

A NOTE ON SPEARMAN'S FOOTRULE

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ABSTRACT

We obtain exact tables of the null distribution of Spearman's footrule for sample sizes $n = 4(1)40$ by using a certain Markov chain property, and we investigate the adequacy of approximations to the distribution.

1. INTRODUCTION

Spearman (1904) based the measure of rank correlation known as his "footrule" on

$$D(\sigma, \pi) = \sum_{i=1}^n | \sigma(i) - \pi(i) | ,$$

where σ and π are any two members of S_n , the set of all permutations of the first n integers. Diaconis and Graham (1977) considered D as a metric on S_n , and discussed its relationships with other widely used nonparametric measures of association such as Kendall's τ and Spearman's ρ . The expected value and variance of D (under the assumption that σ and π are chosen independently and at least one is uniform over S_n) are

$$E[D] = \frac{(n-1)(n+1)}{3}$$

and

$$V[D] = \frac{(n+1)(2n^2+7)}{45} .$$

These were announced by Spearman (1904) and proven by Kleinecke, Ury, and Wagner (1962). Ury and Kleinecke (1979) provided the exact cumulative distribution of D for $n = 2(1)10$. Recently, Franklin (1988) has extended the tabulation to $n = 11(1)18$.

In Section 2 of this note, we discuss a related statistic T which provides an easy way to obtain information concerning D : in particular, its third moment. In Section 3 we provide the exact cumulative distribution of D for $n = 4(1)40$ and discuss the adequacy of two approximations.

2. THE STATISTIC T AND ITS RELATIONSHIP WITH SPEARMAN'S FOOTRULE D

Let $\sigma = \{\sigma(i)\}$ be an element of S_n . Define $T_i = \#\{\sigma(j) \mid \sigma(j) \leq i, j=1, \dots, i\}$, $i=1, \dots, n$. Let $T = \sum_{i=1}^n T_i$. Then the relationship between T and $D(\underline{1}, \sigma)$, where $\underline{1}$ here denotes the identity permutation $\{1, 2, \dots, n\}$, is given by the following

Theorem 1. Let σ be any permutation in S_n ; then

$$\frac{D(\sigma)}{2} + T(\sigma) = \frac{n(n+1)}{2} .$$

Proof. The relation is easily seen to be true for $n = 2$. Assume it is true for some $n-1$, where $n > 3$. Let the permutation σ in S be represented by:

$$\sigma = \begin{array}{cccccc} 1 & \dots & i-1 & i & \dots & n \\ x_1 & \dots & x_{i-1} & x_i & \dots & x_n \end{array}$$

where $x_i = n$. Consider the permutation $\hat{\sigma}$, in S_{n-1} , obtained from σ by deleting the value n from both rows of the previous representation of σ . Thus we have

$$\hat{\sigma} = \begin{array}{cccccc} 1 & \dots & i-1 & i & \dots & n-1 \\ x_1 & \dots & x_{i-1} & x_{i+1} & \dots & x_{n-1} \end{array}$$

Let

$$d_j = |\sigma(j) - j|, \quad j=1, \dots, n$$

and

$$\hat{d}_j = |\hat{\sigma}(j) - j|, \quad j=1, \dots, n-1 .$$

Then it is easy to see that

$$d_j = \hat{d}_j \text{ for } j=1, \dots, i-1,$$

$$d_i = (n-i),$$

$$d_j = \begin{cases} \hat{d}_{j-1}+1 & \text{if } x_j \leq j \\ \hat{d}_{j-1}-1 & \text{if } x_j > j \end{cases} \text{ for } j=i+1, \dots, n.$$

Consider the set $C = \{x_{i+1}, \dots, x_n\} = \{\hat{\sigma}(j) : j=i, \dots, n-1\}$. Let

$$A = \{x_i \in C \mid x_i < i\},$$

$$B = \{x_i \in C \mid x_i > i\};$$

then $\#C = \#A + \#B = (n-i)$. With this notation we can write

$$d_j = \begin{cases} \hat{d}_{j-1}+1 & \text{if } x_{j-1} \in A \\ \hat{d}_{j-1}-1 & \text{if } x_{j-1} \in B \end{cases} \text{ for } j=i+1, \dots, n.$$

Thus

$$D(\sigma) = \sum_{i=1}^n d_i = D(\hat{\sigma}) + (n-i) + \#A - \#B = D(\hat{\sigma}) + 2\#A.$$

We now get a similar relation for T . Let T_i (\hat{T}_i) be the statistic T_i calculated for the permutation σ ($\hat{\sigma}$) respectively. It is easy to see that

$$T_j = \hat{T}_j, \quad j=1, \dots, i-1$$

$$T_j = \begin{cases} \hat{T}_j & \text{if } x_j \in B \\ \hat{T}_{j-1} & \text{if } x_j \in A \end{cases}, \quad j=i, \dots, n-1$$

and

$$T_n = n.$$

Thus

$$T(\sigma) = \sum_{i=1}^n T_i = T(\hat{\sigma}) - \#A + n.$$

Now,

$$\begin{aligned} \frac{D(\sigma)}{2} + T(\sigma) &= \frac{D(\hat{\sigma})}{2} + \#A + T(\hat{\sigma}) - \#A + n \\ &= \frac{D(\hat{\sigma})}{2} + T(\hat{\sigma}) + n . \end{aligned}$$

But by assumption we have

$$\frac{D(\hat{\sigma})}{2} + T(\hat{\sigma}) = \frac{(n-1)(n)}{2} .$$

Thus

$$\frac{D(\sigma)}{2} + T(\sigma) = \frac{n(n-1)}{2} + n = \frac{n(n+1)}{2}$$

as was to be proven.

The statistic T was discussed by Sen and Salama (1983), who obtained its third moment as

$$E[T - E[T]]^3 = \frac{(n+1)(n+2)(2n^2+31)}{3780}$$

under the assumption that σ is chosen uniformly in S_n . From this it follows immediately that

$$E[D - E[D]]^3 = - \frac{2(n+1)(n+2)(2n^2+31)}{945} .$$

A closely related statistic had previously been proposed by Salama and Quade (1981), who showed that the sequence $\{T_1, \dots, T_n\}$ is a Markov chain, i.e. ,

$$P\{T_{i+1} = r_{i+1} \mid T_1 = r_1, \dots, T_i = r_i\} = P\{T_{i+1} = r_{i+1} \mid T_i = r_i\} \text{ for } i=2, \dots, n-1,$$

in particular, that

$$P\{T_{i+1} = r_{i+1} \mid T_i = r\} = \begin{cases} \frac{(n-2i+r)(n-2i+r-1)}{(n-i)^2} , & r_{i+1} = r \\ \frac{(n-2i+r)(2(i-r)+1)}{(n-i)^2} , & r_{i+1} = r+1 \\ \frac{(i-r)^2}{(n-i)^2} , & r_{i+1} = r+2 \\ 0 , & \text{otherwise} \end{cases}$$

with initial conditions $P\{T_1 = 1\} = 1$ and $P\{T_1 = C\} = 0$ for $C \neq 1$.

The Markov property is important because one can use it to generate the exact distribution of T , and thence D , without having to generate all the elements of S_n . This is especially advantageous when considering cases where n is large -- say, 10 or more.

A more general version of Theorem 1 may be considered, as follows. Let σ and π be two permutations in S_n . Define the following sets:

$$\sigma_i = \{\sigma(j), \quad j=1, \dots, i\}, \quad i=1, \dots, n$$

and

$$\pi_i = \{\pi(j), \quad j=1, \dots, i\}, \quad i=1, \dots, n.$$

Define

$$T_i = \#(\sigma_i \cap \pi_i), \quad i=1, \dots, n.$$

We note that if σ is the identity permutation in S_n , then this definition coincides with the definition of T_i given previously. Thus we have:

Theorem 2. Let σ and π be any two permutations in S_n . Let σ^{-1} be the inverse of σ : that is, $\sigma \cdot \sigma^{-1} = 1$. Then

$$\frac{1}{2} D(\sigma \cdot \sigma^{-1}, \pi \sigma^{-1}) + T(\sigma \cdot \sigma^{-1}, \pi \cdot \sigma^{-1}) = \frac{n(n+1)}{2}.$$

3. THE EXACT DISTRIBUTION OF D, AND APPROXIMATIONS TO IT

Table 1 gives the exact cumulative distribution of $D(\sigma, \pi)$, to five decimal places of precision, given that the two permutations are chosen independently and at least one is uniform over S_n . The distribution was calculated using the Markov property of T and its relationship with D as given in Theorem 1. The table is complete for $n = 4(1)40$. A compact notation has been used for very small probabilities: for example, ".948-3" means ".948 x 10⁻³" or ".000948". In the far right tail for each N , only the first value of D for which $P > .999995$ is printed, with P indicated as equaling "1". We have checked Table 1 against the recent tabulation by Franklin (1988) of the complete distribution for $n = 11(1)18$ to four decimal places. Besides five discrepancies of one unit in the fourth place, there are two more serious misprints, as follows: for $n = 15$ and $D = 94$, read .9484 for .9848; and for $n = 17$ and $D = 80$, read .1668 for .1168. Incidentally, we have also verified that the conjecture of Ury and Kleinecke (1973, p. 274), concerning cumulative lower tail frequencies, holds for all n up to 40.

For large n the distribution of D is asymptotically normal, as was shown by Diaconis and Graham (1977). Its skewness is in general

$$\frac{E [D-E[D]]^3}{\sigma^3[D]} = \frac{-2\sqrt{5} (n+2) (2n^2 + 31)}{7\sqrt{n+1} (2n^2+7)^{1.5}} \sim \frac{-\sqrt{10}}{7\sqrt{n}} = \frac{-.45}{\sqrt{n}}.$$

Some representative values of the skewness and kurtosis (calculated directly from the exact distributions) are as follows:

n	5	10	15	20	25	30	35	40	(limit)
skewness	-.344	-.179	-.134	-.111	-.097	-.088	-.080	-.075	0
kurtosis	2.632	2.733	2.811	2.856	2.883	2.902	2.916	2.926	3.000

We have extended the investigation by Franklin (1988) of the accuracy of the normal approximation with continuity correction given by Ury and Kleinecke (1973). For $d < (n^2-1)/3$ this approximation is that

$$P = P \{ D \leq d \} \doteq P^* = \Phi \left(\frac{d - E[D] + 1}{\sigma[D]} \right)$$

where Φ is the standard normal distribution function. The maximum absolute error $|P^*-P|$ decreases from .0088 at $n = 20$ to .0066 at $n = 30$ and .0055 at $n = 40$; with P restricted to be less than .1, the maximum absolute error decreases from .0040 at $n = 20$ to .0030 at $n = 30$ and .0025 at $n = 40$. If $.001 < P < .100$, then P^* is generally smaller than P (always, for $12 \leq n \leq 40$), so the approximation yields an anticonservative test of independence, and this tendency would of course be even worse if the standard continuity correction (the "+1" in the formula) were not applied. When P is very small, however, the error is positive, and the approximation conservative.

We also considered a continuity-corrected chi-squared approximation which fits three moments of the distribution exactly instead of only two:

$$P^{**} = 1 - \chi^2 \left(\frac{d + 1 - E[D] + 2\sigma^2 [D]/\tau[D]}{\tau[D]/4\sigma^2[D]}; \frac{8\sigma^6[D]}{\tau^2[D]} \right)$$

where $\tau[D] = E [D-E[D]]^3$ and $\chi^2(x;f)$ is the chi-squared distribution function with f degrees of freedom. For $.001 < P < .100$ this provides a modest improvement

over the normal approximation. For very small P , however, it is actually worse, perhaps because the chi-squared distribution has higher kurtosis than the normal, which already has higher kurtosis than the distribution of D .

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TABLE 1

Cumulative Probability Distribution of the Footrule Metric

N = 4		N = 8		14 .00641		N = 12		28 .00514		52 .15346	
D P		D P		16 .01408		D P		30 .00898		54 .19604	
0 .04167		0 .248-4		18 .02798		0 .209-8		32 .01498		56 .24507	
2 .16667		2 .198-3		20 .05097		2 .251-7		34 .02400		58 .30007	
4 .45833		4 .00102		22 .08620		4 .182-6		36 .03699		60 .36021	
6 .83333		6 .00387		24 .13643		6 .977-6		38 .05500		62 .42427	
8 1		8 .01198		26 .20319		8 .428-5		40 .07910		64 .49077	
		10 .03095		28 .28632		10 .159-4		42 .11018		66 .55801	
		12 .06873		30 .38300		12 .519-4		44 .14900		68 .62418	
N = 5		14 .13204		32 .48843		14 .150-3		46 .19582		70 .68756	
D P		16 .22371		34 .59569		16 .394-3		48 .25064		72 .74660	
0 .00833		18 .34405		36 .69863		18 .939-3		50 .31265		74 .79994	
2 .04167		20 .48562		38 .79030		20 .00206		52 .38080		76 .84667	
4 .14167		22 .63175		40 .86555		22 .00420		54 .45313		78 .88631	
6 .34167		24 .76696		42 .92302		24 .00799		56 .52773		80 .91876	
8 .63333		26 .87143		44 .96063		26 .01434		58 .60185		82 .94429	
10 .83333		28 .94196		46 .98317		28 .02438		60 .67354		84 .96363	
12 1		30 .98571		48 .99603		30 .03948		62 .73995		86 .97758	
		32 1		50 1		32 .06111		64 .79994		88 .98709	
				N = 11		34 .09071		66 .85151		90 .99324	
N = 6		N = 9		D P		36 .12949		68 .89462		92 .99679	
D P		D P		0 .251-7		38 .17819		70 .92840		94 .99870	
0 .00139		0 .276-5		2 .276-6		40 .23692		72 .95447		96 .99971	
2 .00833		2 .248-4		4 .185-5		42 .30492		74 .97254		98 1	
4 .03333		4 .141-3		6 .927-5		44 .38073		76 .98504			
6 .09722		6 .592-3		8 .378-4		46 .46195		78 .99251		N = 15	
8 .22639		8 .00204		10 .131-3		48 .54551		80 .99709		D P	
10 .41667		10 .00589		12 .395-3		50 .62808		82 .99892		0 .76-12	
12 .62222		12 .01478		14 .00106		52 .70628		84 1		2 .11-10	
14 .81111		14 .03252		16 .00255		54 .77714				4 .101-9	
16 .95000		16 .06372		18 .00560		56 .83834		N = 14		6 .655-9	
18 1		18 .11233		20 .01128		58 .88882		D P		8 .344-8	
		20 .18253		22 .02106		60 .92814		0 .11-10		10 .154-7	
		22 .27424		24 .03681		62 .95691		2 .161-9		12 .603-7	
		24 .38590		26 .06059		64 .97664		4 .133-8		14 .211-6	
N = 7		26 .50782		28 .09456		66 .98858		6 .814-8		16 .670-6	
D P		28 .63323		30 .14032		68 .99528		8 .405-7		18 .195-5	
0 .198-3		30 .74514		32 .19898		70 .99892		10 .171-6		20 .523-5	
2 .00139		32 .84296		34 .26997		72 1		12 .634-6		22 .131-4	
4 .00635		34 .91359		36 .35220				14 .210-5		24 .306-4	
6 .02143		38 .96349		38 .44199		N = 13		16 .628-5		26 .675-4	
8 .05853		40 .98571		40 .53633		D P		18 .172-4		28 .141-3	
10 .13115				42 .62951		0 .161-9		20 .435-4		30 .279-3	
12 .24841		N = 10		44 .71800		2 .225-3		22 .102-3		32 .529-3	
14 .39603		D P		46 .79549		24 .225-3		24 .225-3		34 .962-3	
16 .57143		0 .276-6		48 .86169		26 .467-3		26 .467-3		36 .00168	
18 .73651		2 .276-5		50 .91205		28 .915-3		28 .915-3		38 .00284	
20 .87857		4 .171-4		52 .94984		30 .00171		30 .00171		40 .00464	
22 .95000		6 .788-4		54 .97397		32 .00305		32 .00305		42 .00734	
24 1		8 .297-3		56 .98954		34 .00522		34 .00522		44 .01128	
		10 .944-3		58 .99603		36 .00860		36 .00860		46 .01687	
		12 .00262		60 1		38 .01368		38 .01368		48 .02458	
						40 .02104		40 .02104		50 .03496	
						42 .03137		42 .03137		52 .04856	
						44 .04542		44 .04542		54 .06597	
						46 .06397		46 .06397		56 .08774	
						48 .08777		48 .08777		58 .11435	
						50 .11744		50 .11744		60 .14617	

TABLE 1, continued

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62	.18335	62	.06234	46	.702-3	14	.128-9	140	.98214	90	.05729
64	.22591	64	.08119	48	.00113	16	.470-9	142	.98771	92	.07078
66	.27356	66	.10397	50	.00178	18	.159-8	144	.99181	94	.08654
68	.32582	68	.13098	52	.00274	20	.497-8	146	.99473	96	.10476
70	.38187	70	.16242	54	.00413	22	.145-7	148	.99676	98	.12556
72	.44079	72	.19836	56	.00608	24	.396-7	150	.99810	100	.14906
74	.50132	74	.23871	58	.00879	26	.102-6	152	.99896	102	.17531
76	.56227	76	.28321	60	.01245	28	.249-6	154	.99948	104	.20432
78	.62217	78	.33144	62	.01733	30	.577-6	156	.99976	106	.23601
80	.67987	80	.38276	64	.02371	32	.128-5	158	.99991	108	.27025
82	.73401	82	.43643	66	.03189	34	.271-5	160	.99998	110	.30687
84	.78377	84	.49155	68	.04221	36	.551-5	162	1	112	.34558
86	.82817	86	.54713	70	.05500	38	.108-4			114	.38606
88	.86700	88	.60216	72	.07062	40	.205-4			116	.42794
90	.89976	90	.65563	74	.08936	42	.376-4	N = 19		118	.47078
92	.92687	92	.70659	76	.11152	44	.670-4			120	.51412
94	.94835	94	.75422	78	.13728	46	.116-3	D P		122	.55747
96	.96503	96	.79784	80	.16681	48	.196-3			124	.60035
98	.97725	98	.83694	82	.20011	50	.322-3	0	.82-17	126	.64226
100	.98609	100	.87124	84	.23713	52	.517-3	2	.16-15	128	.68277
102	.99189	102	.90065	86	.27766	54	.813-3	4	.17-14	130	.72143
104	.99571	104	.92523	88	.32136	56	.00125	6	.13-13	132	.75791
106	.99791	106	.94526	90	.36779	58	.00189	8	.85-13	134	.79188
108	.99920	108	.96114	92	.41640	60	.00279	10	.46-12	136	.82314
110	.99971	110	.97334	94	.46649	62	.00406	12	.22-11	138	.85149
112	1	112	.98240	96	.51735	64	.00580	14	.93-11	140	.87690
		114	.98891	98	.56819	66	.00816	16	.36-10	142	.89931
		116	.99337	100	.61824	68	.01128	18	.126-9	144	.91883
		118	.99628	102	.66670	70	.01537	20	.411-9	146	.93555
		120	.99810	104	.71292	72	.02062	22	.125-8	148	.94966
		122	.99912	106	.75620	74	.02728	24	.358-8	150	.96135
		124	.99965	108	.79612	76	.03560	26	.963-8	152	.97090
		126	.99992	110	.83221	78	.04584	28	.246-7	154	.97851
		128	1	112	.86433	80	.05827	30	.596-7	156	.98450
				114	.89229	82	.07315	32	.138-6	158	.98908
				116	.91623	84	.09073	34	.306-6	160	.99252
				118	.93620	86	.11121	36	.651-6	162	.99502
				120	.95260	88	.13475	38	.133-5	164	.99681
				122	.96564	90	.16148	40	.264-5	166	.99803
				124	.97584	92	.19143	42	.506-5	168	.99885
				126	.98352	94	.22456	44	.939-5	170	.99936
				128	.98920	96	.26073	46	.170-4	172	.99967
				130	.99318	98	.29974	48	.298-4	174	.99984
				132	.99594	100	.34126	50	.511-4	176	.99994
				134	.99769	102	.38490	52	.856-4	178	.99998
				136	.99880	104	.43018	54	.140-3	180	1
				138	.99943	106	.47656	56	.224-3		
				140	.99979	108	.52345	58	.352-3		
				142	.99992	110	.57024	60	.543-3	N = 20	
				144	1	112	.61632	62	.821-3		
						114	.66108	64	.00122	D P	
						116	.70396	66	.00179		
						118	.74447	68	.00257	0	.41-18
						120	.78220	70	.00364	2	.82-17
						122	.81681	72	.00508	4	.93-16
						124	.84809	74	.00700	6	.77-15
						126	.87590	76	.00951	8	.51-14
						128	.90023	78	.01274	10	.29-13
						130	.92115	80	.01686	12	.14-12
						132	.93882	82	.02204	14	.63-12
						134	.95346	84	.02847	16	.25-11
						136	.96535	86	.03634	18	.93-11
						138	.97480	88	.04588	20	.31-10

TABLE 1, continued

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22	.100-9	148	.78954	60	.142-4	186	.97757	78	.114-3	204	.97958
24	.298-9	150	.81878	62	.230-4	188	.98293	80	.167-3	206	.98422
26	.837-9	152	.84555	64	.367-4	190	.98722	82	.241-3	208	.98798
28	.223-8	154	.86978	66	.576-4	192	.99060	84	.344-3	210	.99099
30	.563-8	156	.89143	68	.889-4	194	.99322	86	.486-3	212	.99335
32	.136-7	158	.91056	70	.135-3	196	.99522	88	.679-3	214	.99518
34	.314-7	160	.92724	72	.202-3	198	.99670	90	.937-3	216	.99657
36	.697-7	162	.94159	74	.299-3	200	.99778	92	.00128	218	.99761
38	.149-6	164	.95377	76	.435-3	202	.99855	94	.00173	220	.99838
40	.307-6	166	.96396	78	.625-3	204	.99909	96	.00232	222	.99893
42	.612-6	168	.97235	80	.886-3	206	.99944	98	.00308	224	.99931
44	.118-5	170	.97915	82	.00124	208	.99968	100	.00405	226	.99957
46	.222-5	172	.98457	84	.00172	210	.99982	102	.00528	228	.99974
48	.407-5	174	.98881	86	.00235	212	.99991	104	.00682	230	.99985
50	.724-5	176	.99207	88	.00319	214	.99996	106	.00873	232	.99992
52	.126-4	178	.99451	90	.00427	216	.99998	108	.01109	234	.99996
54	.214-4	180	.99630	92	.00566	218	.99999	110	.01397	236	.99998
56	.356-4	182	.99759	94	.00743	220	1	112	.01746	238	.99999
58	.581-4	184	.99848	96	.00965			114	.02164	240	1
60	.928-4	186	.99908	98	.01242			116	.02664		
62	.146-3	188	.99947	100	.01583	N = 22		118	.03254		
64	.225-3	190	.99971	102	.02001			120	.03945	N = 23	
66	.341-3	192	.99986	104	.02505	D P		122	.04750		
68	.509-3	194	.99994	106	.03111			124	.05679	D P	
70	.747-3	196	.99998	108	.03830	0 .89-21		126	.06744		
72	.00108	198	.99999	110	.04676	2 .20-19		128	.07954	0 .39-22	
74	.00154	200	1	112	.05664	4 .24-18		130	.09320	2 .89-21	
76	.00218			114	.06807	6 .22-17		132	.10851	4 .11-19	
78	.00302			116	.08117	8 .16-16		134	.12552	6 .11-18	
80	.00415	N = 21		118	.09607	10 .95-16		136	.14431	8 .80-18	
82	.00562			120	.11287	12 .51-15		138	.16489	10 .50-17	
84	.00753	D P		122	.13164	14 .24-14		140	.18728	12 .28-16	
86	.00998			124	.15245	16 .10-13		142	.21147	14 .14-15	
88	.01307	0 .20-19		126	.17532	18 .41-13		144	.23740	16 .61-15	
90	.01693	2 .41-18		128	.20026	20 .15-12		146	.26501	18 .25-14	
92	.02170	4 .49-17		130	.22722	22 .52-12		148	.29419	20 .95-14	
94	.02754	6 .42-16		132	.25614	24 .17-11		150	.32481	22 .34-13	
96	.03460	8 .29-15		134	.28689	26 .50-11		152	.35671	24 .11-12	
98	.04305	10 .17-14		136	.31933	28 .14-10		154	.38971	26 .35-12	
100	.05307	12 .87-14		138	.35327	30 .40-10		156	.42359	28 .10-11	
102	.06482	14 .40-13		140	.38848	32 .103-9		158	.45812	30 .30-11	
104	.07845	16 .17-12		142	.42472	34 .257-9		160	.49306	32 .80-11	
106	.09413	18 .64-12		144	.46170	36 .616-9		162	.52816	34 .21-10	
108	.11198	20 .23-11		146	.49912	38 .142-8		164	.56316	36 .51-10	
110	.13210	22 .74-11		148	.53668	40 .316-8		166	.59779	38 .123-9	
112	.15457	24 .23-10		150	.57404	42 .678-8		168	.63180	40 .283-9	
114	.17941	26 .67-10		152	.61089	44 .141-7		170	.66494	42 .629-9	
116	.20663	28 .186-9		154	.64693	46 .285-7		172	.69698	44 .136-8	
118	.23616	30 .490-9		156	.68187	48 .561-7		174	.72773	46 .283-8	
120	.26789	32 .123-8		158	.71542	50 .107-6		176	.75699	48 .576-8	
122	.30168	34 .296-8		160	.74737	52 .200-6		178	.78462	50 .114-7	
124	.33732	36 .683-8		162	.77750	54 .365-6		180	.81048	52 .220-7	
126	.37455	38 .152-7		164	.80565	56 .651-6		182	.83449	54 .414-7	
128	.41308	40 .325-7		166	.83169	58 .114-5		184	.85658	56 .762-7	
130	.45257	42 .674-7		168	.85555	60 .194-5		186	.87674	58 .137-6	
132	.49265	44 .135-6		170	.87719	62 .326-5		188	.89496	60 .242-6	
134	.53296	46 .264-6		172	.89662	64 .538-5		190	.91128	62 .420-6	
136	.57309	48 .500-6		174	.91386	66 .871-5		192	.92576	64 .714-6	
138	.61264	50 .925-6		176	.92901	68 .139-4		194	.93847	66 .119-5	
140	.65125	52 .167-5		178	.94216	70 .218-4		196	.94952	68 .196-5	
142	.68855	54 .294-5		180	.95344	72 .337-4		198	.95903	70 .316-5	
144	.72421	56 .506-5		182	.96299	74 .513-4		200	.96712	72 .504-5	
146	.75796	58 .855-5		184	.97098	76 .770-4		202	.97393	74 .790-5	

TABLE 1, continued

76	.122-4	202	.86989	54	.431-8	180	.33456	10	.12-19	136	.00474
78	.186-4	204	.88763	56	.818-8	182	.36294	12	.71-19	138	.00588
80	.281-4	206	.90367	58	.152-7	184	.39214	14	.37-18	140	.00724
82	.418-4	208	.91808	60	.277-7	186	.42200	16	.18-17	142	.00887
84	.614-4	210	.93090	62	.494-7	188	.45239	18	.78-17	144	.01081
86	.891-4	212	.94221	64	.864-7	190	.48312	20	.32-16	146	.01310
88	.128-3	214	.95210	66	.149-6	192	.51403	22	.12-15	148	.01578
90	.182-3	216	.96067	68	.251-6	194	.54493	24	.43-15	150	.01892
92	.256-3	218	.96802	70	.418-6	196	.57565	26	.14-14	152	.02256
94	.356-3	220	.97426	72	.684-6	198	.60601	28	.45-14	154	.02677
96	.491-3	222	.97951	74	.110-5	200	.63583	30	.14-13	156	.03160
98	.670-3	224	.98387	76	.176-5	202	.66495	32	.40-13	158	.03712
100	.906-3	226	.98746	78	.275-5	204	.69322	34	.11-12	160	.04339
102	.00121	228	.99037	80	.426-5	206	.72049	36	.29-12	162	.05048
104	.00161	230	.99271	82	.651-5	208	.74664	38	.74-12	164	.05845
106	.00212	232	.99456	84	.983-5	210	.77155	40	.18-11	166	.06737
108	.00278	234	.99600	86	.147-4	212	.79513	42	.43-11	168	.07729
110	.00360	236	.99712	88	.216-4	214	.81732	44	.10-10	170	.08827
112	.00462	238	.99795	90	.316-4	216	.83804	46	.22-10	172	.10037
114	.00590	240	.99858	92	.456-4	218	.85728	48	.48-10	174	.11363
116	.00747	242	.99904	94	.652-4	220	.87502	50	.101-9	176	.12808
118	.00939	244	.99936	96	.922-4	222	.89125	52	.207-9	178	.14376
120	.01172	246	.99959	98	.129-3	224	.90601	54	.414-9	180	.16068
122	.01452	248	.99974	100	.179-3	226	.91932	56	.811-9	182	.17885
124	.01787	250	.99985	102	.247-3	228	.93125	58	.155-8	184	.19826
126	.02184	252	.99991	104	.337-3	230	.94185	60	.290-8	186	.21891
128	.02652	254	.99995	106	.455-3	232	.95119	62	.533-8	188	.24074
130	.03200	256	.99998	108	.610-3	234	.95936	64	.961-8	190	.26373
132	.03836	258	.99999	110	.812-3	236	.96645	66	.170-7	192	.28781
134	.04570	260	1	112	.00107	238	.97255	68	.295-7	194	.31290
136	.05411			114	.00140	240	.97774	70	.505-7	196	.33892
138	.06369			116	.00182	242	.98213	72	.849-7	198	.36577
140	.07451		N = 24	118	.00235	244	.98579	74	.141-6	200	.39333
142	.08667			120	.00302	246	.98883	76	.230-6	202	.42148
144	.10024		D P	122	.00384	248	.99131	78	.370-6	204	.45009
146	.11529			124	.00485	250	.99333	80	.588-6	206	.47903
148	.13187	0	.16-23	126	.00608	252	.99494	82	.923-6	208	.50813
150	.15001	2	.39-22	128	.00759	254	.99621	84	.143-5	210	.53726
152	.16973	4	.52-21	130	.00940	256	.99721	86	.219-5	212	.56627
154	.19105	6	.50-20	132	.01157	258	.99797	88	.331-5	214	.59500
156	.21394	8	.39-19	134	.01416	260	.99855	90	.496-5	216	.62331
158	.23837	10	.25-18	136	.01722	262	.99899	92	.734-5	218	.65106
160	.26426	12	.14-17	138	.02082	264	.99931	94	.107-4	220	.67811
162	.29154	14	.73-17	140	.02503	266	.99953	96	.156-4	222	.70434
164	.32009	16	.34-16	142	.02991	268	.99970	98	.224-4	224	.72964
166	.34980	18	.14-15	144	.03555	270	.99981	100	.319-4	226	.75390
168	.38050	20	.56-15	146	.04201	272	.99988	102	.449-4	228	.77703
170	.41203	22	.21-14	148	.04938	274	.99993	104	.628-4	230	.79897
172	.44421	24	.71-14	150	.05774	276	.99996	106	.870-4	232	.81966
174	.47683	26	.23-13	152	.06715	278	.99998	108	.120-3	234	.83905
176	.50969	28	.71-13	154	.07769	280	.99999	110	.163-3	236	.85712
178	.54258	30	.21-12	156	.08943	282	1	112	.220-3	238	.87385
180	.57528	32	.58-12	158	.10243			114	.296-3	240	.88926
182	.60758	34	.16-11	160	.11674			116	.394-3	242	.90335
184	.63926	36	.40-11	162	.13241		N = 25	118	.521-3	244	.91615
186	.67013	38	.10-10	164	.14946			120	.684-3	246	.92772
188	.70001	40	.23-10	166	.16792		D P	122	.891-3	248	.93809
190	.72873	42	.54-10	168	.18778			124	.00115	250	.94732
192	.75613	44	.120-9	170	.20904	0	.64-25	126	.00148	252	.95549
194	.78209	46	.260-9	172	.23166	2	.16-23	128	.00190	254	.96266
196	.80652	48	.545-9	174	.25559	4	.22-22	130	.00241	256	.96891
198	.82932	50	.111-8	176	.28078	6	.22-21	132	.00304	258	.97432
200	.85046	52	.222-8	178	.30714	8	.18-20	134	.00381	260	.97896

TABLE 1, continued

13

262	.98290	68	.320-8	194	.14934	320	.99995	102	.111-5	228	.32324
264	.98623	70	.561-8	196	.16568	322	.99997	104	.162-5	230	.34677
266	.98902	72	.970-8	198	.18314	324	.99998	106	.235-5	232	.37094
268	.99132	74	.165-7	200	.20171	326	.99999	108	.338-5	234	.39566
270	.99322	76	.276-7	202	.22137	328	.99999	110	.482-5	236	.42084
272	.99475	78	.456-7	204	.24210	330	1	112	.681-5	238	.44639
274	.99599	80	.744-7	206	.26384			114	.955-5	240	.47220
276	.99697	82	.120-6	208	.28656			116	.133-4	242	.49818
278	.99774	84	.190-6	210	.31019		N = 27	118	.184-4	244	.52423
280	.99834	86	.298-6	212	.33465			120	.252-4	246	.55022
282	.99880	88	.462-6	214	.35987		D P	122	.343-4	248	.57605
284	.99915	90	.708-6	216	.38575			124	.464-4	250	.60163
286	.99940	92	.107-5	218	.41218		0 .92-28	126	.624-4	252	.62683
288	.99959	94	.161-5	220	.43907		2 .25-26	128	.833-4	254	.65158
290	.99973	96	.239-5	222	.46628		4 .37-25	130	.110-3	256	.67576
292	.99982	98	.352-5	224	.49371		6 .39-24	132	.146-3	258	.69928
294	.99989	100	.513-5	226	.52123		8 .34-23	134	.191-3	260	.72208
296	.99993	102	.740-5	228	.54870		10 .24-22	136	.248-3	262	.74407
298	.99996	104	.106-4	230	.57601		12 .15-21	138	.321-3	264	.76519
300	.99998	106	.150-4	232	.60303		14 .85-21	140	.414-3	266	.78538
302	.99999	108	.211-4	234	.62964		16 .43-20	142	.529-3	268	.80460
304	.99999	110	.294-4	236	.65571		18 .20-19	144	.674-3	270	.82280
306	1	112	.407-4	238	.68115		20 .86-19	146	.853-3	272	.83997
		114	.559-4	240	.70583		22 .34-18	148	.00107	274	.85607
		116	.761-4	242	.72968		24 .13-17	150	.00135	276	.87112
	N = 26	118	.103-3	244	.75260		26 .46-17	152	.00168	278	.88510
		120	.138-3	246	.77452		28 .16-16	154	.00208	280	.89803
	D P	122	.184-3	248	.79538		30 .50-16	156	.00257	282	.90993
		124	.244-3	250	.81513		32 .15-15	158	.00315	284	.92082
	0 .25-26	126	.321-3	252	.83373		34 .45-15	160	.00385	286	.93074
	2 .64-25	128	.420-3	254	.85116		36 .13-14	162	.00469	288	.93972
	4 .93-24	130	.545-3	256	.86740		38 .34-14	164	.00567	290	.94782
	6 .10-22	132	.703-3	258	.88245		40 .89-14	166	.00684	292	.95507
	8 .79-22	134	.902-3	260	.89632		42 .23-13	168	.00821	294	.96153
	10 .55-21	136	.00115	262	.90903		44 .55-13	170	.00981	296	.96725
	12 .34-20	138	.00146	264	.92062		46 .13-12	172	.01167	298	.97228
	14 .18-19	140	.00184	266	.93112		48 .30-12	174	.01382	300	.97669
	16 .89-19	142	.00230	268	.94057		50 .67-12	176	.01630	302	.98052
	18 .40-18	144	.00287	270	.94903		52 .15-11	178	.01915	304	.98383
	20 .17-17	146	.00355	272	.95655		54 .31-11	180	.02241	306	.98667
	22 .66-17	148	.00438	274	.96320		56 .64-11	182	.02611	308	.98909
	24 .24-16	150	.00538	276	.96904		58 .13-10	184	.03031	310	.99113
	26 .83-16	152	.00656	278	.97413		60 .25-10	186	.03504	312	.99285
	28 .27-15	154	.00796	280	.97853		62 .49-10	188	.04035	314	.99428
	30 .85-15	156	.00962	282	.98232		64 .94-10	190	.04629	316	.99547
	32 .25-14	158	.01157	284	.98555		66 .175-9	192	.05290	318	.99644
	34 .72-14	160	.01384	286	.98828		68 .321-9	194	.06024	320	.99723
	36 .20-13	162	.01648	288	.99058		70 .578-9	196	.06833	322	.99786
	38 .52-13	164	.01953	290	.99249		72 .102-8	198	.07724	324	.99837
	40 .13-12	166	.02304	292	.99407		74 .178-8	200	.08700	326	.99877
	42 .32-12	168	.02706	294	.99537		76 .306-8	202	.09764	328	.99908
	44 .76-12	170	.03165	296	.99641		78 .519-8	204	.10920	330	.99933
	46 .18-11	172	.03684	298	.99725		80 .866-8	206	.12170	332	.99951
	48 .39-11	174	.04270	300	.99792		82 .143-7	208	.13518	334	.99965
	50 .85-11	176	.04929	302	.99845		84 .232-7	210	.14965	336	.99975
	52 .18-10	178	.05665	304	.99885		86 .373-7	212	.16511	338	.99983
	54 .37-10	180	.06485	306	.99917		88 .591-7	214	.18157	340	.99988
	56 .74-10	182	.07393	308	.99940		90 .928-7	216	.19902	342	.99992
	58 .146-9	184	.08393	310	.99958		92 .144-6	218	.21746	344	.99995
	60 .282-9	186	.09492	312	.99971		94 .221-6	220	.23685	346	.99997
	62 .533-9	188	.10692	314	.99980		96 .336-6	222	.25717	348	.99998
	64 .986-9	190	.11997	316	.99987		98 .505-6	224	.27838	350	.99999
	66 .179-8	192	.13410	318	.99992		100 .752-6	226	.30042	352	.99999

TABLE 1, continued

354	1	112	.104-5	238	.24501	364	.99988	96	.517-8	222	.04738
		114	.149-5	240	.26461	366	.99992	98	.811-8	224	.05341
		116	.212-5	242	.28499	368	.99994	100	.126-7	226	.06003
	N = 28	118	.298-5	244	.30610	370	.99996	102	.194-7	228	.06726
		120	.418-5	246	.32790	372	.99998	104	.296-7	230	.07515
	D P	122	.580-5	248	.35033	374	.99999	106	.446-7	232	.08372
		124	.801-5	250	.37331	376	.99999	108	.668-7	234	.09299
	0 .33-29	126	.110-4	252	.39679	378	.99999	110	.992-7	236	.10301
	2 .92-28	128	.150-4	254	.42067	380	1	112	.146-6	238	.11378
	4 .14-26	130	.202-4	256	.44489			114	.213-6	240	.12532
	6 .16-25	132	.272-4	258	.46935			116	.309-6	242	.13766
	8 .14-24	134	.363-4	260	.49397		N = 29	118	.444-6	244	.15080
	10 .10-23	136	.483-4	262	.51866			120	.634-6	246	.16476
	12 .65-23	138	.637-4	264	.54333		D P	122	.898-6	248	.17952
	14 .38-22	140	.837-4	266	.56788			124	.126-5	250	.19509
	16 .20-21	142	.109-3	268	.59222		0 .11-30	126	.177-5	252	.21147
	18 .94-21	144	.142-3	270	.61626		2 .33-29	128	.245-5	254	.22862
	20 .41-20	146	.183-3	272	.63993		4 .52-28	130	.338-5	256	.24655
	22 .17-19	148	.235-3	274	.66312		6 .59-27	132	.463-5	258	.26521
	24 .66-19	150	.300-3	276	.68577		8 .54-26	134	.630-5	260	.28457
	26 .24-18	152	.382-3	278	.70781		10 .41-25	136	.853-5	262	.30460
	28 .84-18	154	.483-3	280	.72916		12 .27-24	138	.115-4	264	.32525
	30 .28-17	156	.608-3	282	.74976		14 .16-23	140	.154-4	266	.34647
	32 .88-17	158	.762-3	284	.76957		16 .86-23	142	.204-4	268	.36821
	34 .27-16	160	.949-3	286	.78853		18 .42-22	144	.270-4	270	.39040
	36 .77-16	162	.00118	288	.80660		20 .19-21	146	.355-4	272	.41299
	38 .21-15	164	.00146	290	.82377		22 .81-21	148	.465-4	274	.43589
	40 .57-15	166	.00179	292	.83999		24 .32-20	150	.605-4	276	.45905
	42 .15-14	168	.00219	294	.85527		26 .12-19	152	.783-4	278	.48239
	44 .37-14	170	.00267	296	.86959		28 .44-19	154	.101-3	280	.50582
	46 .91-14	172	.00324	298	.88296		30 .15-18	156	.129-3	282	.52927
	48 .21-13	174	.00392	300	.89538		32 .48-18	158	.165-3	284	.55266
	50 .49-13	176	.00471	302	.90687		34 .15-17	160	.210-3	286	.57592
	52 .11-12	178	.00565	304	.91746		36 .44-17	162	.265-3	288	.59896
	54 .24-12	180	.00674	306	.92715		38 .13-16	164	.333-3	290	.62171
	56 .51-12	182	.00802	308	.93600		40 .35-16	166	.418-3	292	.64410
	58 .11-11	184	.00950	310	.94403		42 .93-16	168	.521-3	294	.66605
	60 .21-11	186	.01120	312	.95129		44 .24-15	170	.647-3	296	.68751
	62 .43-11	188	.01317	314	.95781		46 .60-15	172	.800-3	298	.70840
	64 .83-11	190	.01541	316	.96364		48 .14-14	174	.985-3	300	.72866
	66 .16-10	192	.01798	318	.96883		50 .34-14	176	.00121	302	.74826
	68 .30-10	194	.02090	320	.97342		52 .78-14	178	.00147	304	.76714
	70 .55-10	196	.02420	322	.97745		54 .17-13	180	.00179	306	.78526
	72 .100-9	198	.02792	324	.98099		56 .38-13	182	.00217	308	.80259
	74 .179-9	200	.03210	326	.98406		58 .81-13	184	.00262	310	.81909
	76 .315-9	202	.03678	328	.98672		60 .17-12	186	.00315	312	.83476
	78 .546-9	204	.04200	330	.98900		62 .35-12	188	.00377	314	.84958
	80 .933-9	206	.04779	332	.99096		64 .69-12	190	.00450	316	.86354
	82 .157-8	208	.05420	334	.99261		66 .14-11	192	.00535	318	.87663
	84 .262-8	210	.06127	336	.99401		68 .26-11	194	.00634	320	.88887
	86 .430-8	212	.06902	338	.99517		70 .49-11	196	.00748	322	.90026
	88 .698-8	214	.07751	340	.99614		72 .92-11	198	.00879	324	.91081
	90 .112-7	216	.08676	342	.99694		74 .17-10	200	.01030	326	.92056
	92 .178-7	218	.09680	344	.99760		76 .30-10	202	.01203	328	.92952
	94 .279-7	220	.10767	346	.99813		78 .54-10	204	.01400	330	.93772
	96 .433-7	222	.11939	348	.99856		80 .94-10	206	.01624	332	.94520
	98 .666-7	224	.13198	350	.99890		82 .161-9	208	.01878	334	.95198
	100 .101-6	226	.14546	352	.99917		84 .274-9	210	.02164	336	.95811
	102 .153-6	228	.15982	354	.99938		86 .461-9	212	.02486	338	.96361
	104 .228-6	230	.17509	356	.99954		88 .765-9	214	.02846	340	.96854
	106 .338-6	232	.19126	358	.99966		90 .125-8	216	.03248	342	.97293
	108 .495-6	234	.20831	360	.99976		92 .203-8	218	.03695	344	.97683
	110 .721-6	236	.22624	362	.99983		94 .326-8	220	.04190	346	.98026

TABLE 1, continued

15

348	.98327	54	.12-14	180	.426-3	306	.57577	432	1	112	.228-8
350	.98589	56	.27-14	182	.525-3	308	.59770			114	.346-8
352	.98817	58	.59-14	184	.645-3	310	.61937			116	.520-8
354	.99014	60	.13-13	186	.789-3	312	.64071		N = 31	118	.775-8
356	.99183	62	.26-13	188	.962-3	314	.66168			120	.115-7
358	.99327	64	.54-13	190	.00117	316	.68219		D P	122	.169-7
360	.99449	66	.11-12	192	.00141	318	.70221			124	.246-7
362	.99552	68	.21-12	194	.00170	320	.72169	0	.12-33	126	.356-7
364	.99639	70	.41-12	196	.00204	322	.74057	2	.38-32	128	.513-7
366	.99710	72	.78-12	198	.00245	324	.75881	4	.64-31	130	.733-7
368	.99769	74	.15-11	200	.00292	326	.77639	6	.77-30	132	.104-6
370	.99818	76	.27-11	202	.00347	328	.79326	8	.74-29	134	.147-6
372	.99858	78	.49-11	204	.00411	330	.80940	10	.59-28	136	.206-6
374	.99889	80	.88-11	206	.00485	332	.82479	12	.41-27	138	.287-6
376	.99915	82	.15-10	208	.00571	334	.83941	14	.26-26	140	.397-6
378	.99935	84	.27-10	210	.00670	336	.85327	16	.15-25	142	.546-6
380	.99951	86	.46-10	212	.00783	338	.86634	18	.75-25	144	.748-6
382	.99964	88	.78-10	214	.00913	340	.87863	20	.36-24	146	.102-5
384	.99973	90	.131-9	216	.01060	342	.89015	22	.16-23	148	.138-5
386	.99980	92	.216-9	218	.01228	344	.90090	24	.68-23	150	.186-5
388	.99986	94	.354-9	220	.01418	346	.91090	26	.27-22	152	.249-5
390	.99990	96	.573-9	222	.01633	348	.92017	28	.10-21	154	.332-5
392	.99993	98	.917-9	224	.01874	350	.92873	30	.36-21	156	.440-5
394	.99995	100	.145-8	226	.02145	352	.93660	32	.12-20	158	.581-5
396	.99997	102	.228-8	228	.02447	354	.94381	34	.40-20	160	.764-5
398	.99998	104	.355-8	230	.02784	356	.95039	36	.12-19	162	.100-4
400	.99999	106	.546-8	232	.03159	358	.95637	38	.38-19	164	.130-4
402	.99999	108	.834-8	234	.03574	360	.96178	40	.11-18	166	.168-4
404	.99999	110	.126-7	236	.04032	362	.96665	42	.31-18	168	.217-4
406	1	112	.189-7	238	.04536	364	.97103	44	.83-18	170	.279-4
		114	.282-7	240	.05089	366	.97494	46	.22-17	172	.357-4
		116	.416-7	242	.05693	368	.97842	48	.56-17	174	.454-4
	N = 30	118	.610-7	244	.06353	370	.98150	50	.14-16	176	.576-4
		120	.887-7	246	.07070	372	.98421	52	.33-16	178	.728-4
	D P	122	.128-6	248	.07848	374	.98659	54	.78-16	180	.915-4
		124	.183-6	250	.08688	376	.98867	56	.18-15	182	.115-3
	0	126	.261-6	252	.09593	378	.99047	58	.40-15	184	.143-3
	2	128	.369-6	254	.10565	380	.99203	60	.88-15	186	.178-3
	4	130	.518-6	256	.11607	382	.99337	62	.19-14	188	.220-3
	6	132	.723-6	258	.12719	384	.99452	64	.39-14	190	.272-3
	8	134	.100-5	260	.13903	386	.99550	66	.81-14	192	.334-3
	10	136	.138-5	262	.15160	388	.99632	68	.16-13	194	.410-3
	12	138	.189-5	264	.16490	390	.99701	70	.32-13	196	.500-3
	14	140	.257-5	266	.17894	392	.99759	72	.63-13	198	.609-3
	16	142	.348-5	268	.19371	394	.99807	74	.12-12	200	.738-3
	18	144	.469-5	270	.20921	396	.99846	76	.23-12	202	.892-3
	20	146	.628-5	272	.22542	398	.99879	78	.42-12	204	.00107
	22	148	.836-5	274	.24232	400	.99905	80	.77-12	206	.00129
	24	150	.111-4	276	.25990	402	.99926	82	.14-11	208	.00154
	26	152	.146-4	278	.27813	404	.99943	84	.25-11	210	.00184
	28	154	.191-4	280	.29697	406	.99957	86	.43-11	212	.00219
	30	156	.250-4	282	.31639	408	.99967	88	.74-11	214	.00259
	32	158	.324-4	284	.33635	410	.99975	90	.13-10	216	.00306
	34	160	.419-4	286	.35680	412	.99982	92	.21-10	218	.00360
	36	162	.539-4	288	.37769	414	.99987	94	.36-10	220	.00423
	38	164	.690-4	290	.39897	416	.99990	96	.59-10	222	.00495
	40	166	.879-4	292	.42058	418	.99993	98	.97-10	224	.00578
	42	168	.112-3	294	.44246	420	.99995	100	.156-9	226	.00673
	44	170	.141-3	296	.46455	422	.99997	102	.250-9	228	.00781
	46	172	.177-3	298	.48678	424	.99998	104	.396-9	230	.00904
	48	174	.222-3	300	.50908	426	.99998	106	.622-9	232	.01043
	50	176	.277-3	302	.53139	428	.99999	108	.967-9	234	.01200
	52	178	.344-3	304	.55364	430	.99999	110	.149-8	236	.01377

TABLE 1, continued

238	.01575	364	.88756	16	.57-27	142	.792-7	268	.03401	394	.91901
240	.01798	366	.89798	18	.30-26	144	.110-6	270	.03800	396	.92688
242	.02046	368	.90771	20	.15-25	146	.152-6	272	.04235	398	.93418
244	.02323	370	.91678	22	.67-25	148	.210-6	274	.04709	400	.94093
246	.02629	372	.92519	24	.29-24	150	.287-6	276	.05225	402	.94714
248	.02969	374	.93296	26	.12-23	152	.391-6	278	.05784	404	.95285
250	.03344	376	.94013	28	.45-23	154	.530-6	280	.06388	406	.95808
252	.03757	378	.94671	30	.17-22	156	.714-6	282	.07041	408	.96285
254	.04210	380	.95273	32	.58-22	158	.958-6	284	.07743	410	.96718
256	.04705	382	.95822	34	.19-21	160	.128-5	286	.08496	412	.97111
258	.05246	384	.96320	36	.62-21	162	.170-5	288	.09304	414	.97466
260	.05835	386	.96771	38	.19-20	164	.224-5	290	.10166	416	.97785
262	.06474	388	.97177	40	.57-20	166	.295-5	292	.11085	418	.98071
264	.07166	390	.97542	42	.16-19	168	.387-5	294	.12062	420	.98326
266	.07913	392	.97868	44	.45-19	170	.505-5	296	.13098	422	.98553
268	.08717	394	.98159	46	.12-18	172	.656-5	298	.14193	424	.98754
270	.09580	396	.98416	48	.32-18	174	.848-5	300	.15350	426	.98932
272	.10505	398	.98643	50	.81-18	176	.109-4	302	.16567	428	.99088
274	.11492	400	.98843	52	.20-17	178	.140-4	304	.17845	430	.99224
276	.12543	402	.99018	54	.48-17	180	.179-4	306	.19183	432	.99343
278	.13659	404	.99170	56	.11-16	182	.228-4	308	.20582	434	.99446
280	.14841	406	.99303	58	.26-16	184	.289-4	310	.22040	436	.99535
282	.16090	408	.99417	60	.58-16	186	.365-4	312	.23557	438	.99612
284	.17406	410	.99514	62	.13-15	188	.459-4	314	.25130	440	.99678
286	.18788	412	.99598	64	.27-15	190	.575-4	316	.26757	442	.99734
288	.20237	414	.99669	66	.57-15	192	.718-4	318	.28437	444	.99781
290	.21751	416	.99729	68	.12-14	194	.893-4	320	.30167	446	.99821
292	.23329	418	.99779	70	.24-14	196	.111-3	322	.31944	448	.99854
294	.24970	420	.99822	72	.48-14	198	.137-3	324	.33766	450	.99882
296	.26670	422	.99857	74	.93-14	200	.168-3	326	.35627	452	.99905
298	.28429	424	.99886	76	.18-13	202	.207-3	328	.37525	454	.99924
300	.30242	426	.99909	78	.34-13	204	.253-3	330	.39456	456	.99940
302	.32107	428	.99929	80	.63-13	206	.308-3	332	.41415	458	.99953
304	.34020	430	.99944	82	.12-12	208	.374-3	334	.43398	460	.99963
306	.35976	432	.99957	84	.21-12	210	.453-3	336	.45400	462	.99971
308	.37972	434	.99967	86	.38-12	212	.547-3	338	.47416	464	.99978
310	.40003	436	.99975	88	.66-12	214	.659-3	340	.49441	466	.99983
312	.42063	438	.99981	90	.12-11	216	.790-3	342	.51471	468	.99987
314	.44148	440	.99986	92	.20-11	218	.945-3	344	.53500	470	.99990
316	.46252	442	.99989	94	.34-11	220	.00113	346	.55523	472	.99993
318	.48369	444	.99992	96	.57-11	222	.00134	348	.57534	474	.99995
320	.50494	446	.99994	98	.10-10	224	.00159	350	.59530	476	.99996
322	.52621	448	.99996	100	.16-10	226	.00188	352	.61505	478	.99997
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326	.56856	452	.99998	104	.41-10	230	.00260	356	.65372	482	.99999
328	.58953	454	.99999	106	.66-10	232	.00305	358	.67255	484	.99999
330	.61029	456	.99999	108	.105-9	234	.00357	360	.69099	486	.99999
332	.63077	458	.99999	110	.164-9	236	.00416	362	.70900	488	1
334	.65093	460	1	112	.256-9	238	.00483	364	.72654		
336	.67071			114	.395-9	240	.00560	366	.74358		
338	.69007			116	.604-9	242	.00648	368	.76009		
340	.70896		N = 32	118	.918-9	244	.00747	370	.77603		N = 33
342	.72734			120	.138-8	246	.00859	372	.79140		D P
344	.74516			122	.207-8	248	.00986	374	.80617		
346	.76240		D P	124	.307-8	250	.01128	376	.82032	0	.12-36
348	.77902	0	.38-35	126	.452-8	252	.01288	378	.83384	2	.38-35
350	.79499	2	.12-33	128	.661-8	254	.01467	380	.84672	4	.68-34
352	.81031	4	.21-32	130	.961-8	256	.01666	382	.85896	6	.87-33
354	.82494	6	.26-31	132	.139-7	258	.01888	384	.87055	8	.88-32
356	.83887	8	.26-30	134	.199-7	260	.02134	386	.88150	10	.74-31
358	.85211	10	.21-29	136	.284-7	262	.02406	388	.89181	12	.55-30
360	.86463	12	.15-28	138	.402-7	264	.02707	390	.90149	14	.36-29
362	.87645	14	.10-27	140	.566-7	266	.03038	392	.91056	16	.21-28

TABLE 1, continued

18	.11-27	144	.151-7	270	.01323	396	.79750	N = 34	118	.11-10
20	.58-27	146	.212-7	272	.01497	398	.81138		120	.16-10
22	.27-26	148	.296-7	274	.01690	400	.82469	D P	122	.25-10
24	.12-25	150	.411-7	276	.01904	402	.83742		124	.39-10
26	.50-25	152	.569-7	278	.02140	404	.84956	0 .34-38	126	.59-10
28	.19-24	154	.783-7	280	.02400	406	.86112	2 .12-36	128	.89-10
30	.73-24	156	.107-6	282	.02686	408	.87209	4 .21-35	130	.134-9
32	.26-23	158	.146-6	284	.02999	410	.88248	6 .28-34	132	.200-9
34	.89-23	160	.198-6	286	.03342	412	.89228	8 .29-33	134	.296-9
36	.29-22	162	.266-6	288	.03717	414	.90151	10 .25-32	136	.436-9
38	.93-22	164	.358-6	290	.04125	416	.91017	12 .19-31	138	.637-9
40	.28-21	166	.478-6	292	.04567	418	.91828	14 .13-30	140	.926-9
42	.83-21	168	.636-6	294	.05048	420	.92585	16 .76-30	142	.134-8
44	.24-20	170	.841-6	296	.05567	422	.93290	18 .43-29	144	.192-8
46	.65-20	172	.111-5	298	.06127	424	.93944	20 .22-28	146	.274-8
48	.17-19	174	.146-5	300	.06730	426	.94550	22 .10-27	148	.388-8
50	.45-19	176	.190-5	302	.07377	428	.95108	24 .47-27	150	.548-8
52	.11-18	178	.248-5	304	.08071	430	.95622	26 .20-26	152	.770-8
54	.28-18	180	.321-5	306	.08813	432	.96094	28 .81-26	154	.107-7
56	.67-18	182	.415-5	308	.09604	434	.96525	30 .31-25	156	.149-7
58	.16-17	184	.534-5	310	.10446	436	.96918	32 .11-24	158	.206-7
60	.36-17	186	.684-5	312	.11340	438	.97275	34 .40-24	160	.284-7
62	.81-17	188	.873-5	314	.12288	440	.97598	36 .13-23	162	.388-7
64	.18-16	190	.111-4	316	.13289	442	.97890	38 .43-23	164	.528-7
66	.38-16	192	.141-4	318	.14345	444	.98152	40 .13-22	166	.716-7
68	.81-16	194	.178-4	320	.15457	446	.98387	42 .40-22	168	.966-7
70	.17-15	196	.223-4	322	.16624	448	.98598	44 .12-21	170	.130-6
72	.34-15	198	.280-4	324	.17847	450	.98785	46 .33-21	172	.174-6
74	.68-15	200	.350-4	326	.19126	452	.98951	48 .90-21	174	.231-6
76	.13-14	202	.436-4	328	.20459	454	.99097	50 .24-20	176	.306-6
78	.26-14	204	.540-4	330	.21847	456	.99227	52 .62-20	178	.405-6
80	.49-14	206	.668-4	332	.23288	458	.99340	54 .16-19	180	.532-6
82	.92-14	208	.824-4	334	.24781	460	.99439	56 .38-19	182	.697-6
84	.17-13	210	.101-3	336	.26325	462	.99525	58 .92-19	184	.909-6
86	.31-13	212	.124-3	338	.27917	464	.99600	60 .22-18	186	.118-5
88	.56-13	214	.151-3	340	.29555	466	.99664	62 .49-18	188	.153-5
90	.10-12	216	.184-3	342	.31238	468	.99719	64 .11-17	190	.197-5
92	.17-12	218	.224-3	344	.32961	470	.99766	66 .24-17	192	.253-5
94	.30-12	220	.271-3	346	.34723	472	.99807	68 .52-17	194	.324-5
96	.52-12	222	.327-3	348	.36520	474	.99841	70 .11-16	196	.414-5
98	.88-12	224	.393-3	350	.38349	476	.99870	72 .23-16	198	.526-5
100	.15-11	226	.472-3	352	.40206	478	.99894	74 .47-16	200	.666-5
102	.25-11	228	.564-3	354	.42088	480	.99914	76 .94-16	202	.841-5
104	.40-11	230	.673-3	356	.43989	482	.99931	78 .18-15	204	.106-4
106	.66-11	232	.800-3	358	.45907	484	.99944	80 .36-15	206	.133-4
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114	.42-10	240	.00156	366	.53653	492	.99979	88 .44-14	214	.318-4
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122	.236-9	248	.00291	374	.61305	500	.99993	96 .44-13	222	.724-4
124	.357-9	250	.00338	376	.63171	502	.99994	98 .77-13	224	.883-4
126	.534-9	252	.00392	378	.65009	504	.99996	100 .13-12	226	.107-3
128	.795-9	254	.00453	380	.66816	506	.99997	102 .22-12	228	.130-3
130	.117-8	256	.00522	382	.68588	508	.99998	104 .37-12	230	.157-3
132	.172-8	258	.00600	384	.70321	510	.99998	106 .61-12	232	.190-3
134	.251-8	260	.00689	386	.72013	512	.99999	108 .10-11	234	.228-3
136	.364-8	262	.00788	388	.73660	514	.99999	110 .16-11	236	.274-3
138	.524-8	264	.00900	390	.75260	516	.99999	112 .26-11	238	.328-3
140	.749-8	266	.01026	392	.76809	518	1	114 .42-11	240	.391-3
142	.107-7	268	.01166	394	.78307			116 .67-11	242	.465-3

TABLE 1, continued

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244	.552-3	370	.36771	496	.99736	60	.12-19	186	.189-6	312	.01749
246	.653-3	372	.38525	498	.99779	62	.28-19	188	.248-6	314	.01949
248	.771-3	374	.40305	500	.99815	64	.65-19	190	.324-6	316	.02169
250	.909-3	376	.42106	502	.99847	66	.15-18	192	.422-6	318	.02409
252	.00107	378	.43926	504	.99873	68	.32-18	194	.547-6	320	.02671
254	.00125	380	.45761	506	.99896	70	.69-18	196	.707-6	322	.02956
256	.00146	382	.47607	508	.99915	72	.15-17	198	.911-6	324	.03265
258	.00171	384	.49460	510	.99930	74	.31-17	200	.117-5	326	.03601
260	.00199	386	.51316	512	.99944	76	.63-17	202	.150-5	328	.03964
262	.00230	388	.53173	514	.99955	78	.13-16	204	.191-5	330	.04356
264	.00267	390	.55024	516	.99964	80	.25-16	206	.242-5	332	.04778
266	.00308	392	.56868	518	.99971	82	.49-16	208	.307-5	334	.05233
268	.00356	394	.58699	520	.99977	84	.94-16	210	.387-5	336	.05721
270	.00409	396	.60514	522	.99982	86	.18-15	212	.488-5	338	.06243
272	.00469	398	.62310	524	.99986	88	.33-15	214	.612-5	340	.06802
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276	.00614	402	.65827	528	.99992	92	.11-14	218	.954-5	344	.08035
278	.00700	404	.67542	530	.99994	94	.20-14	220	.119-4	346	.08711
280	.00797	406	.69224	532	.99995	96	.36-14	222	.147-4	348	.09429
282	.00905	408	.70869	534	.99996	98	.63-14	224	.181-4	350	.10189
284	.01025	410	.72475	536	.99997	100	.11-13	226	.224-4	352	.10992
286	.01158	412	.74039	538	.99998	102	.19-13	228	.275-4	354	.11840
288	.01307	414	.75559	540	.99999	104	.32-13	230	.337-4	356	.12734
290	.01471	416	.77033	542	.99999	106	.54-13	232	.411-4	358	.13673
292	.01653	418	.78459	544	.99999	108	.90-13	234	.501-4	360	.14658
294	.01853	420	.79835	546	.99999	110	.15-12	236	.609-4	362	.15691
296	.02074	422	.81161	548	1	112	.25-12	238	.738-4	364	.16770
298	.02315	424	.82434			114	.40-12	240	.892-4	366	.17895
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302	.02870	428	.84821		N = 35	118	.10-11	244	.129-3	370	.20287
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306	.03530	432	.86992		D P	122	.25-11	248	.185-3	374	.22861
308	.03904	434	.87998			124	.40-11	250	.221-3	376	.24215
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318	.06275	444	.92238		8 .91-35	134	.33-10	260	.516-3	386	.31599
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338	.14155	464	.97303		28 .32-27	154	.138-8	280	.00236	406	.48580
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344	.17469	470	.98139		34 .17-25	160	.379-8	286	.00358	412	.53914
346	.18675	472	.98365		36 .58-25	162	.526-8	288	.00409	414	.55686
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350	.21239	476	.98751		40 .61-24	166	.100-7	292	.00532	418	.59199
352	.22595	478	.98913		42 .19-23	168	.137-7	294	.00604	420	.60934
354	.24000	480	.99058		44 .56-23	170	.186-7	296	.00685	422	.62650
356	.25451	482	.99186		46 .16-22	172	.252-7	298	.00775	424	.64344
358	.26948	484	.99299		48 .45-22	174	.341-7	300	.00876	426	.66012
360	.28489	486	.99399		50 .12-21	176	.458-7	302	.00988	428	.67652
362	.30071	488	.99486		52 .32-21	178	.613-7	304	.01111	430	.69262
364	.31693	490	.99562		54 .83-21	180	.817-7	306	.01248	432	.70838
366	.33352	492	.99629		56 .21-20	182	.108-6	308	.01399	434	.72378
368	.35046	494	.99686		58 .51-20	184	.143-6	310	.01566	436	.73880

438	.75341	564	.99996	98	.49-15	224	.344-5	350	.04279	476	.83455
440	.76760	566	.99997	100	.87-15	226	.429-5	352	.04677	478	.84536
442	.78136	568	.99998	102	.15-14	228	.533-5	354	.05105	480	.85572
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446	.80749	572	.99999	106	.45-14	232	.818-5	358	.06054	484	.87507
448	.81985	574	.99999	108	.76-14	234	.101-4	360	.06577	486	.88407
450	.83173	576	.99999	110	.13-13	236	.124-4	362	.07134	488	.89261
452	.84312	578	1	112	.21-13	238	.152-4	364	.07727	490	.90072
454	.85401			114	.35-13	240	.186-4	366	.08356	492	.90838
456	.86441			116	.58-13	242	.227-4	368	.09023	494	.91562
458	.87432	N = 36		118	.94-13	244	.277-4	370	.09728	496	.92244
460	.88373			120	.15-12	246	.336-4	372	.10473	498	.92885
462	.89265	D P		122	.24-12	248	.407-4	374	.11259	500	.93487
464	.90110			124	.38-12	250	.492-4	376	.12085	502	.94050
466	.90907	0	.27-41	126	.60-12	252	.593-4	378	.12954	504	.94575
468	.91657	2	.10-39	128	.94-12	254	.713-4	380	.13865	506	.95065
470	.92362	4	.19-38	130	.14-11	256	.855-4	382	.14818	508	.95520
472	.93023	6	.26-37	132	.22-11	258	.102-3	384	.15815	510	.95942
474	.93641	8	.28-36	134	.34-11	260	.122-3	386	.16854	512	.96333
476	.94217	10	.26-35	136	.52-11	262	.145-3	388	.17937	514	.96693
478	.94753	12	.20-34	138	.78-11	264	.173-3	390	.19063	516	.97025
480	.95251	14	.14-33	140	.12-10	266	.205-3	392	.20231	518	.97330
482	.95711	16	.90-33	142	.17-10	268	.242-3	394	.21442	520	.97609
484	.96137	18	.52-32	144	.26-10	270	.286-3	396	.22694	522	.97865
486	.96528	20	.28-31	146	.38-10	272	.337-3	398	.23987	524	.98098
488	.96888	22	.14-30	148	.55-10	274	.396-3	400	.25319	526	.98309
490	.97218	24	.66-30	150	.80-10	276	.464-3	402	.26690	528	.98501
492	.97519	26	.29-29	152	.115-9	278	.543-3	404	.28099	530	.98675
494	.97793	28	.12-28	154	.165-9	280	.633-3	406	.29543	532	.98832
496	.98043	30	.50-28	156	.236-9	282	.738-3	408	.31021	534	.98973
498	.98269	32	.19-27	158	.336-9	284	.858-3	410	.32532	536	.99099
500	.98473	34	.69-27	160	.475-9	286	.00100	412	.34073	538	.99212
502	.98657	36	.24-26	162	.668-9	288	.00115	414	.35642	540	.99313
504	.98822	38	.82-26	164	.935-9	290	.00133	416	.37236	542	.99403
506	.98970	40	.27-25	166	.130-8	292	.00154	418	.38855	544	.99482
508	.99102	42	.84-25	168	.181-8	294	.00177	420	.40494	546	.99553
510	.99220	44	.25-24	170	.249-8	296	.00203	422	.42151	548	.99615
512	.99325	46	.75-24	172	.343-8	298	.00233	424	.43824	550	.99669
514	.99417	48	.21-23	174	.469-8	300	.00266	426	.45510	552	.99717
516	.99498	50	.59-23	176	.638-8	302	.00304	428	.47206	554	.99759
518	.99570	52	.16-22	178	.866-8	304	.00346	430	.48908	556	.99795
520	.99632	54	.42-22	180	.117-7	306	.00394	432	.50614	558	.99826
522	.99687	56	.11-21	182	.157-7	308	.00447	434	.52321	560	.99853
524	.99734	58	.27-21	184	.211-7	310	.00507	436	.54026	562	.99877
526	.99776	60	.66-21	186	.281-7	312	.00573	438	.55726	564	.99897
528	.99811	62	.16-20	188	.374-7	314	.00647	440	.57417	566	.99914
530	.99842	64	.37-20	190	.495-7	316	.00730	442	.59096	568	.99929
532	.99868	66	.84-20	192	.653-7	318	.00821	444	.60762	570	.99941
534	.99890	68	.19-19	194	.858-7	320	.00922	446	.62410	572	.99951
536	.99909	70	.41-19	196	.112-6	322	.01034	448	.64038	574	.99960
538	.99925	72	.89-19	198	.146-6	324	.01157	450	.65644	576	.99967
540	.99938	74	.19-18	200	.190-6	326	.01292	452	.67224	578	.99974
542	.99950	76	.40-18	202	.247-6	328	.01441	454	.68776	580	.99979
544	.99959	78	.81-18	204	.319-6	330	.01604	456	.70298	582	.99983
546	.99967	80	.16-17	206	.410-6	332	.01783	458	.71788	584	.99986
548	.99974	82	.33-17	208	.526-6	334	.01978	460	.73243	586	.99989
550	.99979	84	.64-17	210	.672-6	336	.02191	462	.74663	588	.99991
552	.99983	86	.12-16	212	.856-6	338	.02423	464	.76043	590	.99993
554	.99987	88	.24-16	214	.109-5	340	.02675	466	.77385	592	.99995
556	.99990	90	.44-16	216	.138-5	342	.02948	468	.78685	594	.99996
558	.99992	92	.82-16	218	.174-5	344	.03243	470	.79943	596	.99997
560	.99994	94	.15-15	220	.219-5	346	.03563	472	.81158	598	.99998
562	.99995	96	.27-15	222	.275-5	348	.03907	474	.82329	600	.99998

TABLE 1, continued

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602	.99999	104	.20-15	230	.120-5	356	.02146	482	.70752	608	.99972
604	.99999	106	.35-15	232	.150-5	358	.02365	484	.72173	610	.99977
606	.99999	108	.61-15	234	.188-5	360	.02601	486	.73562	612	.99981
608	.99999	110	.10-14	236	.234-5	362	.02857	488	.74918	614	.99985
610	1	112	.18-14	238	.290-5	364	.03133	490	.76237	616	.99988
		114	.30-14	240	.359-5	366	.03431	492	.77520	618	.99990
		116	.49-14	242	.444-5	368	.03752	494	.78765	620	.99992
	N = 37	118	.81-14	244	.546-5	370	.04096	496	.79971	622	.99994
		120	.13-13	246	.671-5	372	.04466	498	.81137	624	.99995
	D P	122	.22-13	248	.823-5	374	.04861	500	.82263	626	.99996
		124	.35-13	250	.101-4	376	.05285	502	.83347	628	.99997
0	.73-43	126	.55-13	252	.123-4	378	.05736	504	.84390	630	.99998
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4	.54-40	130	.14-12	256	.181-4	382	.06729	508	.86350	634	.99999
6	.76-39	132	.21-12	258	.219-4	384	.07273	510	.87267	636	.99999
8	.84-38	134	.33-12	260	.265-4	386	.07850	512	.88142	638	.99999
10	.78-37	136	.51-12	262	.319-4	388	.08461	514	.88976	640	.99999
12	.63-36	138	.78-12	264	.383-4	390	.09106	516	.89768	642	1
14	.45-35	140	.12-11	266	.460-4	392	.09788	518	.90521		
16	.29-34	142	.18-11	268	.550-4	394	.10506	520	.91233		
18	.17-33	144	.27-11	270	.657-4	396	.11261	522	.91907		N = 38
20	.10-32	146	.40-11	272	.783-4	398	.12054	524	.92542		
22	.49-32	148	.59-11	274	.931-4	400	.12886	526	.93140		D P
24	.24-31	150	.87-11	276	.110-3	402	.13757	528	.93702		
26	.11-30	152	.13-10	278	.131-3	404	.14667	530	.94229	0	.19-44
28	.46-30	154	.19-10	280	.154-3	406	.15617	532	.94722	2	.73-43
30	.19-29	156	.27-10	282	.182-3	408	.16606	534	.95183	4	.15-41
32	.73-29	158	.39-10	284	.214-3	410	.17636	536	.95612	6	.21-40
34	.27-28	160	.56-10	286	.251-3	412	.18705	538	.96010	8	.24-39
36	.10-27	162	.79-10	288	.294-3	414	.19814	540	.96380	10	.23-38
38	.34-27	164	.113-9	290	.344-3	416	.20962	542	.96723	12	.19-37
40	.11-26	166	.159-9	292	.402-3	418	.22148	544	.97039	14	.14-36
42	.36-26	168	.224-9	294	.468-3	420	.23372	546	.97331	16	.93-36
44	.11-25	170	.313-9	296	.544-3	422	.24634	548	.97599	18	.56-35
46	.33-25	172	.436-9	298	.631-3	424	.25931	550	.97845	20	.32-34
48	.10-24	174	.604-9	300	.730-3	426	.27264	552	.98070	22	.17-33
50	.28-24	176	.833-9	302	.844-3	428	.28630	554	.98276	24	.81-33
52	.76-24	178	.114-8	304	.973-3	430	.30029	556	.98463	26	.37-32
54	.20-23	180	.157-8	306	.00112	432	.31459	558	.98633	28	.16-31
56	.53-23	182	.213-8	308	.00129	434	.32918	560	.98788	30	.68-31
58	.14-22	184	.289-8	310	.00148	436	.34405	562	.98927	32	.27-30
60	.34-22	186	.391-8	312	.00169	438	.35917	564	.99053	34	.10-29
62	.82-22	188	.526-8	314	.00193	440	.37452	566	.99166	36	.38-29
64	.20-21	190	.705-8	316	.00220	442	.39009	568	.99268	38	.13-28
66	.46-21	192	.942-8	318	.00251	444	.40585	570	.99359	40	.45-28
68	.11-20	194	.125-7	320	.00285	446	.42178	572	.99440	42	.15-27
70	.24-20	196	.166-7	322	.00324	448	.43785	574	.99512	44	.47-27
72	.52-20	198	.219-7	324	.00367	450	.45403	576	.99576	46	.14-26
74	.11-19	200	.289-7	326	.00415	452	.47031	578	.99633	48	.43-26
76	.24-19	202	.379-7	328	.00468	454	.48666	580	.99683	50	.12-25
78	.50-19	204	.495-7	330	.00527	456	.50304	582	.99727	52	.35-25
80	.10-18	206	.645-7	332	.00593	458	.51943	584	.99766	54	.95-25
82	.21-18	208	.837-7	334	.00666	460	.53582	586	.99800	56	.25-24
84	.42-18	210	.108-6	336	.00747	462	.55215	588	.99829	58	.66-24
86	.82-18	212	.140-6	338	.00836	464	.56842	590	.99855	60	.17-23
88	.16-17	214	.180-6	340	.00935	466	.58460	592	.99877	62	.41-23
90	.30-17	216	.230-6	342	.01043	468	.60065	594	.99896	64	.10-22
92	.57-17	218	.294-6	344	.01162	470	.61655	596	.99913	66	.24-22
94	.11-16	220	.375-6	346	.01292	472	.63229	598	.99927	68	.56-22
96	.20-16	222	.476-6	348	.01434	474	.64782	600	.99939	70	.13-21
98	.36-16	224	.602-6	350	.01590	476	.66313	602	.99949	72	.29-21
100	.65-16	226	.760-6	352	.01760	478	.67820	604	.99958	74	.63-21
102	.12-15	228	.957-6	354	.01945	480	.69300	606	.99965	76	.14-20

TABLE 1, continued

78	.29-20	204	.719-8	330	.00156	456	.31410	582	.98175	18	.18-36
80	.61-20	206	.947-8	332	.00178	458	.32812	584	.98363	20	.10-35
82	.13-19	208	.124-7	334	.00202	460	.34239	586	.98536	22	.54-35
84	.26-19	210	.163-7	336	.00229	462	.35690	588	.98693	24	.27-34
86	.52-19	212	.213-7	338	.00259	464	.37163	590	.98836	26	.13-33
88	.10-18	214	.276-7	340	.00293	466	.38656	592	.98965	28	.57-33
90	.20-18	216	.358-7	342	.00331	468	.40167	594	.99082	30	.24-32
92	.38-18	218	.463-7	344	.00373	470	.41694	596	.99188	32	.10-31
94	.72-18	220	.597-7	346	.00420	472	.43235	598	.99284	34	.38-31
96	.14-17	222	.767-7	348	.00471	474	.44787	600	.99369	36	.14-30
98	.25-17	224	.982-7	350	.00529	476	.46349	602	.99446	38	.51-30
100	.46-17	226	.125-6	352	.00592	478	.47918	604	.99515	40	.18-29
102	.84-17	228	.160-6	354	.00662	480	.49492	606	.99576	42	.59-29
104	.15-16	230	.203-6	356	.00739	482	.51068	608	.99631	44	.19-28
106	.27-16	232	.257-6	358	.00823	484	.52644	610	.99679	46	.59-28
108	.47-16	234	.324-6	360	.00916	486	.54218	612	.99722	48	.18-27
110	.81-16	236	.408-6	362	.01018	488	.55786	614	.99760	50	.53-27
112	.14-15	238	.512-6	364	.01130	490	.57348	616	.99793	52	.15-26
114	.24-15	240	.642-6	366	.01252	492	.58899	618	.99822	54	.42-26
116	.40-15	242	.801-6	368	.01385	494	.60439	620	.99848	56	.11-25
118	.67-15	244	.100-5	370	.01530	496	.61965	622	.99870	58	.30-25
120	.11-14	246	.124-5	372	.01688	498	.63474	624	.99889	60	.79-25
122	.18-14	248	.154-5	374	.01860	500	.64964	626	.99906	62	.20-24
124	.30-14	250	.190-5	376	.02046	502	.66434	628	.99920	64	.50-24
126	.48-14	252	.234-5	378	.02247	504	.67881	630	.99933	66	.12-23
128	.78-14	254	.288-5	380	.02465	506	.69303	632	.99944	68	.29-23
130	.12-13	256	.354-5	382	.02699	508	.70699	634	.99953	70	.67-23
132	.20-13	258	.433-5	384	.02953	510	.72067	636	.99961	72	.15-22
134	.31-13	260	.529-5	386	.03225	512	.73405	638	.99967	74	.34-22
136	.48-13	262	.645-5	388	.03518	514	.74712	640	.99973	76	.76-22
138	.74-13	264	.784-5	390	.03832	516	.75986	642	.99978	78	.16-21
140	.11-12	266	.951-5	392	.04168	518	.77227	644	.99982	80	.35-21
142	.18-12	268	.115-4	394	.04527	520	.78433	646	.99985	82	.74-21
144	.27-12	270	.139-4	396	.04911	522	.79603	648	.99988	84	.15-20
146	.40-12	272	.167-4	398	.05321	524	.80736	650	.99990	86	.31-20
148	.61-12	274	.201-4	400	.05757	526	.81832	652	.99992	88	.62-20
150	.90-12	276	.241-4	402	.06220	528	.82890	654	.99994	90	.12-19
152	.13-11	278	.289-4	404	.06712	530	.83910	656	.99995	92	.24-19
154	.20-11	280	.345-4	406	.07233	532	.84891	658	.99996	94	.47-19
156	.29-11	282	.411-4	408	.07785	534	.85833	660	.99997	96	.89-19
158	.42-11	284	.489-4	410	.08368	536	.86737	662	.99997	98	.17-18
160	.62-11	286	.581-4	412	.08983	538	.87602	664	.99998	100	.31-18
162	.89-11	288	.688-4	414	.09631	540	.88428	666	.99998	102	.57-18
164	.13-10	290	.814-4	416	.10312	542	.89216	668	.99999	104	.10-17
166	.18-10	292	.960-4	418	.11028	544	.89967	670	.99999	106	.19-17
168	.26-10	294	.113-3	420	.11779	546	.90680	672	.99999	108	.34-17
170	.37-10	296	.133-3	422	.12565	548	.91357	674	.99999	110	.59-17
172	.52-10	298	.156-3	424	.13387	550	.91998	676	1	112	.10-16
174	.73-10	300	.183-3	426	.14246	552	.92604			114	.18-16
176	.102-9	302	.213-3	428	.15141	554	.93175			116	.31-16
178	.142-9	304	.249-3	430	.16073	556	.93714		N = 39	118	.52-16
180	.197-9	306	.290-3	432	.17042	558	.94219			120	.88-16
182	.271-9	308	.337-3	434	.18047	560	.94694		D P	122	.15-15
184	.372-9	310	.390-3	436	.19089	562	.95138			124	.24-15
186	.509-9	312	.452-3	438	.20168	564	.95554	0	.49-46	126	.40-15
188	.694-9	314	.523-3	440	.21283	566	.95941	2	.19-44	128	.65-15
190	.942-9	316	.603-3	442	.22433	568	.96302	4	.40-43	130	.11-14
192	.127-8	318	.694-3	444	.23618	570	.96637	6	.59-42	132	.17-14
194	.171-8	320	.798-3	446	.24837	572	.96947	8	.69-41	134	.27-14
196	.230-8	322	.916-3	448	.26089	574	.97234	10	.67-40	136	.43-14
198	.307-8	324	.00105	450	.27374	576	.97500	12	.57-39	138	.67-14
200	.409-8	326	.00120	452	.28690	578	.97744	14	.42-38	140	.10-13
202	.543-8	328	.00137	454	.30036	580	.97969	16	.29-37	142	.16-13

TABLE 1, continued

144	.25-13	270	.272-5	396	.01902	522	.61758	648	.99805	50	.22-28
146	.38-13	272	.331-5	398	.02084	524	.63213	650	.99832	52	.64-28
148	.58-13	274	.402-5	400	.02280	526	.64651	652	.99855	54	.18-27
150	.88-13	276	.487-5	402	.02492	528	.66070	654	.99875	56	.50-27
152	.13-12	278	.589-5	404	.02719	530	.67468	656	.99893	58	.14-26
154	.20-12	280	.712-5	406	.02964	532	.68844	658	.99909	60	.36-26
156	.30-12	282	.857-5	408	.03227	534	.70196	660	.99922	62	.93-26
158	.44-12	284	.103-4	410	.03508	536	.71523	662	.99934	64	.23-25
160	.64-12	286	.124-4	412	.03809	538	.72822	664	.99944	66	.58-25
162	.94-12	288	.148-4	414	.04130	540	.74094	666	.99953	68	.14-24
164	.14-11	290	.177-4	416	.04474	542	.75335	668	.99960	70	.33-24
166	.20-11	292	.211-4	418	.04839	544	.76546	670	.99967	72	.77-24
168	.29-11	294	.251-4	420	.05228	546	.77725	672	.99972	74	.18-23
170	.41-11	296	.298-4	422	.05641	548	.78872	674	.99977	76	.40-23
172	.59-11	298	.354-4	424	.06080	550	.79985	676	.99981	78	.88-23
174	.83-11	300	.419-4	426	.06544	552	.81064	678	.99984	80	.19-22
176	.12-10	302	.494-4	428	.07036	554	.82108	680	.99987	82	.41-22
178	.17-10	304	.583-4	430	.07555	556	.83117	682	.99989	84	.86-22
180	.23-10	306	.686-4	432	.08103	558	.84090	684	.99991	86	.18-21
182	.32-10	308	.806-4	434	.08681	560	.85028	686	.99993	88	.36-21
184	.45-10	310	.944-4	436	.09288	562	.85930	688	.99994	90	.73-21
186	.62-10	312	.111-3	438	.09926	564	.86795	690	.99995	92	.15-20
188	.86-10	314	.129-3	440	.10596	566	.87625	692	.99996	94	.29-20
190	.118-9	316	.151-3	442	.11298	568	.88420	694	.99997	96	.56-20
192	.162-9	318	.175-3	444	.12032	570	.89179	696	.99998	98	.11-19
194	.220-9	320	.204-3	446	.12800	572	.89903	698	.99998	100	.20-19
196	.299-9	322	.236-3	448	.13601	574	.90593	700	.99999	102	.38-19
198	.404-9	324	.274-3	450	.14435	576	.91248	702	.99999	104	.70-19
200	.545-9	326	.316-3	452	.15304	578	.91871	704	.99999	106	.13-18
202	.731-9	328	.365-3	454	.16206	580	.92461	706	.99999	108	.23-18
204	.978-9	330	.421-3	456	.17143	582	.93018	708	.99999	110	.41-18
206	.130-8	332	.484-3	458	.18114	584	.93545	710	1	112	.73-18
208	.173-8	334	.556-3	460	.19119	586	.94042			114	.13-17
210	.229-8	336	.637-3	462	.20157	588	.94509			116	.22-17
212	.303-8	338	.729-3	464	.21229	590	.94948	N = 40		118	.39-17
214	.398-8	340	.833-3	466	.22334	592	.95360			120	.66-17
216	.522-8	342	.951-3	468	.23471	594	.95745	D P		122	.11-16
218	.683-8	344	.00108	470	.24640	596	.96105			124	.19-16
220	.890-8	346	.00123	472	.25840	598	.96441	0	.12-47	126	.31-16
222	.116-7	348	.00140	474	.27070	600	.96754	2	.49-46	128	.52-16
224	.150-7	350	.00159	476	.28329	602	.97044	4	.11-44	130	.85-16
226	.193-7	352	.00180	478	.29616	604	.97313	6	.16-43	132	.14-15
228	.249-7	354	.00203	480	.30930	606	.97563	8	.19-42	134	.22-15
230	.319-7	356	.00229	482	.32270	608	.97793	10	.19-41	136	.36-15
232	.409-7	358	.00258	484	.33633	610	.98005	12	.16-40	138	.57-15
234	.522-7	360	.00290	486	.35020	612	.98200	14	.12-39	140	.91-15
236	.664-7	362	.00326	488	.36428	614	.98380	16	.85-39	142	.14-14
238	.843-7	364	.00366	490	.37855	616	.98544	18	.54-38	144	.22-14
240	.107-6	366	.00410	492	.39300	618	.98695	20	.31-37	146	.35-14
242	.135-6	368	.00459	494	.40761	620	.98832	22	.17-36	148	.53-14
244	.170-6	370	.00512	496	.42236	622	.98957	24	.87-36	150	.82-14
246	.213-6	372	.00572	498	.43723	624	.99070	26	.42-35	152	.12-13
248	.267-6	374	.00637	500	.45220	626	.99173	28	.19-34	154	.19-13
250	.334-6	376	.00708	502	.46725	628	.99266	30	.83-34	156	.28-13
252	.416-6	378	.00787	504	.48237	630	.99351	32	.34-33	158	.43-13
254	.517-6	380	.00872	506	.49752	632	.99426	34	.14-32	160	.63-13
256	.642-6	382	.00966	508	.51269	634	.99494	36	.51-32	162	.94-13
258	.794-6	384	.01069	510	.52785	636	.99555	38	.19-31	164	.14-12
260	.980-6	386	.01180	512	.54300	638	.99610	40	.66-31	166	.20-12
262	.121-5	388	.01302	514	.55809	640	.99659	42	.22-30	168	.30-12
264	.148-5	390	.01434	516	.57312	642	.99702	44	.74-30	170	.43-12
266	.182-5	392	.01578	518	.58806	644	.99741	46	.24-29	172	.62-12
268	.223-5	394	.01733	520	.60288	646	.99775	48	.73-29	174	.90-12

176	.13-11	302	.106-4	428	.02900	554	.65269	680	.99806
178	.18-11	304	.126-4	430	.03148	556	.66627	682	.99831
180	.26-11	306	.150-4	432	.03413	558	.67966	684	.99854
182	.37-11	308	.178-4	434	.03696	560	.69284	686	.99874
184	.51-11	310	.210-4	436	.03998	562	.70579	688	.99891
186	.72-11	312	.249-4	438	.04320	564	.71850	690	.99906
188	.10-10	314	.293-4	440	.04662	566	.73095	692	.99920
190	.14-10	316	.346-4	442	.05025	568	.74314	694	.99931
192	.19-10	318	.406-4	444	.05411	570	.75505	696	.99941
194	.27-10	320	.477-4	446	.05819	572	.76667	698	.99950
196	.37-10	322	.559-4	448	.06251	574	.77800	700	.99958
198	.50-10	324	.654-4	450	.06708	576	.78903	702	.99964
200	.68-10	326	.764-4	452	.07190	578	.79974	704	.99970
202	.93-10	328	.891-4	454	.07698	580	.81014	706	.99975
204	.125-9	330	.104-3	456	.08233	582	.82021	708	.99979
206	.169-9	332	.120-3	458	.08795	584	.82996	710	.99982
208	.227-9	334	.140-3	460	.09385	586	.83938	712	.99985
210	.304-9	336	.162-3	462	.10004	588	.84847	714	.99988
212	.405-9	338	.187-3	464	.10652	590	.85723	716	.99990
214	.539-9	340	.216-3	466	.11331	592	.86565	718	.99992
216	.715-9	342	.249-3	468	.12039	594	.87374	720	.99993
218	.944-9	344	.287-3	470	.12778	596	.88150	722	.99994
220	.124-8	346	.329-3	472	.13548	598	.88893	724	.99996
222	.163-8	348	.378-3	474	.14349	600	.89603	726	.99996
224	.214-8	350	.433-3	476	.15182	602	.90281	728	.99997
226	.279-8	352	.495-3	478	.16046	604	.90928	730	.99998
228	.363-8	354	.565-3	480	.16942	606	.91543	732	.99998
230	.471-8	356	.645-3	482	.17870	608	.92128	734	.99999
232	.610-8	358	.734-3	484	.18830	610	.92683	736	.99999
234	.786-8	360	.835-3	486	.19820	612	.93208	738	.99999
236	.101-7	362	.948-3	488	.20842	614	.93705	740	.99999
238	.130-7	364	.00107	490	.21895	616	.94175	742	.99999
240	.166-7	366	.00122	492	.22977	618	.94617	744	1
242	.212-7	368	.00137	494	.24090	620	.95034		
244	.270-7	370	.00155	496	.25232	622	.95425		
246	.342-7	372	.00175	498	.26402	624	.95792		
248	.433-7	374	.00197	500	.27599	626	.96136		
250	.547-7	376	.00221	502	.28823	628	.96457		
252	.689-7	378	.00248	504	.30073	630	.96757		
254	.866-7	380	.00278	506	.31347	632	.97037		
256	.109-6	382	.00311	508	.32645	634	.97296		
258	.136-6	384	.00348	510	.33965	636	.97538		
260	.169-6	386	.00389	512	.35305	638	.97761		
262	.211-6	388	.00433	514	.36665	640	.97968		
264	.261-6	390	.00482	516	.38043	642	.98159		
266	.324-6	392	.00536	518	.39437	644	.98335		
268	.400-6	394	.00595	520	.40845	646	.98497		
270	.493-6	396	.00660	522	.42267	648	.98645		
272	.607-6	398	.00731	524	.43699	650	.98782		
274	.745-6	400	.00808	526	.45141	652	.98906		
276	.913-6	402	.00893	528	.46591	654	.99020		
278	.112-5	404	.00985	530	.48047	656	.99124		
280	.136-5	406	.01085	532	.49506	658	.99218		
282	.166-5	408	.01194	534	.50967	660	.99303		
284	.201-5	410	.01312	536	.52428	662	.99381		
286	.244-5	412	.01440	538	.53888	664	.99451		
288	.295-5	414	.01578	540	.55344	666	.99514		
290	.356-5	416	.01728	542	.56793	668	.99571		
292	.429-5	418	.01889	544	.58236	670	.99622		
294	.516-5	420	.02063	546	.59668	672	.99667		
296	.619-5	422	.02251	548	.61090	674	.99708		
298	.741-5	424	.02452	550	.62498	676	.99745		
300	.886-5	426	.02668	552	.63892	678	.99777		

APPENDIX

COMPUTER PROGRAMS USED (WRITTEN IN SAS = STATISTICAL ANALYSIS SYSTEM)

* TABULATING THE DISTRIBUTION AND STORING THE RESULTS;
PROC MATRIX;

```
DO N = 4 TO 40; NN = N*(N-1)/2 + 1;
Q = J(NN,N,0); Q(1,1) = N - 1; Q(2,2) = 1;
DO K = 1 TO N - 2; NK = N - K;
R = J(NN,N,0);
DO T = 0 TO K; DO S = T TO T*(-T+1+2*K)/2;
OLD = Q(S+1,T+1); IF OLD > 0 THEN DO;
TS = T + S;
X = (N-K-K+T)*(N-K-K+T-1);
IF X > 0 THEN R(TS+1,T+1) = R(TS+1,T+1) + OLD*X#/NK;
X = (N-K-K+T)*(2*(K-T)+1);
IF X > 0 THEN R(TS+2,T+2) = R(TS+2,T+2) + OLD*X#/NK;
X = (K-T)*(K-T);
IF X > 0 THEN R(TS+3,T+3) = R(TS+3,T+3) + OLD*X#/NK;
END; END; END;
Q = R; END;
R = Q(+); FREE B P; D = 0; W = 0;
DO I = NN TO 1 BY -1; X = R(I,); IF X = 0 THEN GO TO POT;
W = W + X; B = B // (D || X); P = P // W; D = D + 2; END;
POT: P = P#/W; I = J(NROW(P),1,N); X = I || B || P;
SIDE = " "; SIDE = J(NN,1,SIDE); TOP = "N" "D" "W" "P";
OUTPUT X OUT=SASDATA.FOOTRULE ROWNAME=SIDE COLNAME=TOP; END;
```

* PRINTING OUT TABLE1 (COMPLETE MIMEO SERIES VERSION);

```
OPTIONS LS=80 PS=67 NONUMBER NODATE;
DATA ONE; SET SASDATA.FOOTRULE; BY N; RETAIN Q;
IF FIRST.N THEN Q = 0;
IF P > .999995 THEN DO;
IF Q = 0 THEN Q = 1; ELSE DELETE; END;
DATA NULL; SET ONE; BY N;
FILE PRINT N=PS; TITLE; MAXLINE = 65;
RETAIN LINE 5 COLUMN 5 PAGE 9;
IF N = 1 THEN DO; PUT #1 @ 35 "TABLE 1" #3 @ 11
"Cumulative Probability Distribution of the Footrule Metric" @; END;
IF FIRST.N THEN DO; PUT # LINE @ COLUMN " N =" N 3.0
// @ COLUMN " D P" @; LINE = LINE + 4; Q = 0; END;
PUT # LINE @ COLUMN D 3.0 @; PLUS = COLUMN + 3;
IF P > .999995 THEN PUT @ PLUS " 1" @;
ELSE IF P > .000995 THEN PUT @ PLUS P 7.5 @ PLUS " " @;
ELSE IF P > .995*10**-10 THEN DO; P = 100000*P; DO I = -3 TO -9 BY -1;
P = 10*P; Q = INT(P + .5); IF Q < 100 THEN GO TO POT;
PUT @ PLUS " ." Q 3.0 I 2.0 @; GO TO SCHOOL; POT: END; END;
ELSE DO; P = P*10**11; DO I = -10 TO -99 BY -1;
P = 10*P; Q = INT(P + .5); IF Q < 10 THEN GO TO BED;
PUT @ PLUS " ." Q 2.0 I 3.0 @; GO TO SCHOOL; BED: END; END;
SCHOOL: IF LAST.N THEN LINE = LINE + 2; LINE = LINE + 1;
IF LINE LE MAXLINE - 4*LAST.N THEN RETURN; LINE = 3 + 2*(PAGE-9);
COLUMN = COLUMN + 12; IF COLUMN < 70 THEN RETURN;
PAGE = PAGE + 1; PUT PAGE; LINE = 3; COLUMN = 5;
PUT # 1 @ 25 "TABLE 1, continued" @73 PAGE 2.0 @;
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* PRODUCING TABLE 1 (REDUCED VERSION FOR COMMUNICATIONS IN STATISTICS);
OPTIONS LS=80 PS=67 NONUMBER NODATE;
DATA TWO; SET SASDATA.FOOTRULE;
      IF P < .001 THEN Q = 1;
      ELSE IF P < .01 THEN Q = 2;
      ELSE IF P < .025 THEN Q = 3;
      ELSE IF P < .05 THEN Q = 4;
      ELSE IF P < .10 THEN Q = 5;
      ELSE Q = 6;
DATA THREE; SET TWO; BY N Q;
      IF N < 20 THEN OUTPUT;
      ELSE IF N = 20 AND D < 147 THEN OUTPUT;
      ELSE IF N = 20 AND D > 147 THEN DELETE;
      ELSE IF FIRST.N OR LAST.N THEN DELETE;
      ELSE IF FIRST.Q OR LAST.Q THEN OUTPUT;
      ELSE DELETE;
DATA _NULL_ ; SET THREE; BY N;
MAXLINE = 65;
FILE PRINT N=PS; TITLE;
RETAIN LINE 5 COLUMN 5 PAGE 1;
IF _N_ = 1 THEN DO; PUT #1 @ 35 "TABLE 1" #3 @ 11
"Cumulative Probability Distribution of the Footrule Metric" @; END;
IF FIRST.N THEN DO; PUT # LINE @ COLUMN " N =" N 3.0
// @ COLUMN " D P" @; LINE = LINE + 4; END;
PUT # LINE @ COLUMN D 3.0 @; PLUS = COLUMN + 3;
      IF P > .999995 THEN PUT @ PLUS " 1" @;
      ELSE IF P > .000995 THEN PUT @ PLUS P 7.5 @ PLUS " " @;
      ELSE IF P > .995*10**(-10) THEN DO; P = 100000*P; DO I = -3 TO -9 BY -1;
      P = 10*P; Q = INT(P + .5); IF Q < 100 THEN GO TO POT;
      PUT @ PLUS " ." Q 3.0 I 2.0 @; GO TO SCHOOL; POT: END; END;
      ELSE DO; P = P*10**11; DO I = -10 TO -99 BY -1;
      P = 10*P; Q = INT(P + .5); IF Q < 10 THEN GO TO BED;
      PUT @ PLUS " ." Q 2.0 I 3.0 @; GO TO SCHOOL; BED: END; END;
SCHOOL: IF LAST.N THEN LINE = LINE + 2; LINE = LINE + 1;
IF LINE LE MAXLINE - 4*LAST.N THEN RETURN; LINE = 3 + 2*(PAGE=1);
COLUMN = COLUMN + 12; IF COLUMN < 70 THEN RETURN;
PAGE = PAGE + 1; PUT _PAGE_ ; LINE = 3; COLUMN = 5;
PUT # 1 @ 25 "TABLE 1, continued" @;

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* CHECKING APPROXIMATIONS TO THE EXACT DISTRIBUTION;
DATA FOUR; SET SASDATA.FOOTRULE;
  BY N; RETAIN E V T B SKEW DF M3 M4 FACT;
  IF FIRST.N THEN DO;
    M3 = 0; M4 = 0; FACT = 0;
    E = (N+1)*(N-1)/3;
    V = (N+1)*(2*N*N+7)/45;
    T = 2*(N+1)*(N+2)*(2*N*N+31)/945;
    SKEW = - T / V**1.5;
    B = 4*V/T;
    DF = B*B*V/2; END;
  DEV = D - E; C = DEV + 1; FACT = FACT + W;
  Q = W*DEV*DEV*DEV; M3 = M3 + Q; M4 = M4 + Q*DEV;
  X = B*(B*V/2 - C);
  PX = 1 - PROBCHI(X,DF);
  AX = PX - P; RX = AX/P;
  ABSAX = ABS(AX); ABSRX = ABS(RX);
  PN = PROBNORM(C/SQRT(V));
  AN = PN - P; RN = AN/P;
  ABSAN = ABS(AN); ABSRN = ABS(RN);
  IF LAST.N THEN DO; M3 = M3 / FACT; M4 = M4 / FACT;
    SKU = M3 / V**1.5; KURTOSIS = M4 / V**2; END;
DATA FIVE; SET FOUR;
  TYPE = "P"; IF P > 0 THEN L = LOG10(P); OUTPUT;
  TYPE = "X"; IF PX > 0 THEN L = LOG10(PX); OUTPUT;
  TYPE = "N"; IF PN > 0 THEN L = LOG10(PN); OUTPUT;
  KEEP N D TYPE L;
PROC PLOT; BY N;
  PLOT L*D=TYPE;
PROC PRINT; BY N; PAGEBY N;
  ID D; VAR P PX AX RX PN AN RN;
  FORMAT P PX AX RX PN AN RN 9.5;
PROC MEANS N MEAN MIN MAX DATA=FOUR; BY N;
  VAR AX RX ABSAX ABSRX AN RN ABSAN ABSRN;
DATA SIX; SET FOUR; IF P < .001 OR P > .100 THEN DELETE;
PROC MEANS N MEAN MIN MAX; BY N;
  VAR AX RX ABSAX ABSRX AN RN ABSAN ABSRN;
DATA SEVEN; SET FOUR; BY N; IF LAST.N;
PROC PRINT; ID N; VAR E V T SKEW B DF SKU KURTOSIS;

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* CHECKING THE URY-KLEINECKE CONJECTURE;
DATA EIGHT; SET SASDATA.FOOTRULE; BY N;
  IF FIRST.N THEN CUM = W; ELSE CUM = CUM + W; RETAIN CUM;
  IF D = 0 THEN DO; URY = 1; OUTPUT; END;
  IF D = 2 THEN DO; URY = N; OUTPUT; END;
  IF D = 4 THEN DO;
    URY = (((N+3)*N)-6)/2; OUTPUT; END;
  IF D = 6 THEN DO;
    URY = (((N+9)*N-16)*N-24)/6; OUTPUT; END;
  IF D = 8 THEN DO;
    URY = (((N+18)*N-1)*N-210)*N+24)/24; OUTPUT; END;
  IF D = 10 THEN DO;
    URY = (((((N+30)*N+95)*N-750)*N-1176)*N+2880)/120; OUTPUT; END;
PROC PRINT; BY N; ID D; VAR CUM URY;

```