-.780	1.878	1.808	-.618	222	-.888	-.880	-.880	.800	.800	-.747
93	.828	1.800	.800	1.178	1.881	.700	223	.880	.680	-.080	.700	.828	.848
94	-1.100	-1.100	-1.000	.800	.781	-1.887	224	.078	.880	.800	1.178	1.820	.080
95	-.180	.180	.100	.888	.810	-.844	225	.100	.080	.180	.780	.881	.117
96	-.800	-.680	-.180	1.800	1.781	-.180	226	.178	.178	.800	1.088	1.088	.181
97	-.180	-.600	.100	.880	.778	-.198	227	.800	.800	.800	.180	.188	.190
98	.100	-.800	.800	.800	.948	.104	228	.178	.100	.880	.878	.889	.811
99	-.878	-.180	-.800	.818	.618	-.808	229	-1.100	-1.100	-1.100	1.480	1.818	-.728
100	-.878	-.800	-.080	-.888	-.881	-.818	230	-.880	.800	-.800	.848	.888	-.804

TABLE D.—STATISTICS FOR DRAWINGS FROM NORMAL UNIVERSE—(Continued)

Sample Number	\bar{Y}	Median	Max. * Min. z	μ	σ	s	Sample Number	\bar{Y}	Median	Max. * Min. z	μ	σ	s
801	.188	.160	.100	1.485	1.508	.088	801	-.400	-.180	-.680	.480	.684	-.749
802	.478	.400	.660	.978	1.097	.497	802	.625	1.100	.180	1.018	1.198	.632
803	.400	.300	.400	.280	.308	1.498	803	.125	.700	-.680	.928	1.124	.111
804	-.678	-.880	-.400	-.828	1.028	-.656	804	-.100	-.100	-.100	1.750	1.888	-.034
805	.275	.460	.100	.975	.642	.428	805	-.325	-.300	.980	1.125	1.477	-.220
806	-.300	-.080	-.580	.808	1.002	-.899	806	.775	.600	.980	.925	.968	.601
807	-.378	-.280	-.500	.978	.602	-.623	807	-.880	-.400	-.300	.480	.817	-.677
808	.798	.700	.800	1.080	1.188	.688	808	-1.000	-1.000	-.200	.100	1.421	-.709
809	0	-.480	.280	.680	.878	0	809	.300	1.080	-.480	1.400	1.841	.163
810	1.100	1.080	.680	.480	.664	2.271	810	.325	.680	.100	.525	.421	.772
811	.780	.780	.780	.700	.728	.989	811	.400	.800	.600	.400	.474	.844
812	-.325	-.380	-.300	.975	.682	-.618	812	.125	0	.280	.258	.877	.401
813	-.300	-.300	-.300	.380	.480	-.698	813	-.475	-.400	-.680	.825	.602	-1.182
814	-.080	-.380	-.480	-.684	.975	-.654	814	-.275	.880	0	.778	.884	-.312
815	-.325	-.800	-.180	1.075	1.108	-.894	815	-.825	.880	.700	1.080	.758	-.713
816	-.475	-.380	-.600	.928	.975	-.468	816	.680	.880	.480	.678	1.118	.883
817	-.788	-.980	-.800	.388	.421	-1.728	817	.425	.100	.780	.858	1.018	.418
818	.380	.180	.680	.600	.728	.425	818	-.380	-.400	-.800	.800	.840	-.848
819	.175	.100	.280	.725	.740	.840	819	-.800	-.800	-.800	.800	.948	-.984
820	-.325	-.480	-.800	.418	.618	-.688	820	.028	-.100	.180	.825	.898	.028
821	.300	.180	.480	.860	.418	.718	821	-.385	-.680	0	.865	1.042	-.312
822	-.400	-.400	-.400	.380	.581	-1.080	822	-.880	.800	-.700	1.128	1.879	-.182
823	-.080	-.280	.180	.978	.828	-.060	823	1.100	1.200	1.000	.980	1.102	.928
824	-.300	-.180	-.480	.880	.418	-.718	824	.080	-.800	-.800	.800	.928	.684
825	.180	.800	-.800	1.180	1.221	.114	825	.028	-.080	.800	.625	.684	.059
826	-.225	-.100	-.880	.328	.870	-.608	826	-.180	-.080	-.280	.700	.789	-.180
827	.878	.780	.600	.888	.644	1.971	827	-.125	-.100	-.180	.288	.860	-.820
828	-1.078	-1.400	-.800	1.088	1.209	-.828	828	-.080	-.880	.625	.625	.738	-.680
829	.700	.700	.700	.700	.880	.814	829	-.175	-.280	-.100	.468	.642	.873
830	0	-.800	.800	.600	.700	0	830	-.225	-.380	-.100	.378	.488	-.498
831	-.080	.080	-.180	.680	.687	-.078	831	1.275	1.080	1.180	.925	.991	1.287
832	-.080	.880	-.980	1.478	1.710	-.089	832	0	.080	-.080	.880	.867	0
833	-.528	-.880	-.880	.478	.729	-.780	833	.200	0	.600	.480	.688	.828
834	.100	.180	.080	.480	.498	.802	834	-.878	-1.880	-.700	1.598	1.682	-.822
835	-.625	-.700	-.880	.925	.958	-.684	835	-.375	-.400	-.880	.825	.825	-.713
836	.880	.480	.680	.600	.701	.784	836	-.078	-.180	0	.825	.847	-.089
837	.700	.880	.880	1.080	1.087	.806	837	.700	.480	.980	.800	.898	.700
838	.878	.880	.400	.828	.828	2.010	838	.878	.080	1.200	1.218	1.477	.828
839	.678	.600	.600	.825	.878	.778	839	.680	.800	.800	.880	.880	1.045
840	.088	.680	.400	.428	.628	1.008	840	.125	-.180	.400	.468	.878	.217
841	-.625	-.880	-.880	.688	.856	-.780	841	-.225	-.800	.080	1.125	1.212	-.171
842	-.178	.180	-.880	.688	.778	-.228	842	.725	.700	.880	.925	1.064	.688
843	-.680	-.880	-.880	.400	.488	-1.484	843	.825	.880	1.080	.825	.825	.880
844	-.800	.880	.080	.684	.878	.880	844	.078	-.180	.800	.468	.845	.138
845	-.700	-.980	-.480	.800	.921	-.786	845	.175	.880	0	1.278	1.390	.182
846	.810	.180	-.180	.980	.998	.101	846	1.125	.980	1.800	1.178	1.231	.814
847	-.378	-.880	-.880	.628	.878	-.888	847	-.878	-.700	-.780	1.125	1.202	-.608
848	.125	.100	.180	.978	.778	.112	848	-.228	-.880	.878	.828	.828	.748
849	.180	.800	0	.600	.786	.804	849	.028	0	.080	.825	.878	.082
850	.878	.800	.280	.728	.828	.692	850	-.880	-.680	-.680	1.100	1.189	-.847

851	-1.080	-1.100	-.400	.360	.884	-4.980	861	-.388	.280	.400	1.178	1.080	-.884
852	0	.080	-.080	-.080	-.080	-.080	862	-.180	-.180	.800	.800	-.800	-.800
853	.480	.480	-.480	-.880	.818	1.411	863	0	-.080	-.080	-.080	-.080	0
854	-.400	-.400	-.400	.700	.748	-.488	864	-.888	-.888	-.400	1.478	1.468	-1.188
855	-.425	-.100	-.798	-.898	.818	-.468	865	.178	-.080	.400	-.818	.618	-.888
856	.188	-.180	.400	-.888	-.647	.138	866	.880	.480	-.080	1.880	1.888	.188
857	.888	.100	.880	.878	1.088	.818	867	.800	.980	.480	.800	1.088	.478
858	.480	.480	.480	.800	.888	1.844	868	0	.800	-.880	-.800	.878	0
859	.400	.880	.880	.800	.884	1.180	869	-.100	.080	-.880	.800	.647	-.180
860	.880	.180	.880	.700	.898	.878	870	-.880	-.880	.880	.880	1.188	-.800
861	.600	.880	.880	.880	.888	1.870	871	.180	.700	-.600	1.088	1.818	-.184
862	-.080	-.080	-.080	.800	.888	-.088	872	.400	.880	.880	.780	.888	-.468
863	.800	.800	.800	.600	.618	-.888	873	-.178	-.480	.100	.800	.688	-.818
864	-.780	.880	-.980	.780	.801	-.938	874	-.800	-.800	-.100	.800	.807	-.807
865	.880	.880	.880	.488	.818	1.078	875	.888	.800	-.880	.888	.880	8.118
866	.880	.880	.880	.788	.887	.404	876	-.878	-.800	-.880	-.888	.888	-.781
867	-.488	.080	-.800	1.868	1.607	-.884	877	.180	.680	-.180	.878	.607	-.184
868	-.880	.800	-.800	-.678	.888	-.898	878	-.800	-.880	-.480	1.880	1.888	-.484
869	-.680	-.880	-.880	.880	.888	-.848	879	.878	.080	-.600	.888	.780	-.888
870	.080	-.080	.180	.480	.871	.104	880	-.888	0	-1.080	1.088	1.887	-.481
871	-.880	.800	0	-.888	1.080	-.848	881	0	-.880	-.880	.880	1.088	0
872	-.800	-.080	-.680	.780	.881	-.448	882	.880	.800	.800	1.080	1.080	.881
873	-.788	-.880	-.800	-.678	.881	-1.848	883	-.880	.880	.480	.700	.782	.788
874	-.800	-.880	-.880	.700	.840	-.714	884	-.780	-.680	-.880	.888	.788	-1.018
875	.188	.800	-.080	-.878	1.118	.112	885	.100	.180	.080	.700	.784	.188
876	.178	.880	.100	.888	.848	.818	886	.480	.880	.880	.880	.788	.888
877	-.800	.800	-.600	.480	.884	-.872	887	.800	.100	.480	.888	.888	.888
878	-1.888	-1.080	-1.880	.788	.888	-1.808	888	-.178	-.800	-.180	.888	.888	-.811
879	-.878	-.880	0	-.888	1.078	-.888	889	.880	-.400	-.700	.778	.808	.878
880	.488	.880	.800	.878	1.114	.882	890	-.480	-.600	-.800	.800	.888	-.848
881	.800	.100	.880	.880	.880	.808	891	-.100	-.180	-.080	.700	.884	-.180
882	.188	.100	-.080	.878	.798	.197	892	.080	.880	-.180	.878	.701	.071
883	-.178	-.080	-.800	-.818	.877	-.404	893	1.100	1.880	.880	.800	.897	1.108
884	.700	.600	1.080	.700	.848	.888	894	-.128	-.600	1.068	-1.880	-.088	-.088
885	-.878	-.400	-.880	.878	.808	-.412	895	-.088	-.100	-.180	.888	.618	-.080
886	1.878	1.800	.880	.888	.840	8.860	896	-.800	-.780	-.800	.700	.888	-.808
887	-.800	-.180	-.880	.800	.884	-.808	897	.888	.880	.880	.888	.888	.784
888	-.380	-.480	-.880	.780	.788	-.448	898	.878	-.880	-.880	.888	.811	-.468
889	.800	.480	.800	.888	.888	.784	899	.778	1.100	.480	.788	.888	.814
890	.180	-.100	.800	.688	.788	.198	900	.088	.800	-.180	.688	.888	.064
891	-.188	-.080	-.800	.778	.788	-.108	901	.088	.180	-.100	.888	.878	.088
892	.880	.180	-.888	1.880	1.418	-1.418	902	.878	1.100	.880	.818	.888	.804
893	.788	1.080	-.480	.468	.840	1.848	903	-.888	-.800	-.880	1.888	1.888	-.680
894	-.800	-.800	-.700	.800	.888	-1.878	904	.080	.880	-.180	.800	1.088	.048
895	.478	.880	.600	.888	.880	.478	905	-.780	-.600	-.800	.800	.897	-1.088
896	-.800	-.800	-.100	-.888	.787	-.888	906	-.888	-.800	-.800	.784	.784	-.888
897	1.180	.700	1.800	.878	1.088	1.188	907	-.888	-.600	-.480	.688	.880	-.888
898	.680	.800	.600	1.800	1.418	.488	908	.180	.180	.800	.800	.880	.888
899	.800	.480	0	.780	.841	.812	909	0	.680	.800	.880	.880	0
900	-.888	-.888	-.888	-.888	-.888	-.888	910	-.178	.800	-.080	.878	.101	-.184

APPENDIX II

TABLE D.—STATISTICS FOR DRAWINGS FROM NORMAL UNIVERSE—(Continued)

Sample Number	\bar{X}	Median	Max. + Min. s	μ	σ	s	Sample Number	\bar{X}	Median	Max. + Min. s	μ	σ	s
401	-.100	-.100	-.100	.400	.447	-.224	801	.375	-.200	.050	.875	.780	.493
402	.400	.600	.800	.750	.941	.485	802	-.750	-.700	-.800	.800	.868	-1.305
403	.850	.450	.850	.178	.805	1.707	803	-.850	-1.100	-.900	.978	1.229	-.692
404	.500	.450	.550	.700	.718	.696	804	.650	.750	.700	.807	.807	.682
405	.175	.200	.150	.425	.536	.326	805	0	-.050	.050	.800	.255	0
406	-.575	-.650	-.500	.828	.735	-.784	806	.375	.250	.800	.925	1.213	1.309
407	.400	.650	.150	.500	.599	.671	807	-.875	-.550	-.800	.875	.568	-1.616
408	0	-1.100	.150	.450	.574	0	808	-.325	-.250	-.400	.855	.402	-.803
409	-.025	-.400	.850	.663	.773	-.383	809	.400	.550	.250	.600	1.017	.393
410	-.725	-.350	-.900	.725	.836	-.869	810	-.100	-.300	.100	.800	.503	-.199
411	.425	.550	.300	.475	.669	.721	811	.325	.150	.500	.438	.586	.618
412	-.825	-.700	-.950	.876	.901	-.915	812	.875	.580	.600	.825	.654	.908
413	-.225	-.050	-.400	.928	.750	-.300	813	.325	.400	.250	.628	.708	.459
414	.650	.650	.650	.700	.701	.927	814	1.050	1.150	1.150	1.150	1.289	.915
415	0	.350	-.350	1.050	1.177	0	815	.250	.280	.200	.205	1.219	
416	-.300	-.450	-.150	.300	.567	-.817	816	-.150	-.250	-.050	.400	.438	-.342
417	.825	.100	-.350	.338	.410	-.848	817	.325	.450	.200	1.475	1.467	.223
418	-.475	-.850	-.400	.978	.402	-1.182	818	.828	.700	.850	.836	.415	1.988
419	.100	.150	.050	.850	.941	.108	819	0	.200	-.200	.950	1.116	0
420	.350	-.100	.800	1.175	1.432	.244	820	-.875	-.800	-.850	.488	.614	-1.099
421	-.200	0	-.400	.600	.674	-.348	821	-.250	-.450	-.050	1.078	1.593	-.179
422	-.150	-.500	.200	.950	1.071	-.160	822	.225	.150	.500	.636	1.134	1.198
423	.125	.150	.100	.975	.497	.232	823	-1.000	-.900	1.100	.650	.887	-1.167
424	-.175	-.300	-.050	1.375	1.421	-.122	824	.450	0	.900	1.075	1.266	-.350
425	-.675	-.800	-.650	1.225	1.462	-.456	825	-.450	-.850	-.050	.925	1.122	-.369
426	-.250	-.100	.250	.325	.568	-.652	826	.525	.400	.650	.675	.835	.622
427	.200	.100	.300	.350	.612	-.367	827	.675	.600	.850	.738	.965	.899
428	-.175	-.600	.280	1.075	1.249	-.112	828	.800	.950	.850	1.130	1.547	.456
429	-.075	-.100	-.050	.875	.773	-.097	829	-.125	-.400	-.150	.775	.950	-.132
430	.550	.450	.850	.408	.438	1.255	830	-.625	-.750	-.500	1.025	1.068	-.585
431	.850	1.250	.450	.875	1.035	.821	831	.300	.450	.150	1.850	1.866	.189
432	-.825	-.350	.325	.897	-.397	-.778	832	.775	.650	.800	.536	.396	1.958
433	.975	.800	1.150	.975	.879	1.109	833	.475	.700	.250	.975	.784	.703
434	-.600	-.850	-.250	.850	.972	-.617	834	.100	0	.200	.750	.797	.126
435	-.075	.100	.975	.879	-.853	-.853	835	.075	.050	.100	.725	.729	.103
436	.450	-.250	1.150	1.075	1.242	.368	836	0	.250	.250	1.130	1.217	0
437	-.925	-1.000	.407	-.925	.354	-2.593	837	.325	.350	.500	.475	.326	.618
438	.825	.200	.470	.975	.393	.867	838	-.300	-.100	.800	.850	.636	-.472
439	.325	.450	.846	.675	.864	.376	839	-.600	-.350	-.850	.850	.632	-.920
440	.950	.800	.501	.400	.471	2.019	840	1.000	.650	.950	.650	.758	1.319
441	.050	.300	.995	.475	.972	.087	841	-1.425	-1.450	-.900	.475	.658	-2.233
442	.250	.350	.350	.425	.540	.425	842	-.025	.100	-.200	.725	.636	-.027
443	.650	.500	.835	.425	.822	1.245	843	.480	.100	.800	.850	1.052	.452
444	.025	.200	1.661	1.325	1.475	.017	844	.280	.950	-.450	1.330	1.556	.761
445	.480	.800	.976	.300	.319	1.411	845	.400	.950	-.150	1.000	1.190	.336
446	-.225	.300	.945	.975	.387	-.994	846	.875	.800	.880	.488	.618	1.092
447	.425	.250	1.150	1.145	1.410	.331	847	.325	.650	0	.855	.779	.417
448	.825	.650	1.034	.825	.844	.978	848	.475	-.600	-.350	.675	.853	-.359
449	.400	.400	.752	.600	.600	.667	849	.400	.800	0	1.050	1.221	.320
450	-.150	-.200	.752	.600	.654	-.227	850	-.125	0	-.250	.425	.460	-.272

451	.800	.350	.501	.400	.468	.412	861	.180	-.180	-.180	.800	.862	.897
452	.800	-.180	.869	.800	.636	.314	862	-.078	-.100	-.080	.678	.698	-.107
453	.778	1.000	.484	.888	.290	1.097	863	.778	1.080	.800	.788	.978	.794
454	.800	1.350	1.228	1.000	1.178	.621	864	-.888	-1.080	-.800	-.683	.354	-1.480
455	.820	.150	.801	.400	.458	.971	865	-.478	-.800	-.680	.688	.908	-.674
456	.228	.180	.882	.228	.249	.904	866	-.978	-1.800	-.800	.928	.898	-.418
457	1.078	1.800	.853	.485	.460	2.388	867	.680	.880	.880	1.600	1.218	.348
458	-.100	-.350	1.228	1.000	1.098	-.078	868	.800	0	-.600	.800	.848	-.318
459	.028	.180	.971	.778	.817	.308	869	-.100	.880	-.800	.800	1.088	-.098
460	.800	.100	.758	.800	.748	.401	870	-.478	-.800	-.400	.978	.408	-1.182
461	.100	.100	1.708	1.400	1.780	.058	871	.888	-.080	.900	.888	1.078	.328
462	.078	.800	1.410	1.128	1.228	.998	872	-.480	-.900	-.800	.928	1.188	-.508
463	0	.080	.669	.850	.688	0	873	.800	.180	.280	1.180	1.168	-.171
464	.828	1.100	.748	.618	.736	1.121	874	.800	0	.400	.800	.616	.328
465	.180	.800	.977	.900	.908	.812	875	-.978	-.180	-.600	.978	.468	.537
466	.600	.800	.687	.800	.612	.960	876	1.800	-1.180	-.780	.900	.904	-1.200
467	-.978	-.350	.658	.828	.807	-.441	877	-.700	-.900	-.800	.880	.636	-1.100
468	-.478	-.080	.898	.838	.898	-1.610	878	-.800	-1.100	1.800	1.238	-.730	
469	-.800	-1.000	.977	.900	.978	-.918	879	1.178	1.480	.800	.688	.976	2.040
470	-.180	0	.407	.328	.890	-.388	880	1.000	-.900	-1.100	.900	.844	-1.188
471	-.100	.800	1.804	1.800	1.458	-.070	881	-.828	-.600	-.380	.818	.859	-2.028
472	.028	-.180	.781	.878	.648	.039	882	-.078	-.380	.800	.978	1.099	-.068
473	-.800	-.800	.813	.850	.874	-1.098	883	.800	.400	.800	1.800	1.610	.974
474	-.978	-.800	1.288	1.028	1.318	-.829	884	-.900	-.820	-1.180	.800	1.007	-.588
475	-.078	-.180	.888	.888	.888	-.824	885	-.420	-.420	-.800	.884	.884	-.644
476	.800	.460	.684	.460	.524	.868	886	.028	-.060	.100	.978	.444	.054
477	.180	-.880	1.289	1.028	1.268	.184	887	-.800	-.800	-.800	.800	.781	-.204
478	-.978	-.450	.974	.888	.668	-.411	888	-.388	-.480	-.800	.828	.687	-.498
479	.800	.180	1.188	.800	1.098	.458	889	-.100	.280	-.480	.800	.951	-.108
480	-.880	-.600	.107	.128	.148	-.374	890	.888	.800	-.400	.628	.478	1.108
481	.028	-.800	.768	.628	.740	.328	891	-.428	.280	.800	.648	.861	.731
482	.828	.850	1.034	.828	.907	.910	892	.828	.100	.280	.888	.863	.488
483	.978	.300	.627	.800	.618	.732	893	.980	1.000	.800	.480	.476	1.998
484	.100	.080	.978	.800	.339	.898	894	.800	.800	.900	.900	.788	.818
485	.178	.180	1.347	1.078	1.113	.184	895	-.128	-1.180	-.300	.978	.603	-.338
486	.978	.800	.407	.328	.402	.604	896	-.178	0	-.380	.778	.841	-.808
487	-.180	-1.200	.801	.400	.508	2.291	897	-.028	.280	-.300	.628	.847	-.028
488	-.350	.780	1.978	1.100	1.293	-.229	898	-.220	.800	-.680	1.048	.863	-.818
489	.680	.980	.768	.483	.748	.873	899	.800	0	-.600	.900	.256	-.427
490	-.850	-.460	.921	.978	.980	-.723	900	-1.000	-.880	-1.280	.930	.928	-1.180
491	.800	.180	.618	.680	.731	.410	901	-.800	-.100	-.300	.800	.848	-.618
492	.128	.800	.971	.778	.798	.187	902	-.880	-.880	-.400	.680	.642	-.740
493	-.428	-.380	.178	.188	.184	-2.900	903	-.828	-1.280	-.400	.918	1.068	-.768
494	.278	.800	1.034	.828	.930	.868	904	.800	.480	.280	.680	.697	.610
495	.900	.880	.908	.800	.911	.984	905	0	-.100	.100	.800	.788	0
496	.100	-.800	-.688	.880	.880	-.644	906	-.980	-.180	.978	.800	.878	-.970
497	.300	-.450	1.247	1.078	.960	.813	907	-.180	-.800	-.080	.828	.622	-.801
498	-.478	-.080	1.207	.968	1.186	-.411	908	.988	.800	.628	.763	.388	.388
499	.028	0	.788	.828	.956	.381	909	-1.080	-.680	-1.480	.978	1.180	-.800
500	-.478	.800	.971	.778	.811	.683	910	.800	.980	.800	.800	.824	1.287

TABLE D.—STATISTICS FOR DRAWINGS FROM NORMAL UNIVERSE—(Continued)

Sample Number	\bar{X}	Median	Max. + Min. 2	μ	σ	s	Sample Number	\bar{X}	Median	Max. + Min. 2	μ	σ	s
601	-.365	-.500	.400	.683	.676	.461	701	-.278	0	-.050	.618	.789	-.277
602	-.800	-.800	-.300	.800	.824	-1.679	702	.275	-.850	.300	.478	.638	-.431
603	-.275	.750	.600	.976	.623	1.026	703	.478	.800	.150	.928	1.076	-.430
604	.750	.850	.350	.750	.656	-.276	704	-.450	-.850	-.250	1.000	1.114	-.404
605	-.450	-.550	-.250	.350	.415	-1.026	705	1.400	1.111	.900	.600	.707	1.980
606	.275	.450	.700	.976	1.114	.616	706	-.200	-.350	-.050	.800	.623	-.318
607	.075	.100	.030	1.176	1.128	.063	707	.180	.850	-.050	.776	.976	-.154
608	.625	.700	.200	.463	.563	.938	708	-.450	-.750	-.150	.850	.956	-.458
609	-.450	-.600	-.300	.925	.795	-.566	709	.100	.100	.100	.650	.627	-.150
610	-.225	-.400	-.080	.718	.904	-.249	710	-.300	-.450	-.150	.800	.567	-.617
611	-.300	-.650	.050	.600	.696	-.431	711	.075	.050	.100	.375	.497	-.151
612	-.250	-.400	-.100	.376	.485	-.549	712	.075	0	.180	.675	.701	.107
613	-.275	.100	-.450	.618	.923	-.390	713	-.125	-.250	0	.625	.637	-.190
614	-.250	-.600	.100	1.300	1.591	-.127	714	-.375	-.050	-.700	.363	.611	-.527
615	.375	.400	.900	.925	1.018	.368	715	-.275	-.750	-.400	.623	.672	-.255
616	-.200	-.300	-.100	.430	.679	-.346	716	-1.125	-1.150	-.800	.375	.365	-2.840
617	.780	.050	.100	1.080	.675	1.111	717	.025	.200	-.250	.675	.934	.027
618	-.325	-.450	.800	.925	.980	-.542	718	-.025	.800	-.250	.438	.631	-.047
619	.250	.050	.850	.850	.892	-.625	719	.375	.250	1.300	.965	1.135	.653
620	.125	-.250	.800	.628	.601	1.06	720	.150	.400	-.100	.800	.923	.162
621	-.525	-.100	-.950	1.036	1.260	-.417	721	-.125	-.800	.050	1.125	1.160	-.108
622	-.100	.150	.200	.200	.205	.752	722	.800	.450	.350	.200	.255	1.950
623	-1.125	-1.100	-1.030	.723	.795	-1.415	723	.625	.950	.300	.963	1.131	.529
624	-.275	-.350	-.600	.625	.678	-.259	724	.625	.650	.800	1.175	1.131	.529
625	.700	.250	1.150	1.100	1.332	.656	725	.800	.850	.350	.800	.927	.608
626	.200	.500	-.100	.650	.768	.260	726	-.275	-.100	-.450	.563	.427	-.644
627	.425	.450	.400	.625	.644	.504	727	-.250	-.150	-.350	1.050	1.324	-.199
628	.300	.200	.600	1.300	1.221	.246	728	-.025	-.100	-.050	.625	.549	.046
629	.050	0	.100	1.800	1.301	.254	729	-.450	-.250	-.200	1.051	-.119	
630	.350	.100	.600	.950	.779	.449	730	.300	-.150	-.450	.250	.544	-.466
631	.450	.150	.750	.980	1.031	.436	731	.300	-.100	.700	1.150	1.298	.231
632	.600	.630	.400	.300	.534	1.695	732	.250	.400	.050	.900	1.128	.222
633	.200	0	-.400	1.300	1.760	.112	733	.025	.100	-.050	.976	.642	.039
634	-.100	0	-.200	.750	.771	-.150	734	.625	.450	.250	.625	.616	2.195
635	-.075	-.500	-.200	.418	.497	-1.356	735	.350	.900	.800	.976	1.132	.309
636	-.125	-.150	-.100	.525	.554	-.226	736	-.175	-.250	-.100	.976	1.050	-.170
637	1.025	.750	1.800	.775	.923	1.107	737	-.850	-.850	-.250	.180	.179	-4.780
638	.100	.200	0	.560	.679	.173	738	-.325	-.150	-.500	.475	.554	-.537
639	.025	-.050	.100	.238	.293	.065	739	.275	.650	.650	.675	.701	1.391
640	.175	.100	.250	.275	.353	.522	740	-.350	-.800	.100	.958	1.125	-.499
641	-.275	-1.150	-.700	1.075	1.256	-.756	741	.775	1.400	.150	1.238	1.451	.534
642	.750	.750	.750	1.000	.960	.761	742	.350	.250	.450	.850	.907	.398
643	.925	.650	1.000	.638	.760	1.218	743	.125	.300	-.050	.663	.563	.222
644	.200	.800	-.100	1.080	1.210	.153	744	.325	.450	.800	.675	1.023	.316
645	-.775	-.350	-.600	.418	.492	-1.276	745	-1.300	-1.600	-1.100	.923	1.050	-1.310
646	-.675	-.850	-.300	.275	.642	-1.031	746	-.400	.500	-.500	.800	.927	.431
647	-.425	-.550	-.300	.725	.934	-.465	747	-.600	-.750	-.450	.800	.543	-1.105
648	-.800	-.800	-.400	.300	.316	-2.531	748	.025	.100	-.050	.475	.512	.049
649	-.350	-.250	-.850	.850	.966	-.584	749	-.300	-.400	-.200	1.350	1.298	-.213
650	.250	-.300	.500	.676	1.013	-.847	750	.100	-.500	.250	.850	.644	.135

82L	.100	.080	.820	.800	.961	-.100	78L	-.220	.800	-.480	.970	1.177	-.100
82M	-.288	.180	1.070	1.170	1.191	.101	78M	0	-.800	-.800	.860	.688	.688
82N	-.100	.100	.780	.740	1.391	-.131	78N	-.670	-.600	-.880	1.640	.740	-.680
82A	-.800	-.800	.600	1.891	-.070	78A	-.970	-.100	1.880	1.880	1.640	-.100	-.100
82B	1.000	.880	.880	.400	.810	1.840	78B	-.880	-.880	-.880	.880	.880	-.100
82C	-.880	-.780	-.800	.820	.860	-.864	78C	-.970	-.800	-.880	.880	.880	-.100
82D	-.800	-.800	-.600	.400	.474	-.174	78D	.870	.780	-.800	.880	1.080	.884
82E	-.880	-.880	.800	.801	-.830	78E	.870	1.080	.900	.780	.780	.780	1.101
82F	-.800	-1.100	.100	1.130	1.840	-.870	78F	-.870	-.880	-.880	.880	.880	-.680
82G	.880	-.800	.700	1.970	1.460	.140	78G	.880	-.600	1.080	1.080	1.800	.081
82H	-.680	-.800	-.480	.860	1.110	-.840	78H	.070	-.680	.400	.640	.770	.080
82I	1.180	1.100	1.000	1.000	1.094	78I	.800	.800	.100	.800	1.640	.400	.400
82J	.970	.400	.800	.820	.909	.630	78J	.800	-.100	.800	1.180	1.640	.180
82K	-.800	-.600	0	1.800	1.870	-.140	78K	.880	0	-.180	.440	.780	-.090
82L	.180	-.800	-.100	.480	.810	.864	78L	.970	.900	1.080	.870	.990	.977
82M	-.600	-.600	.880	.710	.830	-.080	78M	.880	.800	.800	.870	.870	.881
82N	-.880	.800	0	.870	.804	.650	78N	.880	.880	.800	.900	.904	.880
82O	.880	.170	.180	.800	.780	-.897	78O	.820	.600	.800	.440	.810	1.080
82P	-.100	-.100	-.100	-.780	.830	-.100	78P	.870	.880	.800	.870	.810	1.140
82Q	.880	.700	0	.640	.781	.480	78Q	.870	.800	.080	.880	1.087	.880
82R	.080	.100	-.100	.880	.890	-.641	78R	.880	.800	.800	.870	.887	1.070
82S	.970	.800	.980	.860	.490	1.297	78S	.870	.880	.800	.870	.870	.970
82T	-.070	-.880	.800	.880	.710	-.100	78T	.880	.600	.800	1.100	1.884	.480
82U	.480	.800	.680	1.280	1.840	.810	78U	.870	.700	.880	.870	.880	2.860
82V	-.280	0	-.480	1.180	1.100	-.180	78V	.870	-.080	.800	1.070	1.880	.880
82W	.880	.880	-.680	.800	.887	-.817	78W	.870	.880	.880	1.870	1.864	.877
82X	-.100	-.100	-.100	.800	.480	-.800	78X	.880	.800	.680	.870	.880	1.107
82Y	1.080	.800	1.000	.830	.780	1.899	78Y	.800	.880	.480	1.800	1.880	.884
82Z	-.100	-.800	.080	.780	.791	-.140	78Z	-.680	-.880	-.700	.880	.780	-.780
830	.880	.880	-.100	1.180	1.080	.810	780	-.820	-.600	.100	1.000	1.171	-.810
831	-.870	-.600	-.180	.770	.810	-.890	781	-.870	-.480	-.700	.970	.884	-.744
832	.880	.820	.480	.470	.810	.874	782	-.900	-.880	-.980	.700	.877	-.840
833	.870	.600	.180	.870	.890	.894	783	.870	.100	.480	.780	.770	.880
834	.870	.400	.800	.870	.881	-.640	784	-.880	-.180	-.880	.880	1.080	-.880
835	-.870	-.880	-.880	-.880	-.880	-.880	785	.080	.800	.880	.880	.877	.080
836	.880	.880	.480	.880	1.000	.880	786	.820	.800	.800	.800	.880	.803
837	.880	.180	.880	.800	.877	.801	787	-.070	-.800	.080	.880	.876	-.180
838	.880	.880	.680	.880	.880	.710	788	-.870	-.880	-.400	.880	.887	-1.480
839	1.100	.780	.880	.880	.880	1.780	789	.870	.600	.880	.880	.880	.880
840	.170	.680	-.800	1.180	1.870	.180	790	.180	.800	0	1.100	1.880	.110
841	.880	.880	.880	.880	1.167	.800	791	.780	.800	.880	.880	.870	1.070
842	.880	.880	0	.800	.880	-.810	792	.070	.800	1.680	1.880	.880	.080
843	-.170	0	-.880	.880	.880	-.880	793	.840	.800	.880	.880	.870	.880
844	.880	.880	.880	.880	.880	.810	794	.700	.800	.600	.800	.780	.880
845	-.600	-.880	-.880	.800	.880	-.840	795	-.880	-.800	-.780	.870	.880	-.880
846	-.870	-.600	-.600	.780	.877	-.810	796	.870	.700	.880	.880	.860	1.820
847	-.180	.880	0	.800	.880	-.170	797	.870	.800	.780	.880	.900	.707
848	-.480	-.680	-.800	.640	.840	-.780	798	-.880	-.180	-.800	.880	.780	-.640
849	-.180	-.680	.100	.870	.880	-.800	799	-.600	-.600	-.600	.880	.880	-.814
850	-.880	-.880	-.880	.880	.780	-1.804	800	.880	.600	.880	.880	.880	.780

APPENDIX II

TABLE D.—STATISTICS FOR DRAWINGS FROM NORMAL UNIVERSE—(Continued)

Sample Number	\bar{Y}	Median	Max. + Min. Σ	μ	σ	s	Sample Number	\bar{Y}	Median	Max. + Min. Σ	μ	σ	s
801	-.275	-.300	-.800	.775	.644	-.325	901	-.625	-.600	-.850	.138	.178	-5.490
802	-.975	-1.000	-.825	.825	.299	-3.765	902	.075	.200	-.100	.728	.948	-.080
803	.300	.100	.600	.600	.671	.447	903	-.900	-.700	-.680	.650	.625	-1.874
804	-.300	-.350	-.150	.600	.696	-.718	904	.500	.700	.300	1.800	1.548	.318
805	-.050	-.050	-.080	.400	.531	-.094	905	.775	.800	.650	.868	.990	1.697
806	-.325	-.400	-.300	.375	.471	-.680	906	.850	.800	.900	.750	.792	.316
807	-.175	-.500	-.180	.488	.563	-.311	907	-.800	-.800	-.100	.600	.738	-.407
808	.375	.100	.690	1.125	1.270	.898	908	-.100	-.050	-.120	.450	.604	-.166
809	-.300	.100	-.700	1.050	1.210	-.948	909	.400	.300	.450	.250	.384	-1.254
810	-.225	-.100	-.350	.825	.415	-.542	910	-.225	-.150	-.800	.675	.658	-.264
811	-.125	-.150	-.100	.685	.789	-.171	911	.875	.450	.100	.975	1.016	.271
812	.300	.350	.300	.400	.408	.871	912	-.900	-.600	-.400	.400	.459	-1.091
813	-.400	-.200	-.600	1.080	1.185	-.556	913	.250	.800	.900	.450	.476	.225
814	-.425	-.650	-.500	.415	.312	-.850	914	-.130	-.100	-.200	.400	.416	-.561
815	-.325	-.550	-.100	.915	1.016	-.520	915	.175	.180	.200	.875	.818	.285
816	-.825	-.650	-.700	.475	.525	-1.569	916	.675	.800	.850	.825	.673	.773
817	-.375	-.200	-.250	.368	.427	-.678	917	-.025	.900	-.850	1.188	1.416	-.018
818	.125	-.150	.400	.598	.701	.178	918	-.075	.350	-.600	1.315	1.616	-.040
819	.425	.080	.600	.998	1.203	.363	919	-.975	-.600	-.250	.925	1.055	-.541
820	-.450	0	-.900	.928	.958	-.497	920	.825	.450	.850	.625	.733	.716
821	.575	.600	.250	.225	.228	2.321	921	-.075	.100	-.050	.975	.602	-.125
822	.250	0	.500	.800	.690	.821	922	.175	.500	-.150	.728	.932	.194
823	0	-.150	.150	1.050	1.172	0	923	-.220	-.400	-.100	1.125	1.490	-.168
824	-.075	0	-.150	.375	.421	-.179	924	.650	-.720	-.650	.650	.944	-.689
825	.675	1.000	.250	.636	.774	.670	925	.875	.800	0	.768	.976	.232
826	-.175	.050	-.400	.725	.807	-.217	926	-.225	-.800	.050	.455	.536	-.420
827	-.050	.100	-.200	.850	.622	-.080	927	.050	.100	0	.300	.363	.138
828	.750	.650	.300	.225	.228	.220	928	-.275	-.980	0	.668	.694	-.360
829	.525	.650	.600	.275	.366	1.475	929	.875	-.350	-.800	.738	.993	-.277
830	-.450	-.350	-.500	.450	.359	-.902	930	.450	-.500	-.200	.450	.524	.163
831	.325	.150	.800	.625	.705	.441	931	-.975	-.650	-.800	.359	.577	-.595
832	-.825	-1.050	-.600	.613	.743	-1.110	932	.050	0	.100	.750	.689	.090
833	.825	.400	.250	.128	.217	2.420	933	.125	.250	0	.625	.621	.129
834	.450	.600	.400	.580	.606	.742	934	-.225	.900	-.650	1.088	1.297	-.173
835	-.225	-.480	0	1.175	1.305	-.172	935	-.600	-.350	-.600	.654	.814	-1.124
836	-.450	-.450	-.480	.900	.359	-.805	936	.675	.800	.950	.225	.229	1.635
837	-.175	.250	-.600	1.013	1.222	-.143	937	.025	.300	-.250	.663	.676	.087
838	-.625	-.200	-.600	.638	.756	-.665	938	.975	.950	.700	.368	.502	1.744
839	.500	.650	-.050	.700	.699	.362	939	-.825	-.600	-.850	.458	.602	-1.370
840	-.925	-.650	-1.100	.668	.844	-1.025	940	.125	-.100	.300	1.132	1.473	.065
841	-.975	-.450	.900	1.075	1.151	.602	941	.525	.350	.900	.375	.427	.654
842	-.075	-.200	.050	.625	.766	-.098	942	.050	-.250	.350	.925	1.137	.044
843	.300	.280	.380	.750	.778	.326	943	.325	.800	.180	.625	.597	.245
844	.325	.200	.480	.575	.698	.464	944	-.600	-.130	-1.050	1.200	1.394	-.431
845	-.350	-.200	-.400	.275	.319	-1.097	945	.550	.550	-.100	.650	.680	.606
846	.475	.650	.200	1.425	1.450	.322	946	.100	-.250	.250	.350	.418	.876
847	1.600	1.650	.850	.400	.430	3.720	947	-1.100	-1.000	-.800	.500	.592	-1.556
848	-.250	.200	-.800	1.000	1.205	-.208	948	.425	.450	.400	.485	.507	.838
849	1.300	1.450	.850	.280	.418	3.110	949	-.025	-.430	-.400	.975	1.146	-.022
850	.075	.050	.100	.678	.712	.105	950	.100	.700	-.600	1.050	1.219	.028

851	-.800	-.850	.800	.800	1.058	-.891	951	0	.800	-.800	.800	.648	.0
852	-.100	-.050	-.850	.800	.879	-.179	952	-.888	.850	0	.818	.978	-.888
853	-.800	-.600	.800	.800	.800	-.800	953	-.800	-.800	-.800	.800	.800	-.800
854	-.058	-.100	-.150	.725	.769	-.058	954	-.800	-.120	-.850	.800	.800	-.800
855	-.478	-.800	-.480	.878	.773	-.414	955	-.828	-.680	-.800	.488	.608	-1.870
856	-.878	.850	.800	.778	.894	.631	956	-.628	.850	.700	.878	.614	1.018
857	-.050	-.150	-.800	.800	.800	-.799	957	-.800	-.100	.400	.400	.647	-.898
858	-.078	-.100	-.050	.778	1.088	-.078	958	.600	.600	.800	.800	.800	1.148
859	-.828	-.800	-.150	.828	.608	-.860	959	-.828	-.880	-.800	.878	.641	-.784
860	-.180	.800	0	.428	.817	.890	960	-.878	-.800	-.700	.878	1.018	-.888
861	.878	.800	.850	.888	.808	-.894	961	.800	.700	.800	.800	.848	1.098
862	-.450	-.850	-.850	.600	.438	-1.087	962	.878	1.050	-.800	1.168	1.888	.871
863	-.078	-.850	.100	.738	.848	-.080	963	-1.428	-1.400	-.700	.428	.838	-8.608
864	.050	.180	-.050	.800	.898	.058	964	.100	.150	.050	.800	.887	.170
865	.178	-.050	.400	1.461	1.180	.180	965	.100	.850	-.050	.800	.844	.180
866	-.100	-.050	-.180	.600	.480	-.838	966	.128	0	.250	.888	.887	.188
867	.100	.050	.180	1.800	1.210	-.088	967	.778	1.080	.500	.728	.888	.848
868	-.800	.050	-.480	.850	.784	-.858	968	.428	.800	.880	.728	.768	.858
869	.178	.180	.800	.878	1.081	.171	969	.800	.630	.850	.400	.428	1.968
870	-.400	-.850	-.480	.600	.884	-.748	970	-.028	.050	-.100	.888	.877	-.054
871	.888	.800	.480	.888	.460	.708	971	-.828	-.400	-.050	.648	.838	-.858
872	.800	.800	.600	.850	.779	.884	972	-.828	-.100	-.850	.878	.680	-.844
873	-.828	-.850	-.850	.888	.888	-.476	973	.850	-.050	.180	.878	.471	.108
874	.788	1.000	-.480	.618	.788	-.898	974	.480	.850	.250	.780	.928	.488
875	.800	.858	.350	.850	.761	.788	975	-.800	-.800	-.700	.480	.888	-.888
876	-.828	-.850	-.100	.878	.888	-.888	976	-.800	-.850	-.880	.400	.474	-1.888
877	.428	.700	.180	.878	1.217	.849	977	-.800	-.800	.100	.780	.888	-.818
878	.888	.800	.400	.888	.484	.818	978	-.878	-.850	-.100	.078	.884	-6.488
879	.800	.180	.450	.880	.418	.718	979	.480	.800	.400	.480	.680	.878
880	0	-.100	.100	.800	.681	0	980	1.880	1.880	1.000	1.168	1.078	
881	-.800	-.400	-.800	.600	.408	-.680	981	-.128	.880	.100	.688	.854	-.888
882	-.478	-.800	-.450	.828	.817	-.888	982	.028	.850	-.100	.648	.817	-.881
883	-.180	-.850	-.050	.780	.814	-.184	983	-.850	-.890	-.850	.800	.888	-.688
884	.180	0	.800	.888	.890	.884	984	-.078	0	-.180	1.168	.188	-.891
885	.480	.480	.880	.180	.178	8.318	985	-.100	.800	-.880	1.880	1.818	-.068
886	.878	0	.850	.778	.850	.800	986	.800	.100	-.050	.800	.877	1.608
887	.880	.800	.800	.880	1.188	.488	987	-.888	-.480	1.138	1.887	-.800	
888	.700	.800	.800	.600	.738	.888	988	.128	.100	.180	.888	.881	.888
889	1.000	.850	1.180	.800	.844	1.077	989	-.888	-.880	-.100	.878	.878	-.888
890	.050	0	.100	.178	.817	.817	990	-.180	.878	0	.818	.818	-.841
891	.600	.400	.800	.400	.861	1.108	991	-.600	-.800	-.480	.800	.408	-.880
892	.728	.780	1.080	1.180	1.800	.888	992	-.178	-.800	-.100	1.488	.880	-.818
893	.078	-.100	.880	.418	.878	.188	993	.600	.800	.250	1.880	1.884	.887
894	-.878	-.850	-.450	.778	.788	-.880	994	-.800	0	-.800	.480	.777	-.878
895	.188	.100	.858	.618	.808	.808	995	.878	1.000	-.450	1.888	1.810	.188
896	-1.128	-1.000	-.850	.488	.460	-8.448	996	1.180	1.880	.980	1.800	1.171	.888
897	-.428	-.050	-.800	.688	.801	-.861	997	-.800	-.100	-.700	.800	.870	-.888
898	-.100	.180	-.850	.880	.888	-.148	998	-.178	-.888	-.100	.478	.881	-.801
899	-.828	-.880	0	1.078	1.098	-.808	999	.888	.800	.380	.828	.877	1.178
900	-.850	-.880	.080	1.080	1.801	-.808	1000	-.820	-.680	.180	.728	.844	-.898

APPENDIX II

TABLE E.—STATISTICS FOR DRAWINGS FROM RECTANGULAR UNIVERSE

Sample Number	\bar{Y}	σ	s	Sample Number	\bar{Y}	σ	s	Sample Number	\bar{Y}	σ	s	Sample Number	\bar{Y}	σ	s	Sample Number	\bar{Y}	σ	s
1	-.028	1.112	-.028	101	-.175	1.128	-.158	301	-1.100	1.230	-.888	501	-.425	1.511	.283	401	-.825	.779	.805
2	2.045	.518	.685	102	1.418	.270	.308	302	.050	1.279	.056	502	.650	1.666	.394	402	-.825	1.178	-.704
3	.825	1.542	.550	103	1.800	.768	2.303	303	.685	1.734	.860	503	1.675	.789	2.120	403	.820	1.195	.718
4	.475	2.041	.433	104	.480	1.821	.896	304	.460	1.040	.454	504	1.775	1.209	1.468	404	.475	2.178	.218
5	-.180	.783	-.192	105	.550	1.596	.219	305	0	1.701	0	505	.675	1.445	.497	405	-.975	1.695	-.300
6	.200	1.854	.489	106	.225	1.504	-.123	306	.620	2.123	.508	506	.800	1.058	.848	406	-1.500	.867	-2.400
7	-1.178	1.248	-.878	107	.685	1.075	.367	307	-.050	2.252	-.021	507	1.350	1.344	1.004	407	.400	1.548	.289
8	-.180	1.316	-.114	108	.360	2.104	.166	308	-.675	.895	-.978	508	1.000	1.020	.981	408	-1.850	1.213	-1.525
9	.425	2.117	.801	109	1.175	1.281	.661	309	-1.500	.998	-2.250	509	.600	1.384	.434	409	.800	1.049	.744
10	-.480	1.141	-.394	110	-.100	1.431	-.071	310	-.988	1.139	-.612	510	-.525	.947	-.284	410	.800	1.297	.146
11	-.650	1.246	.658	111	-.425	1.807	-.308	311	.900	1.051	.764	511	-.025	1.784	-.014	411	-1.850	1.268	-1.350
12	-1.800	.636	-2.516	112	.425	1.434	.896	312	.100	1.695	-.591	512	.685	1.467	.428	412	.125	1.114	-.112
13	-1.960	.745	-2.031	113	1.175	1.003	1.171	313	-.975	2.078	-.277	513	-.500	1.468	-.244	413	.825	1.217	.680
14	.800	2.081	.098	114	-1.175	.418	-2.631	314	.785	.873	.630	514	1.100	1.478	.748	414	2.225	.497	4.480
15	-1.000	1.242	-.745	115	.475	2.067	.228	315	2.028	.428	4.784	515	-.250	1.195	-.221	415	1.150	1.987	.610
16	-.275	2.017	-.188	116	-.075	1.610	-.047	316	.150	1.950	.077	516	1.350	1.312	1.310	416	-.700	1.991	-.362
17	-.500	1.502	-.298	117	1.950	.868	2.722	317	.875	2.047	.154	517	.978	1.908	.210	417	.075	.968	.078
18	1.075	.650	1.706	118	.225	2.024	-.112	318	.180	2.195	.069	518	-.150	1.278	-.138	418	.925	.966	.931
19	0	1.595	0	119	-.275	1.822	-.100	319	1.000	1.044	.928	519	.450	1.891	.284	419	-.975	1.992	-.404
20	-.175	1.122	-.168	120	-.650	2.142	-.202	320	-.050	2.092	-.024	520	.075	1.966	.059	420	.975	2.014	.285
21	.625	1.412	.270	121	-.950	1.921	-.979	321	1.250	1.211	1.118	521	-.200	1.298	-.155	421	-.175	1.059	-.164
22	1.800	.765	2.303	122	1.125	1.001	1.184	322	1.175	2.071	.568	522	-.800	1.878	-.107	422	-.400	2.102	-1.190
23	.450	1.891	.819	123	-.425	1.040	-.276	323	.700	1.091	.877	523	-.475	1.504	-.217	423	1.025	1.040	.985
24	.350	1.894	.219	124	.225	1.936	.288	324	.225	1.677	.134	524	.125	1.938	.068	424	.125	1.047	.119
25	.225	1.805	.128	125	-.020	1.689	-.030	325	-1.250	1.040	-1.802	525	1.875	.988	1.640	425	.150	1.410	.105
26	.825	1.075	.397	126	-.975	.778	-1.221	326	-.375	.646	-.260	526	-.300	1.945	-.255	426	-.225	1.932	-.158
27	.350	2.104	1.166	127	.450	1.990	.288	327	-.500	1.421	-.942	527	.100	1.787	.058	427	.675	1.242	-.800
28	-1.875	.798	-1.621	128	.080	2.202	.023	328	-1.225	1.344	-.811	528	-.400	1.605	-.249	428	-.925	1.874	-.568
29	.350	.868	.406	129	.271	2.071	.871	329	1.475	.280	2.042	529	.225	1.668	.125	429	-.500	1.912	-.261
30	1.800	1.268	1.102	130	.220	2.022	.215	330	1.480	.697	2.111	530	0	2.120	0	430	1.280	.228	6.190
31	.800	1.993	.869	131	-.175	1.482	-.121	331	.850	.868	.405	531	1.050	2.228	.440	431	.775	1.850	.491
32	-.750	1.947	-.412	132	1.825	1.664	-.141	332	-.825	1.922	-.189	532	1.180	.800	.178	432	.800	1.993	.106
33	.025	1.240	.020	133	.100	2.248	.043	333	-.875	1.703	-.514	533	.125	1.372	.089	433	-.975	1.717	-.268
34	-1.960	1.280	-.285	134	-1.000	1.022	-.644	334	2.175	.698	2.115	534	-1.000	.634	-1.200	434	-.375	.701	-.355
35	-1.020	1.741	-.378	135	.650	1.467	.443	335	.050	1.110	.048	535	.875	1.601	.319	435	1.075	2.228	.450
36	.625	1.929	.521	136	.420	1.282	.624	336	.480	.994	.452	536	-1.125	1.770	-.650	436	.600	2.021	.293
37	-.425	1.152	-.222	137	-.225	1.542	-.394	337	.750	1.609	.466	537	-.275	2.027	-.122	437	.300	1.933	-.152
38	1.125	.769	1.468	138	1.800	.628	1.962	338	.180	1.212	-.114	538	-1.050	1.734	-.605	438	-1.750	.841	-2.080
39	0	1.784	0	139	1.150	1.224	.866	339	-.975	1.236	-.624	539	-.300	1.434	-.209	439	.450	1.928	.230
40	-.175	1.028	-.129	140	-.500	2.465	-.122	340	-.925	2.072	-.446	540	.075	1.227	.041	440	.825	.854	.723
41	-1.071	1.071	-.178	141	.800	1.266	-.862	341	-.028	1.871	-.012	541	.775	1.261	.959	441	.175	2.220	.077
42	1.075	1.879	.841	142	-.500	1.699	-.471	342	1.000	1.621	.640	542	.825	2.003	.161	442	.650	2.162	.369
43	-.225	1.492	-.216	143	-.225	2.393	-.126	343	1.075	1.230	.874	543	-.875	1.220	-.210	443	-1.075	.769	-2.050
44	1.800	1.268	.288	144	.975	1.222	.792	344	-.200	.900	-.222	544	-.075	2.027	-.277	444	.450	1.787	.227
45	-.625	1.829	-.340	145	.725	1.102	.654	345	.800	1.091	.121	545	.200	2.171	.178	445	1.225	.602	2.700
46	.020	.628	.076	146	.800	1.969	.254	346	-1.225	1.846	-.717	546	-1.225	.768	-2.450	446	-.620	2.028	-.216
47	-1.175	1.612	-.722	147	-.420	1.165	-.265	347	.025	1.702	.018	547	-.500	1.007	-.470	447	.025	1.222	.020
48	-.400	1.911	-.209	148	-.125	.828	-.427	348	-1.175	.817	-1.422	548	.875	2.159	.312	448	-1.100	.822	-1.350
49	.425	1.625	.292	149	1.800	.424	2.222	349	.800	1.202	.642	549	1.050	2.001	.524	449	-.020	1.767	-.028
50	1.180	1.004	1.145	150	-.700	1.249	-.219	350	-.500	2.099	-.252	550	.225	1.420	.370	450	-.075	2.160	-.032

81	.728	1.088	.688	181	-.640	1.938	-.318	261	.630	1.727	.278	341	-.328	2.268	-.164	421	-.900	1.772	-.208	
82	.878	1.438	.838	191	-.790	1.838	-.468	271	.780	1.627	.378	351	-.478	2.168	-.264	431	-.798	1.672	-.308	
83	-.800	8.128	-.858	158	-.428	1.808	-.238	258	.790	2.294	.828	358	-.128	1.424	-.087	458	-.260	1.841	-.278	
84	.878	.701	.992	164	-.628	1.940	-.448	264	-.478	1.081	-.648	364	1.880	.687	8.284	.424	800	1.403	.898	
85	-1.700	.898	-.848	166	-.600	1.988	-.478	266	-.288	1.870	-.108	366	-.080	1.088	-.048	456	-.978	2.068	-.478	
86	.430	1.941	.844	168	-.478	1.734	-.308	268	1.978	1.358	.941	368	1.228	.088	1.978	.424	1.978	1.178	1.248	
87	-.828	1.828	.670	197	1.100	1.151	.928	297	.478	1.848	.410	397	.380	1.798	1.128	497	.380	2.028	-.818	
88	.900	2.108	.487	198	.878	1.192	.818	308	-.080	1.880	-.027	408	.382	1.802	.818	508	-.478	1.458	-.228	
89	.928	.890	.844	198	1.600	.828	1.730	308	1.978	1.301	.886	408	-.078	2.282	-.027	508	-.660	1.968	-.282	
90	.820	1.648	.898	180	-.800	2.080	-.840	360	-.850	2.048	-.411	460	-.820	1.828	-.458	600	-.178	1.828	-.084	
91	-.678	2.050	-.828	161	.878	.779	.864	261	-1.680	.960	-1.718	361	.841	.080	1.428	.031	461	-.820	1.928	-.478
92	-1.880	1.141	-1.168	162	1.178	2.097	.904	262	-.178	.897	-.808	362	.128	1.608	.078	462	.878	1.824	-.218	
93	-.100	1.840	-.064	162	-.878	2.002	-.197	262	-.878	1.112	-.817	362	-.128	2.378	-.028	462	-1.478	1.864	-.874	
94	-.180	1.878	-.108	164	-.600	1.800	-.641	264	-.928	1.021	-.906	364	-1.078	1.888	-1.480	464	.280	1.408	-.218	
95	-.400	1.998	.800	168	-.820	2.612	-.697	268	.878	.884	.888	368	.800	1.738	.888	468	.788	1.128	.941	
96	.828	1.608	.818	186	-.300	2.428	-.184	286	-.800	1.978	-.118	386	.800	1.188	.082	486	-.400	2.184	-.182	
97	.820	1.712	-.148	167	-.880	2.138	-.398	267	.800	1.648	.347	367	.860	1.640	.490	467	1.073	1.428	1.708	
98	-1.800	2.048	-.297	168	.878	1.998	.796	268	.880	1.197	.470	368	-.280	1.828	-.150	468	-1.178	1.928	-.288	
99	.800	1.228	.181	168	.288	1.278	.947	268	.228	2.284	-.101	368	-.400	1.680	-.847	468	-.800	2.808	-.947	
100	-.800	1.718	-.698	170	-.188	2.188	.861	270	-.182	1.008	-.128	370	-.380	1.128	-.200	470	-2.078	1.349	-.898	
101	1.080	.991	2.688	171	-.078	1.968	-.028	271	.228	2.138	.108	371	-.828	2.208	-.260	471	-.778	1.784	-.667	
102	.700	1.088	.488	178	-.078	1.801	-.428	278	-.820	2.918	-.182	378	.288	1.898	-.898	478	.228	1.828	-.448	
103	.220	1.704	.247	178	.828	1.129	.280	278	-.028	2.208	-.110	378	-.400	1.728	-.228	478	-.080	1.401	-.088	
104	-.478	2.898	-.818	174	1.100	2.718	.637	274	-1.620	.234	-1.771	374	.800	1.788	.168	474	1.180	1.081	1.064	
105	-1.028	1.897	-.790	178	-.188	.897	-.818	278	.820	1.178	-.811	378	-.900	1.461	-.618	478	-.978	1.638	-1.044	
106	1.820	1.830	.688	178	.880	1.068	.800	278	.728	2.078	.648	378	-1.028	1.680	.728	478	.400	1.968	-.828	
107	1.268	1.928	.877	177	1.000	1.878	-.228	277	.800	1.397	.800	377	.820	1.820	.814	477	-.880	1.280	-.647	
108	.780	1.180	2.484	.060	176	1.640	1.944	.907	278	.228	1.884	.884	378	-.300	1.487	-.182	478	-1.078	1.180	-.981
109	1.860	1.872	.898	178	-.800	1.828	-.644	277	-.828	1.971	-.886	377	-1.978	1.868	-1.008	477	-.280	1.428	-.848	
110	-.480	2.110	-.808	180	.800	1.088	.121	280	-.880	1.828	-.818	380	-.180	1.481	-.288	480	.400	1.978	-.281	
111	-.880	1.768	-.897	181	-.800	1.994	-.621	281	.800	1.620	.821	381	.878	.844	.941	481	1.900	.888	1.168	
112	-.028	1.864	-.018	182	-.800	1.843	-.180	282	.800	1.972	-.820	382	.480	1.604	.881	482	-.928	1.608	-.680	
113	-.400	1.108	-.848	182	-1.700	1.098	-1.888	282	-1.228	.948	-1.200	382	-1.288	1.801	-1.108	482	-1.878	1.994	-.828	
114	.448	1.778	1.107	184	-.788	1.898	-.288	284	1.020	1.820	-.854	384	-.120	1.680	.148	484	-.800	1.981	-.088	
115	-.880	2.277	-.878	188	1.428	1.960	.218	288	-1.820	1.898	.898	388	-.700	.881	-.821	488	.228	1.287	-.178	
116	-1.820	1.384	-.928	186	-1.288	.974	-1.968	286	.878	1.488	.888	386	.428	1.620	.341	486	-.628	1.818	-.878	
117	-.820	.898	-1.601	187	-1.620	.810	-1.898	287	1.820	1.099	1.128	387	2.978	.888	2.710	487	1.228	.801	2.878	
118	-1.100	1.118	-.984	188	1.178	.968	1.214	288	.878	2.128	.871	388	-1.128	2.094	-.618	488	.800	1.828	-.428	
119	.220	1.228	.218	188	-.800	1.128	-.778	288	1.078	2.028	.828	388	1.878	1.228	1.480	488	.880	1.971	.941	
120	1.028	1.928	.728	188	.800	1.048	.480	290	1.228	.789	1.680	390	-1.728	1.228	-1.420	490	1.400	.778	1.798	
121	1.228	.801	1.684	191	.800	2.098	.481	291	.600	1.688	.874	391	-.020	1.074	-.047	491	-.800	1.870	-.628	
122	-.780	1.770	-.484	192	.478	1.848	.890	292	.020	2.012	-.082	392	-.820	2.084	-.618	492	-.498	1.870	-.874	
123	-.788	1.848	-.328	192	1.228	1.124	1.088	292	.820	1.217	.688	392	.828	.928	.248	492	.800	1.111	-.620	
124	-.128	1.848	-.178	194	1.978	1.828	.968	294	1.000	.904	1.100	394	.800	1.728	.428	494	-.628	1.008	-.680	
125	1.400	1.070	1.210	198	-.800	1.880	-1.180	298	1.728	.780	2.870	398	.400	2.211	1.228	498	.800	2.878	.0	
126	-1.728	1.474	-1.170	194	-.078	1.880	-.428	298	-.820	1.878	-.128	398	-.478	1.884	-.848	498	.800	1.828	.428	
127	-1.800	1.878	-1.128	197	-.828	1.718	-.874	297	-.878	1.428	-.400	397	.400	1.008	.880	497	-.978	1.690	-.840	
128	.0	1.878	.0	198	-.800	1.928	-.197	298	1.128	2.008	-.840	398	.880	1.908	.348	498	-.178	1.431	-.821	
129	1.728	.0	1.628	198	-.600	1.701	-.828	299	-.178	1.721	-.108	399	.880	1.084	.740	499	-.978	1.028	1.182	
130	.0	1.898	.0	200	-.820	1.820	-.891	300	-1.178	1.641	-.717	400	.878	.928	.928	500	.228	1.728	-.207	

APPENDIX II

TABLE E.—STATISTICS FOR DRAWINGS FROM RECTANGULAR UNIVERSE—(Continued)

Sample Number	\bar{X}	σ	s	Sample Number	\bar{X}	σ	s	Sample Number	\bar{X}	σ	s	Sample Number	\bar{X}	σ	s	Sample Number	\bar{X}	σ	s
801	-.950	1.250	-.772	601	-.950	1.293	-.755	701	-.975	.975	-.694	801	-.750	1.016	-.759	901	1.425	1.043	1.565
802	.075	2.461	-.030	602	1.400	.994	1.459	702	-1.725	.993	-1.845	802	1.300	1.369	.950	902	1.250	1.568	-.914
803	-.150	1.834	-.098	603	.075	1.254	.060	703	-1.975	1.040	-1.803	803	1.475	1.707	.940	903	1.575	1.008	1.552
804	1.000	1.768	.965	604	.650	1.704	.499	704	-1.300	.815	-1.965	804	.825	1.255	.506	904	.950	1.770	.656
805	-1.225	1.045	-1.175	605	-.175	2.233	-.373	705	-.925	1.417	-.655	805	1.300	1.223	1.028	905	-.975	.978	-.354
806	.500	2.176	1.138	606	-.400	1.619	-.247	706	-.575	1.132	-.499	806	-.325	1.595	-.804	906	1.400	.946	1.480
807	1.375	1.666	.845	607	-.875	1.103	-.240	707	.075	1.176	.064	807	.175	1.833	.094	907	-1.975	.759	-2.598
808	-.950	1.137	-.368	608	-.650	1.617	-.368	708	.750	1.479	.807	808	.700	1.602	.437	908	-.825	1.418	-.561
809	-.325	2.181	-.148	609	-1.100	1.135	-1.013	709	.975	1.978	1.190	809	.225	1.425	.193	909	.800	1.840	1.109
810	.875	1.311	1.155	610	.125	2.008	-.066	710	-.025	1.499	-.015	810	-1.100	1.214	-.028	910	1.500	1.976	.452
811	-1.025	2.250	-2.021	611	1.150	.936	1.164	711	-1.650	.450	-5.759	811	-1.950	2.259	-.725	911	-1.700	.711	-2.590
812	-.350	2.103	-.154	612	1.750	.897	1.973	712	-.300	2.241	-.069	812	-.325	1.497	-.286	912	1.375	.981	1.401
813	.475	1.316	.365	613	.250	.921	.227	713	.400	.904	.652	813	.050	.492	.102	913	-1.725	.870	-1.931
814	.050	1.742	.090	614	-.725	1.846	-.393	714	1.750	1.879	.931	814	-2.150	.765	-2.810	914	-2.400	.975	-3.558
815	-1.500	1.034	-1.781	615	-.575	1.136	-.500	715	.150	1.176	.123	815	.925	.942	.968	915	-.950	1.236	-.755
816	.350	1.159	.310	616	-.225	.991	-.323	716	.875	.929	.264	816	-.225	1.292	.117	916	-.225	1.973	-.353
817	-.375	1.467	-.393	617	-1.150	1.197	-.961	717	.500	1.279	-.622	817	-.775	1.988	-.390	917	1.400	2.004	.699
818	-.475	1.614	-.260	618	-1.025	1.454	-1.317	718	-.875	1.397	-.654	818	-1.925	1.145	-1.628	918	-1.275	1.127	-1.098
819	.475	1.682	.298	619	1.450	1.071	1.364	719	.150	1.323	.108	819	.800	1.297	.641	919	-.950	1.927	-.492
820	.250	1.359	.167	620	-.325	1.580	-.214	720	2.175	.512	4.246	820	.080	1.584	.053	920	-1.050	-1.226	-.886
821	.950	1.727	.650	621	-.725	1.218	-.297	721	.525	1.712	.207	821	-.225	2.171	-1.194	921	1.550	1.110	1.399
822	.875	1.025	.660	622	-.750	1.741	-.451	722	.175	2.029	.086	822	.825	1.130	.471	922	1.425	.942	1.510
823	1.125	1.790	.650	623	1.725	.722	2.299	723	.975	2.019	.493	823	-.600	1.070	-.274	923	-1.625	.822	-1.695
824	-.025	1.850	-.013	624	.200	1.369	.146	724	.100	1.203	.076	824	-.775	1.563	-.540	924	-2.000	.628	-2.450
825	-1.600	1.762	-.661	625	.125	2.068	.080	725	1.300	1.136	1.126	825	1.600	-.943	1.699	925	.650	2.061	.892
826	2.175	1.256	2.553	626	.875	2.070	.423	726	-.875	1.645	-.603	826	-1.925	1.222	-1.561	926	-.900	1.204	-.747
827	-1.850	1.126	-1.643	627	.400	2.123	1.163	727	1.000	.977	1.023	827	.275	1.073	.256	927	-.225	1.139	-.461
828	-1.925	.693	-2.156	628	-1.225	1.215	-1.008	728	-.800	1.795	-.646	828	.825	.970	.633	928	.600	2.104	.284
829	-1.100	.951	-1.197	629	-1.450	.879	-1.650	729	1.475	1.355	1.031	829	-1.650	1.429	-1.293	929	1.225	1.279	.659
830	.250	1.590	.180	630	-.225	1.777	-.127	730	.450	1.635	.875	830	1.225	2.284	.588	930	-1.500	1.394	-1.091
831	-1.100	2.378	-.042	631	-1.425	.763	-1.868	731	.825	1.940	.654	831	-.325	1.696	-.217	931	-.650	1.797	-.475
832	-.500	1.745	-.172	632	-.700	1.745	-.397	732	1.350	.450	2.000	832	.300	2.313	-.216	932	-.975	1.939	-.718
833	-.900	1.238	-.698	633	-.650	1.544	-.851	733	-1.475	1.693	-.753	833	-1.475	1.503	-.658	933	.900	1.377	.218
834	-.325	.934	-.346	634	-1.125	1.445	-.779	734	.050	1.968	.051	834	-2.450	1.427	-6.745	934	.050	1.871	.026
835	.800	1.428	.690	635	-.150	1.447	-.104	735	.400	1.299	.288	835	.475	1.423	.354	935	.625	.759	.721
836	.900	1.285	.226	636	-1.100	.970	-1.134	736	.975	1.021	.267	836	.900	1.177	.766	936	-1.050	2.329	-.461
837	1.800	1.138	1.027	637	-1.975	.512	-3.467	737	-.800	1.465	-.656	837	-.950	1.893	-.755	937	-.950	1.774	-.479
838	1.600	2.024	.791	638	-.425	.471	-.803	738	.325	1.124	.874	838	-.175	1.650	-.106	938	.800	.745	.268
839	-.500	.735	-.406	639	.875	2.179	.864	739	.250	1.881	.164	839	-.375	1.934	-.192	939	-1.225	1.648	-.969
840	.600	.895	.677	640	.775	2.123	.365	740	-1.275	1.080	-.807	840	1.100	.255	4.280	940	-.600	1.551	-.284
841	.700	1.810	.399	641	.300	2.457	.122	741	1.100	1.668	-.658	841	-.425	.884	-.461	941	-.650	2.658	-.267
842	-.425	.449	-.847	642	-.975	1.603	-.219	742	-.125	1.846	-.058	842	-.975	1.197	-.554	942	-.150	1.219	-.034
843	1.500	1.321	1.056	643	-.975	2.084	-.420	743	.400	1.621	.820	843	.800	1.945	.508	943	.675	.457	-1.307
844	.100	1.462	.097	644	1.150	2.129	.597	744	-1.850	1.594	-2.803	844	-.600	.821	-.481	944	.075	.769	.694
845	1.600	.919	1.741	645	1.500	.643	2.414	745	-.825	1.699	-.499	845	-.825	1.229	-.505	945	-.225	1.627	-.178
846	.225	1.737	.183	646	-.975	2.014	-.494	746	.800	2.229	.597	846	.675	1.647	.409	946	1.975	.602	3.115
847	-.850	.951	-.210	647	1.050	1.901	.062	747	-1.425	1.258	-1.025	847	.025	1.691	.014	947	-.250	2.179	-.151
848	1.725	.729	2.214	648	.775	1.604	-.422	748	.825	1.828	.649	848	-1.900	1.232	-.970	948	-.325	.913	-.151
849	-1.475	.895	-1.848	649	-1.400	1.998	-.004	749	-.200	2.123	-.141	849	1.975	1.659	.945	949	-.050	1.668	-.023
850	.400	1.991	.201	650	-.025	1.852	-.014	750	.350	.466	.721	850	-.800	1.436	-.139	950	-.275	1.954	-.140

501	-.025	1.171	-.021	551	.860	1.145	.744	701	-.300	1.084	-.876	851	-.775	.953	.830	901	1.880	1.613	1.091
502	-.178	1.099	-.107	552	-.828	1.165	-.866	702	-.600	1.006	-.853	852	-.875	8.078	-.128	902	-.675	1.888	-.683
503	-.600	1.218	-.838	553	-.600	1.218	-.110	703	-.050	1.000	-.800	853	-.800	1.000	-.800	903	-.800	1.175	-.680
504	-.380	1.058	-.178	554	-.380	1.058	-.621	704	-.685	1.075	-.648	854	-.1700	-.882	-.1751	904	1.675	1.480	1.841
505	-.820	8.807	-.804	555	-.820	1.808	-.886	705	-.475	1.287	-.569	855	-.300	8.008	-.148	905	-.300	1.108	-.148
506	.100	.605	.848	556	-.878	1.801	-.828	706	-.650	1.098	-.898	856	-.1000	1.047	-.796	906	.800	.804	-.821
507	1.800	-.018	1.900	557	-.800	1.885	-.678	707	-.685	1.287	-.898	857	-.750	1.048	-.888	907	-.125	1.687	-.089
508	-.825	1.840	-.804	558	1.800	1.838	-.897	708	-.725	1.835	-.872	858	-.175	1.748	-.810	908	-.375	1.834	-.823
509	-.650	1.145	-.810	559	1.000	1.828	-.840	709	-.475	1.794	-.868	859	1.000	1.170	-.088	909	-.675	1.634	-.808
510	-.825	1.785	-.868	560	1.078	1.455	-.734	710	-.875	1.775	-.636	860	1.800	1.745	-.688	910	-.485	1.980	-.800
511	-.800	1.785	-.118	561	-.978	1.88	-.897	711	-.450	1.610	-.878	861	-.850	1.880	-.018	911	-.775	1.884	-.877
512	-1.800	1.785	-.848	562	-.800	1.818	-.841	712	-.178	1.848	-.141	862	-.088	1.868	-.068	912	1.178	1.828	-.078
513	-.975	1.014	-.037	563	-.680	1.638	-.897	713	-.050	1.770	-.018	863	-.488	1.708	-.848	913	1.188	1.841	-.169
514	-.600	1.061	-.866	564	-.080	1.733	-.028	714	-.928	1.937	-.478	864	-.075	8.081	-.084	914	-.880	1.887	-.828
515	-.800	1.188	-.814	565	-.485	1.848	-.830	715	-.878	1.868	-.684	865	-.875	1.875	-.884	915	-.980	1.430	-.880
516	-.850	1.618	-.171	566	-.825	1.750	-.800	716	-.800	1.869	-.887	866	-.875	1.678	-.881	916	-.828	1.804	-.174
517	-.880	1.855	-.825	567	1.475	1.621	-.810	717	-.100	1.725	-.088	867	-.875	1.808	-.831	917	-.178	1.808	-.087
518	1.825	-.884	1.728	568	-.400	1.958	-.808	718	-.875	1.808	-.810	868	-.888	1.808	-.160	918	-.880	1.688	-.888
519	-.078	1.808	-.048	569	1.785	1.428	1.807	719	-.300	1.881	-.168	869	-.075	1.888	-.040	919	-.880	1.884	-.888
520	1.825	1.188	-.877	570	1.100	1.798	-.086	720	-1.778	1.830	-1.480	870	-.018	8.108	-.084	920	-.878	1.828	-.897
521	-.975	1.858	-.884	571	-.825	1.875	-.647	721	-.480	1.844	-.841	871	-.825	1.64	-8.440	921	-.088	1.488	-.018
522	-.800	1.808	-.811	572	-.680	1.874	-.688	722	-.675	1.808	-.499	872	-.878	1.684	-.864	922	-.878	1.831	-.168
523	1.800	-.831	1.868	573	-1.400	1.828	-1.814	723	-1.878	1.748	-8.111	873	-.300	1.684	-.828	923	-.800	1.618	-.188
524	-.820	1.887	-.188	574	-.128	1.698	-.074	724	-.550	1.684	-.817	874	1.800	1.848	1.809	924	-1.800	1.808	-8.881
525	-.850	1.471	-.858	575	-.828	1.848	-.178	725	-.875	1.887	-.868	875	1.825	1.488	-.859	925	-.878	1.810	-.187
526	-.875	1.808	-.848	576	-.650	1.888	-.489	726	-1.900	1.918	-8.348	876	1.800	1.761	-.888	926	-1.800	1.884	-8.881
527	-.825	1.859	-.168	577	-.878	1.861	-.148	727	-1.325	1.812	-.834	877	-.878	1.468	1.821	927	-.828	1.888	-.888
528	-.825	1.890	-.827	578	-.778	1.822	-1.078	728	-.800	1.841	-.888	878	-.880	1.770	-.455	928	-1.878	1.148	-8.110
529	-.828	1.866	-.858	579	-.878	1.858	-.874	729	-.800	1.888	-.478	879	1.800	1.480	1.830	929	-.878	1.648	-.888
530	-.650	1.833	-.682	580	-1.800	1.878	-1.770	730	-.800	1.888	-.884	880	-.078	1.738	-.048	930	-1.828	1.848	-1.821
531	-.8475	1.811	-7.928	581	-.880	1.785	-.198	731	1.100	8.068	-.078	881	-.128	8.688	-.048	931	-.880	1.858	-1.111
532	-.878	1.898	-.840	582	-.828	1.878	-.838	732	-.800	1.841	-.810	882	-.478	1.807	-.868	932	-.878	1.804	-.178
533	-.850	1.738	-.888	583	1.328	1.833	-.884	733	-.828	1.844	-.808	883	-.800	1.868	-.818	933	-.878	1.883	1.88
534	1.680	1.188	1.463	584	-.700	1.893	-.808	734	-.028	1.907	-.018	884	-.680	1.813	-.808	934	1.878	1.80	18.820
535	-.800	1.884	-.810	585	-1.478	1.817	-.768	735	-1.388	1.848	-.868	885	-1.350	1.680	-1.888	935	-1.828	1.887	-1.841
536	-.878	1.886	-.888	586	-.800	1.871	-.148	736	-.878	1.808	-.871	886	-.100	1.718	-.878	936	-.100	1.884	-.118
537	-.018	1.808	-.018	587	-1.450	1.748	-1.888	737	-.800	1.838	-.728	887	-1.028	1.117	-.818	937	-.878	1.834	-.844
538	-.800	1.818	-.868	588	-.128	1.807	-.104	738	-.300	1.810	-.848	888	-.080	1.887	-.053	938	1.800	1.891	1.078
539	1.180	1.663	-.891	589	-1.128	1.872	-1.674	739	-1.028	1.808	-.859	889	-.878	1.808	-.808	939	-.878	1.818	-.864
540	-.800	8.888	-.488	590	-1.078	1.604	-.748	740	1.878	1.683	-.781	890	-.100	1.808	-.808	940	-.800	1.808	-.050
541	1.028	1.481	-.828	591	-.180	1.821	-.078	741	1.178	1.880	1.110	891	1.400	1.696	1.018	941	-.800	1.808	-.489
542	-.878	1.778	-.811	592	-.880	1.898	-.609	742	1.178	1.642	1.107	892	-.880	1.880	-.888	942	-.800	1.888	-.888
543	-.878	1.883	-.808	593	-.800	1.990	-.808	743	-.080	1.412	-.038	893	-.890	1.898	-.441	943	-.800	1.828	-.894
544	1.180	1.897	-.818	594	-.828	1.764	-.128	744	-1.028	1.604	-.640	894	-.878	1.745	-.878	944	-.088	1.880	-.014
545	-.800	1.808	-.784	595	-.180	1.873	-.840	745	-.880	1.827	-.198	895	-.680	1.821	-.708	945	-.030	1.613	-.031
546	-.878	1.809	-.841	596	-.878	1.842	-.142	746	-.800	1.874	-.348	896	-.478	1.808	-.818	946	-.700	1.830	-.784
547	-.878	1.810	-.418	597	-.478	1.874	-.878	747	-.600	1.847	-.328	897	-.825	1.804	1.80	947	-.800	1.818	-.881
548	-.880	1.887	-.738	598	-.400	1.808	-.788	748	-.878	1.831	-.400	898	-.378	1.881	-.804	948	-.188	1.768	-.871
549	-.878	1.808	-.181	599	-1.828	1.881	-1.888	749	-.828	1.842	-.118	899	-1.678	1.840	-1.087	949	1.178	1.488	-.828
550	-.880	1.880	-.380	600	-.780	1.834	-.836	750	-1.780	1.808	-8.800	900	-.400	1.788	-1.828	1000	-.400	1.888	-.870

TABLE F.—STATISTICS FOR DRAWINGS FROM RIGHT TRIANGULAR UNIVERSE

Sample Number	\bar{X}	σ	s	Sample Number	\bar{X}	σ	s	Sample Number	\bar{X}	σ	s	Sample Number	\bar{X}	σ	s	Sample Number	\bar{X}	σ	s
1	0	.895	0	101	.628	.650	1.078	201	.500	.688	.735	301	.075	.617	.122	401	.922	1.422	.650
2	.025	1.021	.024	102	-.220	.690	-.424	202	.028	.768	.033	302	-.225	.688	-.787	402	.800	1.228	.635
3	.200	.825	.566	103	-.225	.675	-.591	203	-.275	.618	-.445	303	.400	.658	.613	403	.800	1.228	.674
4	-.175	1.033	-.159	104	.400	.827	.481	204	.375	.651	.567	304	-.075	.708	-.104	404	.325	1.029	.295
5	.700	.884	.790	105	.975	.893	.633	205	-.500	.645	-.774	305	-.450	.684	-.625	405	.150	1.115	1.154
6	.350	.971	.360	106	.125	.633	.187	206	.425	.755	.863	306	-.450	.610	-.738	406	.250	1.070	.234
7	-.450	.918	-.490	107	-.050	.610	-.028	207	.050	.179	.054	307	-.225	.640	-.220	407	.350	1.022	.350
8	.050	1.010	.049	108	-.600	.580	-1.000	208	.025	.675	.029	308	.225	.678	.776	408	.028	1.190	.021
9	-.050	.961	-.028	109	-.200	.493	-.404	209	.100	.615	-.123	309	-.050	.657	-.076	409	-.050	1.110	-.045
10	.200	1.028	.128	110	-.700	.464	-1.450	210	.800	.735	.872	310	.050	.654	-.074	410	.925	3.008	.708
11	.125	.950	.132	111	-.225	.675	-.361	211	.250	.725	.546	311	-.200	.695	-.288	411	1.125	.112	-1.008
12	.025	1.001	.025	112	.850	1.035	.328	212	.075	.671	.112	312	-.125	.601	-.129	412	-.200	.125	-4.065
13	0	1.099	0	113	0	.616	0	213	-.250	.770	-.714	313	.175	.712	.246	413	-.225	.085	-7.359
14	.250	.953	.266	114	-.225	.512	-1.050	214	-.250	.695	-.791	314	-.475	.683	-.999	414	.775	.945	17.333
15	-.175	1.035	-.169	115	.325	.507	.641	215	.625	.694	.901	315	-.600	.660	-.910	415	1.250	1.195	1.050
16	.025	1.036	.024	116	-.250	.659	-.447	216	-.750	.725	-1.052	316	-.400	.720	-.565	416	.500	1.260	.456
17	-1.000	1.056	-.025	117	-.125	.597	-.220	217	-.375	.759	-.509	317	-.700	.660	-1.041	417	.500	1.239	.444
18	-.250	.827	-.299	118	-.475	.540	-.890	218	.175	.768	.228	318	-.425	.696	-.679	418	.675	1.199	.568
19	.075	.694	.103	119	.025	.624	.041	219	1.275	.356	2.379	319	-.350	.693	-.728	419	-.450	.602	-.748
20	.800	1.185	.675	120	.225	.628	.359	220	-.400	.839	-.748	320	-.250	.701	-.525	420	.475	.601	.790
21	-.200	.604	.332	121	-.625	.676	-.911	221	.075	.683	.110	321	1.225	1.126	1.146	421	-.375	.179	-2.026
22	-.175	.676	-.304	122	-.350	.677	-.607	222	-.025	.705	-.052	322	-.450	.639	-.422	422	-.675	.170	5.212
23	.225	.618	.274	123	-.450	.677	-.769	223	-.200	.678	-.296	323	-.375	.638	-.268	423	-.325	.148	-2.196
24	-.050	.610	-.028	124	-.325	.641	-.507	224	1.075	.672	1.600	324	-.075	.661	-.038	424	.175	.142	1.123
25	-.825	.603	1.270	125	.650	.422	1.349	225	-.275	.685	-.403	325	.100	.668	.121	425	-.250	.125	-.6723
26	-.025	.592	-.042	126	-.775	.610	-1.280	226	-.025	.708	-.052	326	.675	.672	-.855	426	.500	.141	.6723
27	.120	.563	.223	127	-.075	.615	-1.115	227	-.100	.750	-.132	327	-.375	.774	-.425	427	-.600	.141	-7.022
28	-.325	.622	-.222	128	-.225	.492	-.407	228	-.200	.798	-.595	328	-.350	.728	-.422	428	-.200	.141	-8.650
29	.700	.627	1.123	129	-.750	.503	-1.495	229	-.075	.678	-.111	329	-.200	.678	-.220	429	-.200	.125	.225
30	-.650	.627	-1.037	130	-.475	.658	-.895	230	-.025	.691	-.052	330	.375	.630	.595	430	-.600	.125	-2.800
31	.625	.522	1.132	131	.175	.675	.304	231	-.050	.742	-.027	331	-.225	.633	-.345	431	.675	1.150	.800
32	.550	.500	1.000	132	-.425	.676	-.738	232	-.375	.844	-.444	332	-.100	.635	-.127	432	.300	1.267	.325
33	.250	.660	.466	133	-.775	.660	-1.356	233	-.225	.796	-.402	333	-.175	.634	-.276	433	.500	1.136	.264
34	.250	.640	.456	134	-.675	.636	-.822	234	-.225	.714	-.314	334	-.150	.673	-.175	434	-.625	1.430	.243
35	-.175	.656	-.213	135	-.250	.669	-.440	235	.625	.723	.853	335	.800	.930	.215	435	-.400	.212	-1.867
36	-.250	.588	-.400	136	-.800	.604	-.822	236	.050	.722	.029	336	.500	.675	.444	436	-.250	.180	-2.026
37	1.000	.908	1.00	137	-.400	.636	-.629	237	1.120	.773	1.420	337	-.775	.222	-3.399	437	.500	.290	.612
38	-.100	.554	-.292	138	-.250	.742	-.342	238	-.475	.653	-.727	338	-.020	.830	-.242	438	.525	.292	.365
39	.125	.650	.275	139	.475	.729	.422	239	.675	.626	1.402	339	.750	.802	-.641	439	-.375	1.010	-.371
40	-.025	.696	-.042	140	-.025	.760	-.033	240	-.422	.924	-.713	340	-.600	.127	-3.220	440	1.025	.655	1.670
41	.460	1.030	.427	141	.850	.650	.485	241	-.100	.695	-.144	341	-.120	.634	-.236	441	1.000	.129	.029
42	.300	1.123	.227	142	.450	1.002	.449	242	-.050	.680	-.074	342	-.125	.621	-.202	442	-.200	.125	.365
43	.350	.976	.399	143	-.050	1.010	-.049	243	.125	.712	.176	343	.025	.680	.038	443	.100	1.177	.026
44	.400	1.150	.344	144	-.125	.978	-.122	244	.225	.697	.222	344	-.250	.693	-1.021	444	0	1.122	0
45	-.075	1.142	-.025	145	-.025	.843	-.022	245	-.175	.602	-.291	345	-.225	.660	-.262	445	.350	1.195	.294
46	.425	1.141	.272	146	-.425	1.043	-.407	246	-.425	.636	-.656	346	-.200	.663	-.242	446	-.225	1.245	-.121
47	.670	.921	.616	147	-.325	1.042	-.312	247	-.425	.652	-.652	347	-.200	.640	-.213	447	-.250	1.245	-.201
48	.325	1.006	.223	148	0	.920	0	248	-.350	.650	-.659	348	.775	.690	1.720	448	.225	1.117	.470
49	.725	1.050	.628	149	-.175	1.024	-.164	249	-.150	.722	-.207	349	-.475	.652	-.626	449	.275	1.222	.222
50	.125	1.244	.100	150	-.075	1.024	-.075	250	-.025	.701	-.052	350	-.400	.644	-.621	450	.975	1.222	.769

51	-.600	1.081	.375	151	-.825	.722	-.866	801	-.880	-.772	-.624	861	-.800	.828	-.892	821	-.800	.824	1.282
52	-.320	.938	.250	152	-.800	.639	1.226	802	0	.728	0	862	-.828	.630	-.807	822	-.828	.824	-.068
53	-.150	.800	.100	153	-.700	.630	-1.700	803	-.176	.718	-.844	863	-.800	.828	-.818	823	-.828	-.641	-1.480
54	-.328	.936	.347	154	-.800	.685	-.612	804	-.000	-.848	-.876	864	-.876	-.841	-.717	824	-.800	-.900	-1.188
55	-.025	1.008	-.025	155	-.050	.472	-.117	805	-.878	-.648	1.216	865	-.800	.712	-.878	825	-.800	.712	-.608
56	-.250	.638	-.849	156	-.800	.674	-1.058	806	1.000	-.694	1.440	866	-.600	.728	-.628	826	-.600	.000	.480
57	-.425	.818	-.321	157	-.125	.830	-.226	807	-.178	.778	-.822	867	-.480	.810	-.728	827	-.480	-.200	-.708
58	-.225	1.081	.300	158	-.675	.490	-1.375	808	-.828	-.648	-.828	868	-.850	.810	-.808	828	-.800	.000	1.240
59	-.600	1.100	-.145	159	-.822	.490	1.070	809	-.830	-.697	-.528	869	-.878	.810	-.828	829	-.878	.800	-.000
60	-.800	1.208	-.898	160	-.450	.692	-.918	810	-.878	-.788	-.478	870	-.100	-.966	-.144	830	-.700	.000	-1.167
61	-.178	1.040	-.128	161	-.848	.792	-.610	811	0	.828	0	871	-.800	.490	-.408	831	1.025	.876	2.710
62	-.425	.478	.693	162	-.800	.740	-.475	812	-.122	.777	-.168	872	-.680	-.421	-.028	832	-.125	.876	-.821
63	-.700	.685	1.443	163	-.825	.643	1.283	813	-.828	-.740	-.034	873	-.850	-.400	-.128	833	-.775	.815	-2.280
64	-.800	.685	-.613	164	-.820	.697	-.908	814	1.22	.750	.187	874	-.800	.480	-.800	834	-.800	.000	-1.800
65	-.825	.815	1.020	165	-.475	.640	-1.080	815	-.030	.783	-.064	875	-.825	.475	1.028	835	-1.000	.880	-3.922
66	-.000	1.109	-.043	166	-.878	.446	-.838	816	-.830	.728	-.864	876	-.480	.377	-1.127	836	-1.000	-.844	-4.280
67	-.878	1.058	.921	167	-.825	.458	-1.190	817	-.875	-.828	-.477	877	-.828	.376	-1.288	837	-.750	.829	-3.878
68	-.000	.898	-.090	168	-.125	.438	-.885	818	-.828	-.698	.179	878	-.800	.413	.728	838	-.750	.800	-.800
69	.775	.901	.790	169	-.878	.681	-1.268	819	-.125	.708	.177	879	-.175	.886	-.448	839	-.875	.849	-3.816
70	-.800	-.897	.807	170	-.030	-.418	-.121	820	-.878	.728	1.068	880	-.800	.294	-.428	840	-.800	.300	-3.888
71	1.150	.888	.152	171	-.480	.480	1.000	821	-.800	.740	.048	881	-.800	-.811	.887	841	-.800	.863	3.010
72	.030	1.039	-.048	172	-.728	.640	-1.850	822	-.125	.718	-.174	882	-.830	.808	1.078	842	-.800	.800	-.800
73	-.800	1.036	-.891	173	-.875	.680	-.870	823	-.800	.880	-.884	883	-.125	.653	-.191	843	-.825	.818	-.708
74	-.050	.978	-.031	174	-.875	.628	-1.615	824	-.100	-.646	-.126	884	-.828	.636	.368	844	-.888	.808	3.087
75	-.800	1.008	-.898	175	-.875	.628	-1.129	825	-.878	-.752	-.817	885	-.475	.808	.794	845	-.875	.808	-1.088
76	-.025	1.141	.022	176	-.875	.628	-1.400	826	-.485	.680	-.644	886	-.425	.868	-.726	846	-.800	.300	2.840
77	.788	1.140	.637	177	.020	.628	.115	827	.877	.640	.868	887	-.825	.868	-.888	847	.830	.891	2.640
78	-.825	1.064	.978	178	-.878	.638	-.637	828	-.800	-.708	-.837	888	-.400	-.644	-.641	848	-.800	.800	-.800
79	.878	1.071	.784	179	-.478	.684	-1.019	829	-.850	.197	-.707	889	-.878	.708	1.228	849	-.800	.800	-.800
80	.825	1.249	.861	180	-.800	.487	-1.282	830	-.050	.745	-.047	890	-.478	.701	-.477	850	-.800	.800	-.800
81	1.150	1.230	.128	181	-.888	.432	-.848	831	-.475	.715	-.648	891	0	.898	0	851	-.900	.800	-8.000
82	-.800	1.217	.308	182	1.028	.768	1.338	832	-.825	.681	.794	892	-.725	.890	-.988	852	-.850	.842	-1.905
83	-.825	1.109	.708	183	-.800	.828	-.800	833	-.800	.640	-.648	893	-.825	.800	-1.218	853	-.875	.810	-1.810
84	1.100	1.089	-.148	184	1.150	1.170	-.182	834	-.880	.718	-.775	894	-.800	.458	.684	854	-.800	.800	-.800
85	0	1.084	0	185	-.178	1.043	-.168	835	-.800	.100	.735	895	-.100	.364	-.364	855	-.800	.803	-1.438
86	-.878	1.060	.868	186	-.825	1.030	-.025	836	-.828	.638	-.810	896	-.878	.415	1.349	856	-.800	.808	-1.628
87	.728	1.060	.868	187	-.178	1.171	1.142	837	-.800	-.848	-.848	897	-.800	.361	-1.228	857	-.800	.808	-.978
88	1.100	1.193	-.128	188	-.800	1.009	-.648	838	-.875	.708	-.810	898	-.750	.884	-1.225	858	-.800	.808	-.800
89	-.078	1.180	-.068	189	-.878	.701	-.854	839	-.825	.678	-.233	899	-.875	.881	1.506	859	-.700	.891	-8.410
90	-.800	1.120	.867	190	-.050	.638	-.114	840	-.778	.644	-.818	900	-.078	.370	-.803	860	-.820	.880	.781
91	-.100	1.190	-.128	191	-.100	.684	-.218	841	-.100	-.641	-.818	901	-.825	.800	-.977	861	-.800	.800	-1.288
92	-.800	1.168	.897	192	-.850	.471	-.831	842	-.800	.688	-.735	902	-.825	.858	-.808	862	-.080	.800	-.800
93	.478	1.064	.644	193	1.188	1.180	-.958	843	-.900	.702	1.880	903	-.875	.870	-1.864	863	-.800	.804	-1.418
94	-.050	1.060	-.047	194	-.850	1.846	-.801	844	-.125	.746	-.108	904	-.900	.374	-2.408	864	-.875	.896	-1.898
95	1.100	1.074	-.140	195	1.050	1.197	-.850	845	-.800	.730	-.843	905	-.800	.361	-1.070	865	-.800	.803	-2.848
96	-.825	1.184	-.190	196	-.825	1.442	-.194	846	1.820	.008	1.800	906	-.725	.598	1.830	866	-.180	.878	-.897
97	-.100	1.089	-.098	197	-.950	.335	-1.043	847	-.878	.770	-.618	907	-.775	.882	-1.878	867	-.800	.332	-.804
98	-.125	1.118	.186	198	-.180	.898	-.181	848	-.878	-.648	-.688	908	-1.000	-.608	-2.668	868	-.100	.600	-.880
99	-.800	1.154	-.868	199	-.800	.820	.388	849	-.178	.651	-.871	909	-.800	.801	-1.098	869	-.800	.600	-8.000
100	-.078	1.170	-.068	200	1.108	.148	-.808	850	-.825	-.697	-.848	910	-.400	.808	-.888	870	-.800	.898	-1.860

TABLE F.—STATISTICS FOR DRAWINGS FROM RIGHT TRIANGULAR UNIVERSE—(Continued)

Sample Number	\bar{Y}	σ	s	Sample Number	\bar{Y}	σ	s	Sample Number	\bar{Y}	σ	s	Sample Number	\bar{Y}	σ	s	Sample Number	\bar{Y}	σ	s
501	-.175	1.020	-.175	601	-.460	.448	-1.008	701	-.385	.839	-.598	801	-.850	1.118	-.884	901	.850	1.009	-.856
502	-.100	1.158	-.087	602	-.460	.580	-1.286	702	-.485	1.008	-.483	802	-.180	1.309	-.110	902	.475	1.035	-.457
503	-.700	1.058	-.687	603	-.050	.800	-.148	703	.250	.991	-.828	803	-.180	1.810	-.118	903	.280	1.160	-.816
504	-.825	1.043	-.808	604	.378	1.270	-.205	704	.350	1.006	-.848	804	-.150	1.228	-.185	904	.560	1.118	-.688
505	-.750	.907	-.827	605	.075	1.885	-.058	705	-.288	.808	-.858	805	-.125	1.860	-.009	905	0	1.120	0
506	-.878	.980	-.828	606	-.100	1.225	-.068	706	0	.744	0	806	.428	1.145	-.371	906	.380	.968	-.568
507	-.100	1.020	.098	607	.478	1.108	.451	707	-.128	.780	-.197	807	.600	1.177	.810	907	.128	.995	-.188
508	.880	1.020	.888	608	-.428	1.220	-.346	708	-.875	.764	-.860	808	.228	1.310	.178	908	-.128	.926	-.128
509	.878	.968	-.828	609	-.878	.409	-.818	709	-.825	.790	-.688	809	-.850	1.388	-.640	909	-.700	1.088	-.678
510	.800	1.061	.828	610	-.480	.474	-.846	710	-.280	-.787	-.850	810	.750	1.198	.689	910	-.800	1.027	-.487
511	.078	.980	.078	611	.878	.465	-.691	711	-.178	.825	-.812	811	.150	1.848	-.120	911	.500	.919	-.844
512	.828	.973	-.840	612	-.100	.810	-.197	712	.580	.737	-.468	812	.078	1.280	.080	912	.428	.912	-.468
513	.828	.865	.860	613	.100	.810	.196	713	.380	.795	-.409	813	.128	1.280	.102	913	.878	.915	-.787
514	-.178	.897	-.197	614	.280	1.280	-.800	714	-.400	.896	-.421	814	.800	1.890	.188	914	.580	1.068	-.380
515	-.128	.868	-.146	615	-.120	1.081	-.189	715	.380	1.190	-.808	815	-.078	.838	-.089	915	.878	1.848	-.801
516	.778	1.050	.736	616	.180	.894	.168	716	.480	1.141	-.394	816	.428	.883	.816	916	.380	1.880	-.289
517	.828	1.042	-.812	617	.080	.898	-.059	717	.478	1.234	-.289	817	.100	.840	-.119	917	.178	1.198	-.148
518	-.028	1.146	-.028	618	-.028	.924	-.027	718	.878	1.119	.814	818	-.628	.844	-.741	918	-.078	1.227	-.097
519	.400	1.086	.879	619	.078	1.008	-.074	719	.180	1.101	.186	819	-.828	.848	-.868	919	-.100	1.282	-.078
520	.050	1.061	.046	620	1.000	.888	1.126	720	.488	1.898	-.489	820	.400	.801	-.688	920	.800	1.221	-.410
521	1.100	.943	1.108	621	.878	1.145	-.608	721	.180	.780	-.800	821	-.850	1.458	-.844	921	-.088	1.000	-.028
522	.828	.868	-.828	622	.828	1.136	-.850	722	.188	.804	-.188	822	.178	1.470	.119	922	.850	1.080	-.810
523	-.800	.928	-.828	623	.178	1.581	.129	723	.400	.821	-.478	823	.878	1.234	.709	923	0	1.090	0
524	.028	.908	-.028	624	.728	.798	-.912	724	1.800	.822	1.400	824	.878	1.280	.700	924	.880	1.180	-.781
525	.050	.921	-.028	625	.228	.798	-.228	725	.280	.862	.180	825	.028	1.387	-.018	925	-.800	1.148	-.174
526	-.850	.868	-.894	626	.228	.817	-.908	726	-.800	.790	-.866	826	-.850	1.419	-.847	926	-.080	1.087	-.048
527	-.880	.868	-.898	627	.480	.864	-.827	727	-.228	.873	-.828	827	.800	1.841	-.842	927	.078	1.048	-.072
528	.020	.887	-.088	628	-.228	.810	-.878	728	-.878	.888	-.790	828	.178	1.246	.140	928	-.080	1.031	-.048
529	-.878	.973	-.828	629	-.078	.880	-.088	729	.188	.888	-.148	829	.180	1.264	.180	929	-.228	1.027	-.818
530	-.800	.918	-.828	630	-.178	.880	-.380	730	.380	.888	-.418	830	.800	1.218	.484	930	.178	1.048	-.187
531	1.000	.870	1.149	631	.800	.886	-.908	731	.800	.798	-.868	831	.480	1.280	-.869	931	0	1.088	0
532	-.800	.968	-.808	632	-.000	.910	-.050	732	-.180	.789	-.180	832	.980	1.484	-.640	932	-.180	1.109	-.180
533	-.878	.988	-.880	633	-.880	.888	-.411	733	.400	.822	-.487	833	.478	1.470	.888	933	-.100	1.118	-.082
534	-.178	.988	-.188	634	-.180	.741	-.878	734	-.488	.766	-.686	834	.880	1.268	-.878	934	.080	1.108	-.028
535	.888	.978	-.888	635	1.080	.788	-.841	735	-.488	.888	-.218	835	.880	1.280	-.888	935	-.880	.888	-.888
536	-.480	.980	-.448	636	-.800	.788	-.864	736	-.888	.888	-.874	836	.020	1.267	-.086	936	-.878	1.148	-.888
537	-.078	.978	-.077	637	-.400	.968	-.448	737	-.800	.886	-.884	837	-.128	1.417	-.088	937	-.400	1.110	-.888
538	-.128	.884	-.148	638	.878	.781	-.888	738	.980	.901	1.084	838	-.800	1.488	-.808	938	-.128	1.108	-.118
539	-.100	1.048	-.100	639	-.880	.748	-.471	739	.978	.798	1.228	839	-.180	1.477	-.108	939	-.888	1.091	-.888
540	-.180	.980	-.186	640	-.888	.948	-.888	740	-.078	.868	-.101	840	.480	1.248	-.868	940	.878	1.040	-.801
541	.800	.887	-.888	641	-.888	.864	-.860	741	-.880	.808	1.088	841	-.100	1.270	-.078	941	.800	1.027	-.046
542	.400	.897	-.448	642	-.800	.918	-.889	742	-.178	.868	-.198	842	.828	1.178	-.191	942	-.878	1.118	-.837
543	-.880	.844	-.898	643	.800	.897	-.884	743	.080	.828	-.061	843	-.880	.989	-.848	943	.888	1.280	-.174
544	.888	1.040	-.808	644	.088	.998	-.028	744	.800	.928	-.288	844	.120	.814	-.184	944	-.880	1.178	-.886
545	.478	.998	-.878	645	.878	1.480	-.687	745	0	.867	0	845	.880	.800	1.180	945	.478	1.188	-.400
546	-.788	1.088	-.028	646	-.180	.864	-.178	746	1.00	.867	-.874	846	-.028	.821	-.081	946	-.178	1.188	-.184
547	.800	1.209	-.829	647	-.888	.808	-.480	747	.478	1.219	-.880	847	.480	.886	-.838	947	-.628	1.110	-.868
548	.900	1.180	.768	648	-.028	.918	-.027	748	-.800	.480	-.698	848	.428	.844	-.804	948	.900	1.198	-.788
549	.878	1.180	.808	649	-.800	.907	-.886	749	-.780	.470	-.180	849	-.800	.918	-.819	949	.888	1.208	-.848
550	.878	1.188	.881	650	.088	.991	-.028	750	-.228	.418	-.768	850	.478	.984	-.810	950	.900	1.170	-.770

881	.800	1.164	-.897	641	-.800	-.898	-.841	781	-.178	-.780	-.880	821	-.978	-.888	-.978	961	-.888	-.888	-.888
882	-.100	-.884	-.880	642	-.880	-.884	-.888	782	-.888	1.848	-.818	822	-.880	-.888	-.880	962	-.880	-.880	-.880
883	-.180	-.874	-.840	643	-.874	-.874	-.840	783	-.880	-.880	-.880	823	-.180	-.880	-.880	963	-.880	-.880	-.880
884	0	-.884	0	644	-.888	-.884	-.888	784	-.100	-.810	-.180	824	-.880	-.888	-.880	964	-.188	-.188	-.188
885	0	-.888	0	645	-.178	-.844	-.188	785	-.880	-.888	1.818	825	-.888	-.888	-.888	965	-.880	-.880	-.880
886	-.178	-.888	-.888	646	-.178	-.848	-.188	786	-.888	-.888	-1.087	826	-.178	-.888	-.880	966	-.878	-.880	-.844
887	-.800	-.880	-.880	647	-.800	-.884	-.888	787	-.888	-.880	-1.480	827	-.188	-.818	-.178	967	-.880	-.884	-.848
888	1.800	-.880	1.800	648	-1.180	-.814	-1.418	788	-.100	-.841	-.887	828	-.880	-.888	-.888	968	-.888	-.888	-.888
889	-.888	1.088	-.811	649	-.178	-.818	-.818	789	-.880	-.888	-.114	829	1.188	-.880	1.400	969	-.888	-.880	-.888
890	-.800	1.880	-.888	650	1.080	1.101	-.884	790	-.878	-.881	-.818	830	-.878	-.884	-1.488	970	0	818	0
891	-1.128	1.818	-1.184	651	-.878	-.888	-.818	791	-.800	-.748	-.801	831	-.880	-.888	-1.878	971	-.880	1.008	-.848
892	-.878	-.884	-.880	652	-.888	-.878	-1.888	792	1.080	-.878	1.448	832	-.878	-.844	-1.070	972	-.878	1.100	-.874
893	-.844	-.880	-.880	653	-.848	-.848	-1.880	793	-.800	-.810	-.888	833	-.878	-.880	-1.088	973	-.878	1.038	-.888
894	-.878	-.844	-.888	654	-.888	-.880	-1.870	794	-.880	-.888	-.878	834	-.880	-.818	-1.488	974	-.880	1.018	-.884
895	0	-.881	0	655	1.800	-.878	1.800	795	-.888	-.888	-.888	835	0	-.884	0	975	-.880	1.040	-.188
896	-.878	-.880	-.878	656	-.880	-.880	-.880	796	-.880	-.880	-.880	836	-.180	-.888	-.888	976	-.180	-.888	1.010
897	-.880	-.844	-.880	657	-.888	-.888	-.848	797	-.178	-.788	-.888	837	-.880	1.088	-1.810	977	-.880	-.884	-.848
898	-.888	-.884	-.888	658	-.888	-.888	-.888	798	-.888	-.888	-.888	838	-.880	-.880	-.880	978	-.188	1.088	-.187
899	-.888	-.888	-.888	659	-.888	-.888	-.888	799	-.888	-.888	-.888	839	-.880	-.880	-1.880	979	-.888	-.881	-.881
900	0	-.887	0	660	-.878	-.878	-.888	800	-.180	-.888	-.178	870	-.880	-.888	-.888	980	-.880	-.881	-.881
901	-.878	-.880	-.880	661	-.888	-.888	-.888	801	-.178	-.888	-.888	871	-.880	-.888	-1.884	981	-.888	1.064	-.811
902	-.880	-.880	-.888	662	-.888	-.888	-.888	802	-.888	-.818	-.880	872	-.880	-.888	-.888	982	-.888	1.088	-.878
903	-.888	-.888	-.888	663	-.888	-.888	-.888	803	-.888	-.888	-.888	873	-.880	-.888	-1.888	983	-.888	1.088	-.888
904	-.888	-.888	-.888	664	-.888	-.888	-.888	804	-.888	-.888	-.888	874	-.880	-.888	-1.884	984	-.888	1.118	-.888
905	-.888	-.888	-.888	665	-.888	-.888	-.888	805	-.888	-.888	-.888	875	-.880	-.888	-1.880	985	-.888	1.118	-.888
906	-.888	-.888	-.888	666	-.888	-.888	-.888	806	-.888	-.888	-.888	876	-.880	-.888	-1.888	986	-.888	1.181	-.880
907	-.888	-.888	-.888	667	-.888	-.888	-.888	807	-.888	-.888	-.888	877	-.888	-.888	-1.888	987	-.888	1.188	-.888
908	-.888	-.888	-.888	668	-.888	-.888	-.888	808	-.888	-.888	-.888	878	-.888	-.888	-1.888	988	-.888	1.040	-.888
909	-.888	-.888	-.888	669	-.888	-.888	-.888	809	-.888	-.888	-.888	879	-.888	-.888	-1.888	989	-.888	1.080	-.874
910	-.888	-.888	-.888	670	-.888	-.888	-.888	810	-.888	-.888	-.888	880	-.888	-.888	-1.888	990	-.888	1.080	-.878
911	-.888	-.888	-.888	671	-.888	-.888	-.888	811	-.888	-.888	-.888	881	-.888	-.888	-1.888	991	-.888	1.088	-.888
912	-.888	-.888	-.888	672	-.888	-.888	-.888	812	-.888	-.888	-.888	882	-.888	-.888	-1.888	992	-.888	1.088	-.888
913	-.888	-.888	-.888	673	-.888	-.888	-.888	813	-.888	-.888	-.888	883	-.888	-.888	-1.888	993	-.888	1.047	-.888
914	-.888	-.888	-.888	674	-.888	-.888	-.888	814	-.888	-.888	-.888	884	-.888	-.888	-1.888	994	-.888	1.108	-.888
915	-.888	-.888	-.888	675	-.888	-.888	-.888	815	-.888	-.888	-.888	885	-.888	-.888	-1.888	995	-.888	1.208	-.888
916	-.888	-.888	-.888	676	-.888	-.888	-.888	816	-.888	-.888	-.888	886	-.888	-.888	-1.888	996	-.888	1.288	-.888
917	-.888	-.888	-.888	677	-.888	-.888	-.888	817	-.888	-.888	-.888	887	-.888	-.888	-1.888	997	-.888	1.288	-.888
918	-.888	-.888	-.888	678	-.888	-.888	-.888	818	-.888	-.888	-.888	888	-.888	-.888	-1.888	998	-.888	1.818	-.888
919	-.888	-.888	-.888	679	-.888	-.888	-.888	819	-.888	-.888	-.888	889	-.888	-.888	-1.888	999	-.888	1.087	-.888
920	-.888	-.888	-.888	680	-.888	-.888	-.888	820	-.888	-.888	-.888	890	-.888	-.888	-1.888	1000	-.888	1.087	-.888
921	-.888	-.888	-.888	681	1.080	1.188	-.888	821	-.888	-.888	-.888	891	-.888	1.800	-.888	991	-.888	1.087	-.888
922	-.888	-.888	-.888	682	-.888	-.888	-.888	822	-.888	-.888	-.888	892	-.888	1.800	-.888	992	-.888	1.087	-.888
923	-.888	-.888	-.888	683	-.888	-.888	-.888	823	-.888	-.888	-.888	893	-.888	1.800	-.888	993	-.888	1.087	-.888
924	-.888	-.888	-.888	684	-.888	-.888	-.888	824	-.888	-.888	-.888	894	-.888	1.800	-.888	994	-.888	1.087	-.888
925	-.888	-.888	-.888	685	-.888	-.888	-.888	825	-.888	-.888	-.888	895	-.888	1.800	-.888	995	-.888	1.087	-.888
926	-.888	-.888	-.888	686	-.888	-.888	-.888	826	-.888	-.888	-.888	896	-.888	1.800	-.888	996	-.888	1.087	-.888
927	-.888	-.888	-.888	687	-.888	-.888	-.888	827	-.888	-.888	-.888	897	-.888	1.800	-.888	997	-.888	1.087	-.888
928	-.888	-.888	-.888	688	-.888	-.888	-.888	828	-.888	-.888	-.888	898	-.888	1.800	-.888	998	-.888	1.087	-.888
929	-.888	-.888	-.888	689	-.888	-.888	-.888	829	-.888	-.888	-.888	899	-.888	1.800	-.888	999	-.888	1.087	-.888
930	-.888	-.888	-.888	690	-.888	-.888	-.888	830	-.888	-.888	-.888	900	-.888	1.800	-.888	1000	-.888	1.087	-.888

APPENDIX II

APPENDIX III

A BIBLIOGRAPHIC GUIDE WITH SUGGESTIONS FOR STUDY IN THE FURTHER DEVELOPMENT OF A SCIENTIFIC BASIS FOR THE ECONOMIC CON- TROL OF QUALITY OF MANUFACTURED PRODUCT

As stated in the preface, the present book is but an *initial* step toward the formulation of a scientific basis for securing economic control. Much remains to be done. In presenting a list of references for further study, an attempt has been made to include those suggestive of what appear to be profitable lines of further development.

Throughout the book we have had occasion to give many specific references. The object of the present bibliography is to suggest references of a more or less general nature to be read in connection with each of the seven parts. It is hoped that in many instances these references will be suggestive of work which may be profitably done in extending the theory of quality control, particularly in the direction of the development of improved ways of securing good data through the more thorough application of the scientific method.

REFERENCES FOR PARTS I AND III

1. *Exact and Statistical Laws*

In Parts I and III the rôles of exact, empirical, and statistical laws in helping us to do what we want to do are touched upon.

The recent book, *A History of Science*, C. D. Whetham, 2nd edition, Macmillan Company, New York, 1930, gives an interesting and up-to-date survey of the results of human effort in establishing laws of nature. To get a more exact picture, however, we must turn to some such book as *Introduction to Theoretical Physics*, A. Haas, 2nd edition, Constable & Company, London, Vol. I, 1928, Vol. II, 1929; or the book of the same title by L. Page, D. Van Nostrand Company, Inc., New York, 1928.

With the development of the atomic structure of matter and electricity, it became necessary to think of laws as being statistical in nature. The importance of the law of large numbers in the interpretation of physical phenomena will become apparent to any one who even hastily surveys any one or more of the following books: *Statistical Theories of Matter, Radiation, and Electricity*, K. K. Darrow, The Physical Review Supplement, Vol. I, No. 1, July 1929, also published in the series of Bell Telephone Laboratories' reprints, No. 435; *Introduction to Statistical Mechanics for Students of Physics and Physical Chemistry*, J. Rice, Constable & Company, Ltd., London, 1930; *Statistical Mechanics with Applications to Physics and Chemistry*, R. C. Tolman, Chemical Catalog Company, New York, 1927; *Kinetic Theory of Gases*, L. B. Loeb, McGraw-Hill Book Company, New York, 1927; *The Kinetic Theory of Gases*, E. Bloch, Methuen & Company, Ltd., London, 1924; *Introduction to Modern Physics*, F. K. Richtmeyer, McGraw-Hill Book Company, New York, 1928; *Modern Physics*, H. A. Wilson, Blackie & Son, Ltd., London, 1928; *Introduction to Contemporary Physics*, K. K. Darrow, D. Van Nostrand Company, Inc., New York, 1926; and *Atoms, Molecules and Quanta*, A. E. Ruark and H. C. Urey, McGraw-Hill Book Company, New York, 1930.

One cannot return from even a brief excursion into the field of modern physics and chemistry without having caught a glimpse of the importance of the concept of the statistical limit in all of the latest developments. Even in this field of exact science *nothing is exact*. In the last analysis the influence of chance causes is felt. Almost the only things that appear to be constant are distribution functions or statistics of these functions—and this constancy is only in the statistical sense. For example, one interested in the specification of quality of materials need read only Chapter III of *The Physics of Solids and Liquids*, P. P. Ewald, Th. Pöschl and L. Prandtl, Blackie and Son, Ltd., 1930, to see how far we are from being able to explain some of even the simplest mechanical properties in terms of atomic physics.

2. Empirical Laws

To contrast the way in which the so-called exact and statistical laws enable one to predict with the way in which an empirical law does, the recent excellent book *Business Cycles*, W. C. Mitchell, Na-

tional Bureau of Economic Research, New York, 1927, should prove to be of interest. The author of this book discusses in a critical manner the very extensive amount of work that has been done in trying to develop a rational basis for predicting cyclic movements with a net result that is not so very encouraging. Even a casual reading of this book must impress one with the serious hopelessness of trying to predict the future in terms of the past when the *chance* cause system is not constant. In the present state of the scientific method of induction, it appears that empirical relationships such as time series give little basis for prediction. This conclusion is consistent with that so admirably presented in a recent paper by S. L. Andrew in the *Bell Telephone Quarterly*, Jan., 1931, and also with conclusions set forth in the recent book *Business Adrift*, by W. B. Donham, Dean of the Harvard Business School. Such reading cannot do other than strengthen our belief in the fact that control of quality will come only through the weeding out of assignable causes of variation—particularly those that introduce lack of constancy in the chance cause system.

3. *Frequency Distribution Functions*

In Part III we considered very briefly the problem of determining the kind of frequency distribution function or functions that we might expect controlled quality to follow. In this connection we touched upon the philosophy of frequency curves as laws of distribution.

Two systems of curves were mentioned in particular, namely, the Pearson and the Gram-Charlier systems. Although we have not had occasion to make much use of these functions as such, a serious student of control of quality will find it greatly to his advantage to read some of the original memoirs dealing with these two systems of curves. Those of Pearson are naturally available in English and cannot help but prove stimulating. The more formal part of Pearson's work in this field has been summarized by Elderton in the interesting book, *Frequency Curves and Correlation*, second edition, Layton, London, 1928. T. L. Kelley, a former student of Pearson, also has much of interest to say about this system of curves in his book, *Statistical Method*, Macmillan Company, New York, 1923.

Very interesting and stimulating accounts of the significance of the Gram-Charlier series have been given by Arne Fisher, *Mathe-*

matical Theory of Probabilities, 2nd edition, Macmillan Company, New York, 1922; by F. Y. Edgeworth in a series of articles referred to in his article *Probability* in the 13th edition of the *Encyclopedia Britannica*; and by T. N. Thiele, *Theory of Observations*, London, 1903. J. F. Steffensen in *Some Recent Researches in the Theory of Statistics and Actuarial Science*, Cambridge University Press, 1930, makes some very interesting and pertinent remarks on the theoretical foundation of certain types of frequency curves.

It is of particular interest to note the way in which Edgeworth arrives at the Gram-Charlier series as a method of expressing the results of the joint action of a complicated system of causes. Of course, the Pearson system can be given somewhat similar causal interpretation although great emphasis has not been laid upon this point by many of those writing about the Pearson system.

The sythetic building up of a frequency curve in terms of the effects of component groups of causes forms a basis, as we have seen, for our discussion of the necessary and sufficient conditions of maximum control. We have emphasized the significance of the fact that, as the number of causes of variability is increased, we seem to approach closer and closer to what we have termed the point (0, 3) of maximum control in the $\beta_1 \beta_2$ plane.

In this connection *The Behavior of Prices*, F. C. Mills, National Bureau of Economic Research, Inc., New York, 1928, should prove interesting reading, particularly that part having to do with the march of the β 's back to normalcy, as he puts it.

4. *Probability*

Probability and its Engineering Uses, T. C. Fry, D. Van Nostrand Company, New York, 1928, and *An Introduction to Mathematical Probability*, J. L. Coolidge, Oxford University Press, New York, 1925, contain interesting discussions of the meaning of probability and the difficulty involved in defining it.

5. *Quality Control*

The only book touching upon the subject of quality control in anything like the sense of the present text is that by Becker, Plaut, and Runge, referred to in Chapter I of Part I.

REFERENCES FOR PART II

1. *Economics*

The problem of economic control of quality in its broadest sense is, as we have seen, that of doing what we want to do within limits which are economical. To do this, we must establish *economic standards* of quality. A brief outline of the economic considerations which must be taken into account in attempting to establish such standards of quality is given in an interesting article, "Standard Quality," G. D. Edwards, *Bell Telephone Quarterly*, Vol. VII, pp. 292-303.

For example, in establishing such a standard, we must consider the relationship between cost and value. Value, however, is not so easily defined in a way that will cover all of the prevalent concepts of this term. To attempt to do so leads us into difficulties touched upon in our discussion of the definition of quality.

Naturally, value in some way or other depends upon the degree to which a given quality satisfies human wants; but, in turn, human wants are not constant even for the same person. Furthermore, the degree to which a thing having several quality characteristics tends to satisfy the human wants of even a single person is to a large extent a complicated and unknown function of the magnitudes of the physical characteristics of the thing. Even assuming that the value determined on the basis of the wants of a single person is a constant, it is apparent that the values for different people differ among themselves so that, in the last analysis, value, if it can be expressed quantitatively, is presumably a frequency distribution function.

A brief, terse exposition of the fundamental economic problems involved in attaining a dynamic measure of value will be found in the *Mathematical Introduction to Economics*, G. C. Evans, McGraw-Hill Book Company, New York, 1930. Having obtained a picture of the complicated nature of this problem, one may feel inclined to despair of its solution. However, for some time to come, it is likely that we shall not get away from the desire on the part of all of us to find some measure of quality which is common to all qualities.

In our discussion of economic control, we left out any detailed consideration of this problem of finding an adequate measure of value, even though such a measure apparently would serve a very useful purpose. We started with the tacit assumption that when such a measure of value can be found, it will have two characteristics: it will

be a statistical quantity, and it will be statistically related to the measurable quality characteristic of the product.

Beginning at this point, we have shown, particularly in Part I, that certain economic advantages can be attained in the production of a controlled quality. This means, of course, as previously stated, that the quality standard is some frequency distribution function. We emphasized the importance of at least two characteristics, namely, the average \bar{X} and the standard deviation σ of this function. To insure that the specified parameters in a given case are economic standards would require a consideration of the fundamental problems involved in establishing measures of value already referred to. In such cases we must choose standards which to the best of our knowledge at the present stage of the development of the subject appear to be reasonable estimates of economic standards.

2. *Texts on Statistical Theory*

The ninth edition of Yule's *An Introduction to the Theory of Statistics*, C. Griffin & Company, Ltd., 1930, should prove to be a veritable storehouse of knowledge in respect to many of the things discussed in Part II. This is particularly true in respect to measures of central tendency, dispersion, and correlation. As supplementary reading for the more technical part of the discussion, *Mathematical Statistics*, H. L. Rietz, Open Court Publishing Company, Chicago, 1917, should prove of great value, particularly in connection with the consideration of the analytical aspects of correlation. A. L. Bowley's *Elements of Statistics*, Chas. Scribner's Sons, New York, 1926—in particular the second volume—contains much of interest in regard to the point binomial and the second approximation (23). *The Mathematics of Statistics*, R. W. Burgess, Houghton Mifflin Company, New York, 1927, will be found helpful as a general elementary text. It also contains references to several elementary books dealing with statistical methods and their application in other fields such as economics. Two of these should be mentioned here: *Statistical Methods Applied to Economics in Business*, F. C. Mills, Henry Holt & Company, New York, 1924, and *Principles and Methods of Statistics*, R. E. Chaddock, Houghton Mifflin Company, Boston, 1925. Attention should also be called to the recent book, *The Mathematical Part of Elementary Statistics*, B. H. Camp, D. C. Heath & Co., New York, 1931.

3. Curve Fitting

In connection with our discussion of the derivation of empirical formulas to represent relationships, the little book, *Empirical Formulas*, T. R. Running, Wiley & Sons, New York, 1917, is of interest. The method of moments is discussed in some detail in Elderton's book, *Frequency Curves*, previously referred to. The method of least squares is admirably treated in the *Calculus of Observations*, E. T. Whittaker and G. Robinson, 2nd edition, Blackie & Son, London, 1926.

REFERENCES FOR PART IV

In 1922, R. A. Fisher presented in *The Philosophical Transactions of the Royal Society* in London an article, "The Mathematical Foundations of Theoretical Statistics," in which he characterized three fundamental problems, namely, specification, distribution, and estimation. At least the first nine paragraphs of this paper should be read by any one interested in the application of statistical theory in the control of quality. In Part IV, we are particularly interested in the theory of distribution which has been developed to a marked extent during the last few decades at the hands of R. A. Fisher, "Student," J. Neyman, L. Isserlis, A. E. R. Church, V. J. Romanovsky, J. Wishart, E. L. Dodd, B. H. Camp, H. Hotelling, Karl Pearson, E. S. Pearson, L. H. C. Tippett, P. R. Rider, A. A. Tchouproff, A. A. Markoff, M. Watanabe and E. Slutsky.

Perhaps one of the best ways for a newcomer to orientate himself in this field of investigation is to read the excellent "Report on Statistics" by H. L. Rietz, published in the *Bulletin of the American Mathematical Society*, October, 1924, pp. 417-453. References to later work of the men mentioned in the previous paragraph and others on the theory of distribution will be found in the bibliographies of the books by Yule, Rietz, and Kelley, already referred to. In connection with the discussion of Tchebycheff's theorem, one of the most interesting articles is that of A. A. Tchouproff, "Asymptotic Frequency Distribution of the Arithmetic Means of n Correlated Observations for Very Great Values of n ," *Journal of the Royal Statistical Society*, Vol. LXXXVII, 1925, pp. 91-104. This article gives detailed references to the work of Watanabe, Markoff, Slutsky, and others touching upon this same problem.

A recent paper, "British Statistics and Statisticians Today," H. Hotelling, *Journal of the American Statistical Association*, June,

1930, pp. 186-190, gives an interesting brief account of what is going on in England today in the development of statistical theory. If one is interested in tracing the development of the theory of distribution or, in fact, any part of statistical theory back through the ages, *Studies in the History of Statistical Method*, Helen M. Walker, Williams & Wilkins Company, Baltimore, 1929, will be found helpful. Perhaps our best general source of information on the important work of the Scandinavian School of statisticians is the book by Arne Fisher previously mentioned.

REFERENCES FOR PARTS VI AND VII

1. *Estimation*

Two fundamental statistical problems are touched upon in Parts VI and VII. One is that of going from a random sample of size n to its universe.

Today there are in the literature the following three general methods of going from a sample to its universe:

- (a) The *a posteriori* method.
- (b) The method of maximum likelihood.
- (c) The empirical method.

To mention these three in the same breath in the presence of a group of statisticians is almost certain to start an argument, for there is a wide divergence of opinion as to the comparative validities of these methods.

For this reason, the reader will find it advantageous to consider in some detail the original memoirs dealing with these separate methods. The *a posteriori* method is tied up with the theory of causes and the name of Bayes. The recent important article, "Frequency Distribution of the Unknown Mean of a Sampled Universe," E. C. Molina and R. I. Wilkinson, *Bell System Technical Journal*, Vol. VIII, pp. 632-645, October, 1929, should prove an interesting starting point for the consideration of this method, although the reader will doubtless wish to read other original memoirs referred to in connection with the discussion of Bayes' theorem in the general bibliographies mentioned in a previous paragraph.

The method of maximum likelihood is tied up largely with the work of R. A. Fisher, starting primarily with his article in the *Philosophical Transactions* previously mentioned.

A recent article, "On the Use and Interpretation of Certain Test Criteria for Purposes of Statistical Inference," E. S. Pearson and J. Neyman, *Biometrika*, XXA, pp. 175-240, 1927, and XXA, pp. 263-294, 1928, is perhaps the best critical discussion of the available methods of solving the problem of estimation. It should certainly be read by any serious student of this subject.

The third edition of *Statistical Methods for Research Workers*, R. A. Fisher, summarizes most of the detailed methods of estimation developed by him. It is a book of particular value to scientists and engineers, although one must keep in mind the serious limitations of all methods of estimation based upon small samples as noted in the text and discussed in such references as that of Pearson and Neyman.

It is of interest to note that a divergence of opinion is expressed in the literature as to the usefulness of the theory of the so-called small sample. Perhaps most of the critical remarks are based upon the assumption that this theory is to be used as the basis of estimation, and that it may give the impression that we can replace large samples by small ones. In the first place, a careful reading of the available literature does not reveal any specific suggestion to substitute small samples for large ones. In the second place, it should be noted that the application of small sample theory used in this text is required in handling large numbers of data in a *rational* way by breaking them up into rational subgroups. In this work the distribution theory for small samples plays a prominent rôle.

In general the problem of estimation presents the universal difficulties involved in all induction. If one reads such a book as *A Treatise on Probability*, J. M. Keynes, Macmillan Company, New York, 1921, he may feel at first very much discouraged, because his attention will have been directed to many of the serious difficulties involved in the application of probability theory. A useful tonic in such a case is to read any one or more of the following books: *The Nature of the Physical World*, A. S. Eddington, Macmillan Company, New York, 1928; *The Logic of Modern Physics*, P. W. Bridgman, Macmillan Company, New York, 1928; *The Analysis of Matter*, Bertrand Russell, Harcourt, Brace & Company, Inc., New York, 1927. At least, these three books should prove to be a tonic, if it is true that misery loves company. Certainly the serious difficulties involved in the interpretation of physical phenomena are common in all fields, and the discussions in these books show how much we must rely upon the application of probability theory even in an "exact" science.

2. *Detecting Lack of Control*

The second fundamental statistical problem is that of determining whether or not a given set of data comes from a constant system of causes, or more generally it is the problem of dividing the universe of objective values into rational subgroups schematically represented in Fig. 144. In our discussion of ways and means for detecting lack of control, we have pointed out again and again the necessity of subdividing the data into rational subgroups. To do this requires the exercise of human judgment.

In the last analysis we must depend upon the use of scientific method—that is, upon human intuition, imagination, reasoning, and knowledge. It is perhaps only through the application of this general method that we can hope to attain good data, one characteristic of which is that they be subdivided into rational subgroups. It may be of interest, therefore, to sketch briefly a course of reading which will be found helpful to the student in the application of scientific method to the further development of the theory of quality control. To do so necessarily takes us into the fields of psychology, philosophy, and logic; into the field of psychology because we must get some sort of picture of the way the mind works; into the field of philosophy because we need some hypothesis as to the nature of reality and the function of laws, theories, and causal explanations; into the field of logic because it presents what we know about the formal methods available in the theory of deduction and induction.

How do data depend upon the mind? What is the effect of factual experience and the effect of reasoning upon an observer? These are important questions. What we sense through any one of our senses depends partly upon previous use of these senses. Thus a child looking at a straight stick extending beneath the surface of a pool of water sees a bent stick. Similarly, the first time one sees what is shown in Fig. 131, he sees the length of the line (*a*) to be different from that of line (*b*), although they are of the same length. In this way, factual experience influences what we sense through any one of our senses.

Perhaps more important, however, is that the mental experience involving reasoning influences to a marked extent what we sense. One looking at a line *AB*, Fig. 1, and thinking of the points on the line, sees those points in an entirely different way after he has tried to place such points as $\sqrt{3}$ and π on that line.

Almost every day one hears of some physical discovery which has been influenced by a conceptual theory. A trained experimentalist who is at the same time familiar with the current theory or theories having to do with the phenomena which he is investigating will, in many cases at least, be able to get better data for the particular purpose in hand than he would be if he did not know the theory.



FIG. 1.

In this same connection, it is important to note some of the applications of the theory of frequency curves in assisting one to break down an observed set of data into rational subgroups or to indicate in ways other than those described in the text whether or not this can be done. For example, the fact that an observed point in the $\beta_1 \beta_2$ plane is in the neighborhood of $(0, 1.8)$, Fig. 2, is consistent

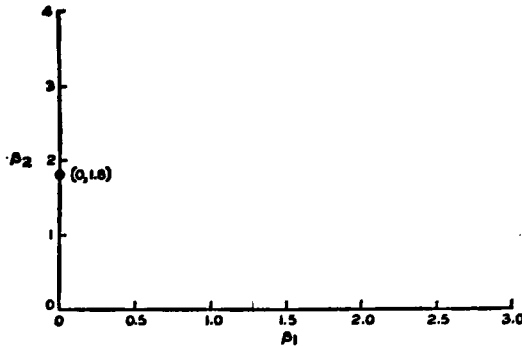


FIG. 2.

with the hypothesis that the observed set of data came in approximately equal proportion from, let us say, m rational subgroups. In a similar way, an observed value of skewness may be consistent with some rational hypothesis in respect to the causes of variation. In other words, an observed set of statistics can be suggestive of a working hypothesis in much the same way that a rough plot of an observed frequency distribution may be suggestive in the sense indicated by E. B. Wilson in his article, "The Development of a Fre-

quency Function and Some Comments on Curve Fitting," *Proceedings of the National Academy of Sciences*, Vol. 10, 1924, pp. 79-84.

Another very important use of the knowledge of the theory may be that of detecting mistakes in computation. For example, if one found a point (β_1, β_2) below the line $\beta_2 - \beta_1 - 1 = 0$, Fig. 3, he would know that a mistake had been made because, as was originally shown by Pearson, it is not possible for a frequency distribution function to have a point in this area.

Broadly speaking, we see again why it is so necessary in the control of quality of manufactured product to have data accumulated by someone acquainted with the available factual and conceptual expe-

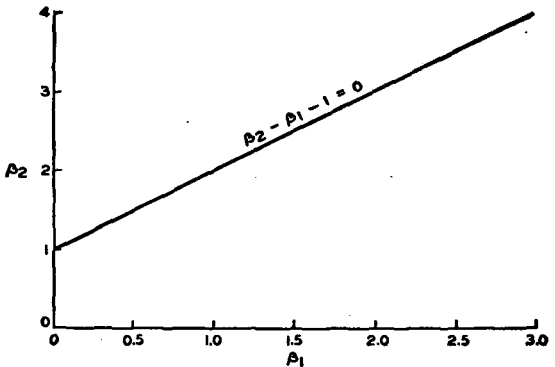


FIG. 3.

rience relating to the particular problem in hand. Books such as: *Scientific Thought*, C. D. Broad, Harcourt, Brace & Company, Inc., New York, 1927; *The Function of Reason*, A. N. Whitehead, Princeton University Press, Princeton, New Jersey, 1929; *The Analysis of Mind*, Bertrand Russell, George Allen and Unwin, Ltd., London, 1922; *Conflicting Psychologies of Learning*, H. B. Bode, D. C. Heath & Company, New York, 1929; *The Principles of Psychology*, William James, Henry Holt & Company, New York, 1890; *The Revolt Against Dualism*, A. L. Lovejoy, W. W. Norton & Company, Inc., New York, 1930; and *Human Learning*, E. L. Thorndike, The Century Co., 1931; contain much of interest in this connection.

Having seen what an important part conceptual experience may play in taking data, one is likely to become more interested in formal logic. The meaning of the laws of thought and the application of

sylogistic reasoning take on a new interest. For example, a fundamental understanding of the theory of control tacitly involves such mathematical concepts as function, limit, continuity, and so on, developed to a degree of refinement which comes from the study of the discussion of these subjects in such a book as G. H. Hardy's *Pure Mathematics*, Cambridge University Press, London, 1928.

Perhaps of even greater interest, however, is the consideration of what we mean by *judgment* and *common sense*—two things which we find we must use so often in experimental work of all kinds. One soon finds that there is a considerable divergence of opinion in respect to such matters as will be evidenced by a more or less systematic browsing in the following treatises on logic. *Elementary Logic*, A. Sidwick, Cambridge University Press, London, 1914; *Principles of Logic*, H. W. Bradley, Vol. I and Vol. II, 2nd Edition, Oxford University Press, London, 1922; *An Introduction to Logic*, H. W. B. Joseph, 2nd Edition, Oxford University Press, London, 1922; *Formal Logic*, J. N. Keynes, 4th Edition, Macmillan Company, Ltd., London, 1928; *Logic, General*, 1921; Vol. II, *Logic Demonstrative Inference: Deductive and Inductive*, 1922; Vol. III, *The Logical Foundation of Science*, 1924; *The Logic of Discovery*, R. D. Carmichael, The Open Court Publishing Co., Chicago, 1930; *Rational Induction*, H. H. Dubs, The Chicago University Press, Chicago, 1930; and *Scientific Inference*, Harold Jeffreys, Macmillan Co., New York, 1931.

It will be noted that the application of the formal scientific method in discovery involves a human choice at every step. For example, in the discovery of a functional or statistical relationship, the following choices must be made:

1. Choice of data.
2. Choice of functional form.
3. Choice of number of parameters, at least in certain cases.
4. Choice of method of estimating parameters.

To a certain extent this field of choice is a kind of methodological No-Man's Land.

History of science shows, however, that the discoverers of the past have, in general, been those broadly trained in the particular field of discovery of their choice. They have been those familiar with the status of experimental and theoretical results in their particular field. The importance of theory in helping one to choose the

right thing to be discovered is illustrated by the fact that several elements in the periodic table have been looked for and found because their existence was suggested by the blank spaces. So it is that many of the discoveries of science have been suggested by theory.

Furthermore, it is of interest to note that important discoveries have usually come only after the investigator has surrounded himself for a considerable period of time with the facts bearing upon the subject and during this period has kept these more or less constantly in mind. It is true, however, history also indicates that many of these discoveries have only come after the investigator has dropped the search for a time more or less completely from his conscious consideration. In all cases, however, it appears that preliminary conscious attention to the facts in hand is essential.

Coming now to the more or less formal treatment of scientific method, the following books will be found helpful in something like the order listed: *The Foundations of Science*, H. Poincare, The Science Press, New York, 1929; *The Principles of Science*, W. S. Jevons, Macmillan Company, Ltd., London, 1924; *Essentials of Scientific Method*, A. Wolf, Macmillan Company, New York, 1927; *Scientific Method*, A. D. Ritchie, Harcourt, Brace & Company, New York, 1923; and *Physics, The Elements*, N. R. Campbell, Cambridge University Press, London, 1920, together with Vol. III of Johnson's *Logic* noted in the previous paragraph.

Books such as the *Quest for Certainty*, John Dewey, Minton Balch Company, New York, 1929; and in particular, A. N. Whitehead's *Process and Reality*, Macmillan Company, New York, 1930, contain much of interest. Just as a simple example, it is necessary for us to think of a quality characteristic as an entity in the sense adopted by Whitehead if it is to be general enough to be of use in the many practical problems that arise in the interpretation of a sample.

OTHER REFERENCES

1. *Errors of Measurement*

It is assumed that the reader has available one or more of the following books on the discussion of the errors of measurement: *The Combination of Observations*, David Brunt, University Press, London, 1917; *The Calculus of Observations*, E. T. Whittaker and G. Robinson, Blackie & Son, London, 1924; *The Theory of Measurements*, A. D. Palmer, McGraw-Hill Publishing Company, New York, 1930; and

The Theory of Measurements, L. Tuttle and J. Satterly, Longmans, Green & Company, New York, 1925.

Brunt's book contains, in addition to the ordinary discussion of the theory of errors, an interesting introductory chapter indicating various ways of developing the normal law. The book by Tuttle and Satterly gives a particularly good elementary discussion of many things which must be considered in correcting data for errors of measurement. Palmer's treatise is of particular value in outlining things which must be considered in planning physical measurements so as to reduce the errors of measurement to a minimum.

2. Tables

Of course, every one needs a table of squares, reciprocals, and square roots such as that of Barlow published in revised form by E. and F. N. Spon, Ltd., London, 1930, and a table of logarithms such as those of Vega published by D. Van Nostrand Company, New York, 1916. In addition to these, any one interested in the theory of quality control will find much use for Pearson's *Tables for Statisticians and Biometricians*, published by the Cambridge University Press, London, 1924. The second volume of these tables which is now in the process of preparation is supposed to contain the tables which have appeared in *Biometrika* since the publication of the first volume in 1924. In a way, the promised second volume will be even more helpful than the first. The books by Fry, Arne Fisher, and R. A. Fisher contain many useful tables. For a more complete bibliography, the reader is referred again to that of Yule.

3. Magazines

Without question, one magazine which has been found most useful in our study of quality control has been *Biometrika*, edited by Karl Pearson and his son Egon Pearson, and published by the Cambridge University Press, London. It has carried many of the important papers of "Student," R. A. Fisher, L. H. C. Tippett, J. Neyman, J. O. Irwin, Karl Pearson, E. S. Pearson, J. Wishart, and their associates. The *Skandinavisk Aktuarietidskrift*, Stockholm, contains many important articles in English as well as in foreign languages. The same is true of *Metron*, an international review of statistics published in Rome, Italy.

The Journal of the American Statistical Association, New York, contains many discussions of the applications of the more elementary theory of statistics in the field of economics. The same can be said of the *Journal of the Royal Statistical Society*, London, although this Journal has also published several important articles on the theory of statistics. Both of these Journals are of value because of their reviews of current literature. The *Annals of Mathematical Statistics* is a Journal recently started in cooperation with the American Statistical Association. It is devoted to both theory and application of mathematical statistics.

A glance at any of the complete bibliographies previously referred to will show that important articles have appeared in many other journals than those listed here.

4. *Mathematics*

It is assumed, of course, that the student of the theory of control is equipped with elementary texts up to and including differential and integral calculus. For a more complete treatment than is ordinarily given in any elementary text, the following books are suggested. In questions involving purely algebraical manipulation as in the discussion of the multinomial theorem, the student will find *Algebra*, G. Chrystal, Vol. I and Vol. II, 5th Edition, A. and C. Black, Ltd., London, 1920, of great help. For a discussion of the subject of symmetric functions and related topics of interest in the application of the method of moments and the use of semi-invariants, M. Bôcher's *Introduction to Higher Algebra*, Macmillan Company, New York, 1921, will be helpful. *Advanced Calculus*, W. F. Osgood, Macmillan Company, New York, 1925, treats in sufficient detail for most purposes the analytical methods required for an understanding of the mathematical theory found in most articles on the subjects of specification, distribution, and estimation. Two excellent books on the mathematical theory of statistics are: *Statistique Mathématique*, G. Darmon, Gaston Doin et Cie., Paris, 1928, and *Statistique Mathématique*, Charles Jordan, Gauthier-Villars et Cie., Paris, 1927.

5. *Graphical Methods*

We have neglected to consider in any great detail the important problem of presenting the results of quality control studies in a way to be of greatest service even though so much depends upon a thought-

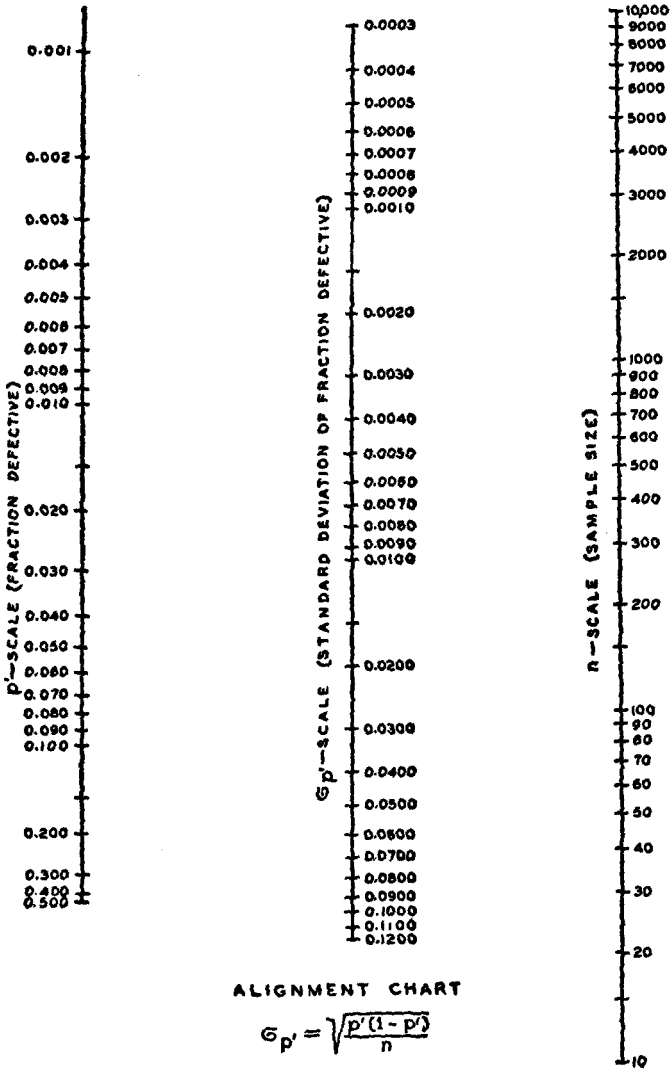
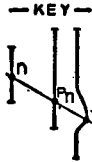
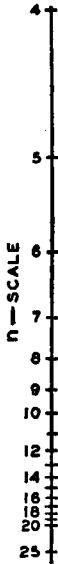


FIG. 4.

NOMOGRAPHIC REPRESENTATION
 OF PROBABILITY (P_n) THAT AT ERROR ($\bar{x}-\bar{x}'$)
 IN AVERAGE ESTIMATED FROM THE MEAN OF
 A SAMPLE (\bar{X}) OF SIZE n AND MEASURED IN
 TERMS OF ITS STANDARD DEVIATION LIES
 BETWEEN $-\infty$ AND $+t$ FOR VARIOUS
 n (FROM $n=4$ TO $n=25$)



PROBABILITY P_t OF HAVING THE SAME
 ERROR IN AVERAGE BETWEEN $-t$ AND $+t$
 CAN BE CALCULATED FROM:
 $P_t = 2 (P_n - 0.5)$

NUMERICAL VALUES OF PROBABILITY P_n
 ARE TAKEN FROM R.A. FISHER'S TABLES
 GIVEN IN HIS PAPER: EXPANSION
 OF "STUDENT'S" INTEGRAL IN POWERS
 OF n^{-1} ("METRON" VOLUME 7, NO. 3, 1925)

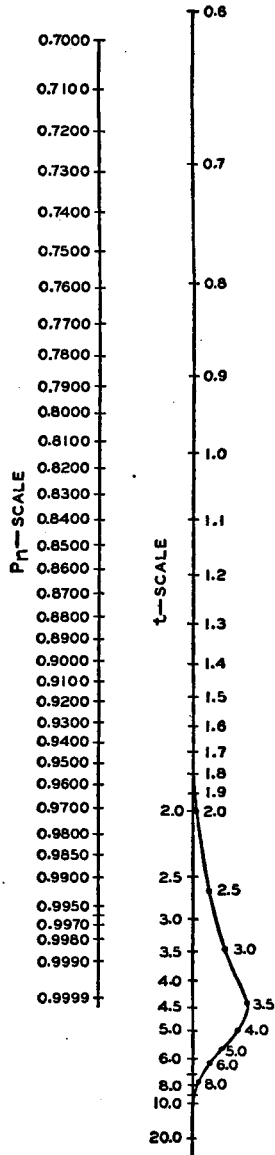


FIG. 5.

ful and artistic layout of the graphical presentation. In this connection, *Layout in Advertising*, W. A. Dwiggins, Harper & Bros., New York, 1928, should prove to be suggestive.

In closing, we should note that in the application of the method of control, it is sometimes advisable to substitute nomograms for tables in shop practice. For example, Fig. 4 gives a nomogram which enables one to read off the standard deviation σ in terms of a given sample size n and probability p' . In a similar way, Fig. 5 presents in graphical form the very complicated table of "Student's" integral. For a discussion of this nomogram and of the application of nomography in this way, see the paper by V. A. Nekrassoff, "Nomography in Applications of Statistics," published in *Metron*, Vol. VIII, 1930, pp. 95-99.

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