UNIVERSITI SAINS MALAYSIA

PEPERIKSAAN KURSUS SEMASA CUTI PANJANG
ACADEMIC SESSION 2008/2009

JUNE 2009

JIB 213 – BIOSTATISTICS
[BIOSTATISTIK]

Duration : 3 hours
[Masa : 3 jam]

Please ensure that this examination paper contains NINE printed pages before you begin the examination.

Answer **FIVE** questions. You may answer **either** in Bahasa Malaysia or English.

All answers must be written in the answer booklet provided.

Each question is worth 20 marks and the marks for each sub question is given at the end of that question.

Sila pastikan bahawa kertas peperiksaan ini mengandungi SEMBILAN muka surat yang bercetak sebelum anda memulakan peperiksaan ini.

*Jawab **LIMA** soalan. Anda dibenarkan menjawab soalan **sama ada** dalam Bahasa Malaysia atau Bahasa Inggeris.*

Setiap jawapan mesti dijawab di dalam buku jawapan yang disediakan.

Setiap soalan bernilai 20 markah dan markah subsoalan diperlihatkan di penghujung subsoalan itu.

1. A study on the effects of exercise on the menstrual cycle provides the following ages (in years) of menarche (beginning of menstruation) for 10 female swimmers who began training at least 1 year prior to menarche :

13.6 13.9 14.0 14.2 14.9 15.0 15.0 15.1 15.4 16.4

Kajian kesan senaman ke atas usia baligh terhadap sepuluh orang perenang wanita menghasilkan umur (tahun) permulaan baligh yang berikut. Perenang wanita yang dijadikan sampel dalam kajian ini telah memulakan latihan renang setahun sebelum baligh.

13.6 13.9 14.0 14.2 14.9 15.0 15.0 15.1 15.4 16.4

(a) Calculate the mean and standard deviation for this sample. Construct the 95% confidence interval for the mean.

Cari nilai min dan sisihan piawai bagi data ini. Bina selang keyakinan 95% bagi min sampel di atas.

[10 marks/*markah*]

(b) Is the sample mean significantly higher than the overall population mean for non swimmers of 12.5 years? Use the confidence interval to provide your rationale.

Adakah min sampel ini lebih besar daripada min populasi terhadap wanita bukan perenang iaitu 12.5 tahun? Gunakan selang keyakinan 95% untuk menyokong alasan anda.

[10 marks/ *markah*]

2. Watching a commercial on television you hear the claim that without changing your eating habits, a particular herbal extract when taken daily will allow you to lose 5 lb in 5 days. You decide to test this claim by enlisting 12 of your classmates into an experiment. You weigh each subject, ask them to use the herbal extract for 5 days and weigh them again. From the results recorded below, test the claim of 5 lb lost in 5 days at $\alpha = 0.05$.

Subject	Weight before (lb)	Weight after (lb)
1	128	120
2	131	123
3	165	163
4	140	141
5	178	170
6	121	118
7	190	188
8	135	136
9	118	121
10	146	140
11	212	207
12	135	126

[20 marks]

Iklan di televisyen telah mengesyorkan bahawa satu ekstrak herba berupaya menurunkan berat badan sebanyak 5 paun dalam masa 5 hari tanpa menukar amalan pemakanan harian. Untuk menguji kesahihan kenyataan iklan ini, anda telah melakukan kajian terhadap 12 orang kawan anda sebagai sampel. Berat badan ditimbang sebelum kajian, diminta mereka menggunakan ekstrak tersebut selama 5 hari dan berat badan diambil semula. Data berat badan sebelum dan selepas kajian adalah seperti berikut. Uji pada $\alpha = 0.05$ sama ada kenyataan yang disyorkan oleh iklan ini boleh diterima atau tidak.

Sampel	Berat sebelum (paun)	Berat selepas (paun)
1	128	120
2	131	123
3	165	163
4	140	141
5	178	170
6	121	118
7	190	188
8	135	136
9	118	121
10	146	140
11	212	207
12	135	126

[20 *markah*]

3. (a) Assume that the body temperature of a human population has a mean of 98.6°F and the standard deviation is 0.62°F. If a sample of size n = 106 is randomly selected, find the probability of getting a mean of 98.2 °F or **lower** at level of confidence $\alpha = 0.05$.

*Andaikan suhu badan populasi manusia mempunyai nilai min 98.6 °F dan sisihan piawai 0.62 °F. Jika saiz sampel n = 106 dipilih secara rawak, hitung nilai kebarangkalian untuk mendapatkan nilai min 98.2 °F atau **kurang** pada aras keertian $\alpha = 0.05$.*

[10 marks/ *markah*]

(b) In an ecological study of grasses, each quadrant was 1 meter square. Table 1 shows the number of sedge plants, *Carex flacea* found in 800 sample quadrants.

Table 1 : Frequency of *Carex flacea* in 800 quadrants.

Plants / Quadrants (X_i)	Frequency (f_i)
0	268
1	316
2	135
3	61
4	15
5	3
6	1
7	1

Dalam suatu kajian ekologi berkenaan tumbuhan rumput, setiap kuadrat mempunyai keluasan satu meter persegi. Jadual 1 menunjukkan bilangan tumbuhan rumput Carex flacea yang ditemui pada 800 sampel kuadrat.

Jadual 1 : Kekerapan Carex flacea dalam 800 kuadrat.

Tumbuhan / Kuadrat (X_i)	*Kekerapan (f_i)*
0	*268*
1	*316*
2	*135*
3	*61*
4	*15*
5	*3*
6	*1*
7	*1*

Calculate the descriptive statistic of :-

Hitung nilai deskriptif statistik bagi :

(i) Mean sample

Min sampel

(ii) Variance and standard deviation sample.

Varian dan sisihan piawai sampel.

[10 marks/*markah*]

4. The heights and arm spans of 10 adult males were measured (in cm). Is there a correlation between these two measurements?

Height (cm)	Span (cm)
171	173
195	193
180	188
182	185
190	186
175	178
177	182
178	182
192	198
202	202

Ketinggian dan panjang depa lengan 10 orang lelaki dewasa diukur (cm). Adakah terdapat korelasi antara kedua-dua ukuran tersebut?

Ketinggian (cm)	Depa (cm)
171	173
195	193
180	188
182	185
190	186
175	178
177	182
178	182
192	198
202	202

(a) Generate a scatter plot using the above data.

Lakarkan gambar rajah rawak menggunakan data di atas.

[15 marks/*markah*]

(b) Calculate linear correlation value **r** for this data. Explain.

Hitung nilai korelasi ***r*** *untuk data ini. Terangkan.*

[5 marks/*markah*]

5. Table 2 represents length (cm) and weight (kg) of 8 male bears.

Table 2 : Length and weight of Male Bears.

Bear Number	Length (cm)	Weight (kg)
1	53.0	80
2	67.5	344
3	72.0	416
4	72.0	348
5	73.5	262
6	68.5	360
7	73.0	332
8	37.0	34

Jadual 2 mewakili data ukuran panjang badan (cm) dan berat (kg) 8 ekor beruang jantan

Jadual 2 : Panjang (cm) dan berat (kg) beruang jantan.

Bilangan Beruang	*Panjang (cm)*	*Berat (kg)*
1	*53.0*	*80*
2	*67.5*	*344*
3	*72.0*	*416*
4	*72.0*	*348*
5	*73.5*	*262*
6	*68.5*	*360*
7	*73.0*	*332*
8	*37.0*	*34*

(a) Based on the data, is there an association between the length of a bear and its weight? What is that association? Prove your statement.

Berdasarkan data ini, adakah terdapat hubungan antara panjang dan berat badan beruang? Apakah hubungan itu? Buktikan kenyataan anda.

[5 marks/*markah*]

(b) Using a regression equation, predict the weight of a bear if its length is 71.0 cm.

Dengan menggunakan persamaan regresi, jangkakan berat badan beruang jika panjangnya 71.0 cm.

[15 marks/*markah*]

...8/-

6. Genetic model hybrid between two heterozygote paternal genes are as follows :

AaBb × ***AaBb***

↓

Expected F_1 generations (E_1)

A__B__	:	***A__bb***	:	***aaB__***	:	***aabb***
9		3		3		1

Allels ***A*** and ***B*** are considered dominant, where else ***a*** and ***b*** are recessive.

Cross-breeding was done and F_1 generation frequencies were shown as follows :

Observed F_1 generations (O_i)

A__B__	:	***A__bb***	:	***aaB__***	:	***aabb***
8.5		2.8		3.5		1.2

Model genetik untuk kacukan antara gen induk heterozigot adalah seperti berikut :

AaBb × ***AaBb***

↓

Generasi F_1 yang dijangkakan (E_i)

A__B__	:	***A__bb***	:	***aaB__***	:	***aabb***
9		3		3		1

*Alel **A** dan **B** dianggap dominan, manakala alel **a** dan **b** adalah resesif.*

Satu kacukan silang telah dijalankan dan kekerapan generasi F_1 yang ditunjukkan seperti berikut :

Generasi F_1 yang dicerap (O_i)

A__B__	:	***A__bb***	:	***aaB__***	:	***aabb***
8.5		2.8		3.5		1.2

(a) Carry some tests to evaluate whether the ratio of observed (O_i) F_1 generation is equivalent to the ratio of expected (E_i), based on genetic model hybrid between heterozygote parents at significance level 0.05.

Jalankan ujian untuk menilai sama ada nisbah generasi F_1 yang diperolehi (O_i), sama dengan nisbah yang dijangkakan (E_i), berdasarkan model genetik untuk kacukan antara induk yang bersifat heterozigot pada aras keertian 0.05.

[17 marks/*markah*]

(b) State your conclusion.

Nyatakan kesimpulan anda.

[3 marks/*markah*]

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APPENDIX

JIB 213
BIOSTATISTICS

Formulas and Tables

Biostatistics for the Biological and Health Sciences,
by Marc M. Triola, M.D. and Mario F. Triola

Ch. 2: Descriptive Statistics

$\bar{x} = \frac{\Sigma x}{n}$ Mean

$\bar{x} = \frac{\Sigma f \cdot x}{\Sigma f}$ Mean (frequency table)

$s = \sqrt{\frac{\Sigma(x - \bar{x})^2}{n - 1}}$ Standard deviation

$s = \sqrt{\frac{n(\Sigma x^2) - (\Sigma x)^2}{n(n-1)}}$ Standard deviation (shortcut)

$s = \sqrt{\frac{n[\Sigma(f \cdot x^2)] - [\Sigma(f \cdot x)]^2}{n(n-1)}}$ Standard deviation (frequency table)

variance $= s^2$

Ch. 3: Probability

$P(A \text{ or } B) = P(A) + P(B)$ if A, B are mutually exclusive

$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ if A, B are not mutually exclusive

$P(A \text{ and } B) = P(A) \cdot P(B)$ if A, B are independent

$P(A \text{ and } B) = P(A) \cdot P(B|A)$ if A, B are dependent

$P(\overline{A}) = 1 - P(A)$ Rule of complements

$P(A|B) = \frac{P(A) \cdot P(B|A)}{[P(A) \cdot P(B|A)] + [P(\overline{A}) \cdot P(B|\overline{A})]}$ Bayes

${}_nP_r = \frac{n!}{(n-r)!}$ Permutations (no elements alike)

$\frac{n!}{n_1!\, n_2! \ldots n_k!}$ Permutations (n_1 alike, ...)

${}_nC_r = \frac{n!}{(n-r)!\, r!}$ Combinations

Absolute risk reduction $= \left| \frac{a}{a+b} - \frac{c}{c+d} \right|$

	Disease	No Disease
Treatment	a	b
Placebo	c	d

Relative risk: $p_t/p_c = \frac{\frac{a}{a+b}}{\frac{c}{c+d}}$

Number needed to treat $= \frac{1}{\text{absolute risk reduction}}$

Odds ratio $= \frac{\text{odds for treatment group}}{\text{odds for control group}}$

Odds ratio $= \frac{ad}{bc}$

Ch. 4: Probability Distributions

$\mu = \Sigma x \cdot P(x)$ Mean (prob. dist.)

$\sigma = \sqrt{[\Sigma x^2 \cdot P(x)] - \mu^2}$ Standard deviation (prob. dist.)

$P(x) = \frac{n!}{(n-x)!\, x!} \cdot p^x \cdot q^{n-x}$ Binomial probability

$\mu = n \cdot p$ Mean (binomial)

$\sigma^2 = n \cdot p \cdot q$ Variance (binomial)

$\sigma = \sqrt{n \cdot p \cdot q}$ Standard deviation (binomial)

$P(x) = \frac{\mu^x \cdot e^{-\mu}}{x!}$ Poisson distribution where $e \approx 2.71828$

Ch. 5: Normal Distribution

$z = \frac{x - \bar{x}}{s}$ or $\frac{x - \mu}{\sigma}$ Standard score

$\mu_{\bar{x}} = \mu$ Central limit theorem

$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$ Central limit theorem (Standard error)

Ch. 6: Confidence Intervals (one population)

$\hat{p} - E < p < \hat{p} + E$ Proportion

where $E = z_{\alpha/2}\sqrt{\frac{\hat{p}\hat{q}}{n}}$

$\bar{x} - E < \mu < \bar{x} + E$ Mean

where $E = z_{\alpha/2}\frac{\sigma}{\sqrt{n}}$ (σ known)

or $E = t_{\alpha/2}\frac{s}{\sqrt{n}}$ (σ unknown)

$\frac{(n-1)s^2}{\chi^2_R} < \sigma^2 < \frac{(n-1)s^2}{\chi^2_L}$ Variance

Ch. 6: Sample Size Determination

$n = \frac{[z_{\alpha/2}]^2 \cdot 0.25}{E^2}$ Proportion

$n = \frac{[z_{\alpha/2}]^2 \hat{p}\hat{q}}{E^2}$ Proportion ($\hat{p}$ and $\hat{q}$ are known)

$n = \left[\frac{z_{\alpha/2}\sigma}{E}\right]^2$ Mean

Formulas and Tables

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Ch. 7: Test Statistics (one population)

$z = \dfrac{\hat{p} - p}{\sqrt{\dfrac{pq}{n}}}$ Proportion—one population

$z = \dfrac{\bar{x} - \mu}{\sigma/\sqrt{n}}$ Mean—one population (σ known)

$t = \dfrac{\bar{x} - \mu}{s/\sqrt{n}}$ Mean—one population (σ unknown)

$\chi^2 = \dfrac{(n-1)s^2}{\sigma^2}$ Standard deviation or variance—one population

Ch. 8: Test Statistics (two populations)

$z = \dfrac{(\hat{p}_1 - \hat{p}_2) - (p_1 - p_2)}{\sqrt{\dfrac{\bar{p}\bar{q}}{n_1} + \dfrac{\bar{p}\bar{q}}{n_2}}}$ Two proportions

$t = \dfrac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\dfrac{s_1^2}{n_1} + \dfrac{s_2^2}{n_2}}}$ df = smaller of $n_1 - 1, n_2 - 1$

Two means—independent; σ_1 and σ_2 unknown, and not assumed equal.

$t = \dfrac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\dfrac{s_p^2}{n_1} + \dfrac{s_p^2}{n_2}}}$ $(\text{df} = n_1 + n_2 - 2)$

where $s_p^2 = \dfrac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}$

Two means—independent; σ_1 and σ_2 unknown, but assumed equal.

$z = \dfrac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\dfrac{\sigma_1^2}{n_1} + \dfrac{\sigma_2^2}{n_2}}}$ Two means—independent; σ_1, σ_2 known.

$t = \dfrac{\bar{d} - \mu_d}{s_d/\sqrt{n}}$ Two means—matched pairs $(\text{df} = n - 1)$

$F = \dfrac{s_1^2}{s_2^2}$ Standard deviation or variance—two populations (where $s_1^2 \geq s_2^2$)

Ch. 10: Multinomial and Contingency Tables

$\chi^2 = \Sigma\dfrac{(O-E)^2}{E}$ Multinomial $(\text{df} = k - 1)$

$\chi^2 = \Sigma\dfrac{(O-E)^2}{E}$ Contingency table $[\text{df} = (r-1)(c-1)]$

where $E = \dfrac{(\text{row total})(\text{column total})}{(\text{grand total})}$

$\chi^2 = \dfrac{(|b-c|-1)^2}{b+c}$ McNemar's test

Ch. 8: Confidence Intervals (two populations)

$(\hat{p}_1 - \hat{p}_2) - E < (p_1 - p_2) < (\hat{p}_1 - \hat{p}_2) + E$

where $E = z_{\alpha/2}\sqrt{\dfrac{\hat{p}_1\hat{q}_1}{n_1} + \dfrac{\hat{p}_2\hat{q}_2}{n_2}}$

$(\bar{x}_1 - \bar{x}_2) - E < (\mu_1 - \mu_2) < (\bar{x}_1 - \bar{x}_2) + E$ (Indep.)

where $E = t_{\alpha/2}\sqrt{\dfrac{s_1^2}{n_1} + \dfrac{s_2^2}{n_2}}$ (df = smaller of $n_1 - 1, n_2 - 1$)

(σ_1 and σ_2 unknown and not assumed equal)

$E = t_{\alpha/2}\sqrt{\dfrac{s_p^2}{n_1} + \dfrac{s_p^2}{n_2}}$ $(\text{df} = n_1 + n_2 - 2)$

$s_p^2 = \dfrac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{(n_1 - 1) + (n_2 - 1)}$

(σ_1 and σ_2 unknown but assumed equal)

$E = z_{\alpha/2}\sqrt{\dfrac{\sigma_1^2}{n_1} + \dfrac{\sigma_2^2}{n_2}}$

(σ_1, σ_2 known)

$\bar{d} - E < \mu_d < \bar{d} + E$ (Matched pairs)

where $E = t_{\alpha/2}\dfrac{s_d}{\sqrt{n}}$ $(\text{df} = n - 1)$

$\dfrac{ad}{bc} \cdot e^{-z_{\alpha/2}\sqrt{\frac{1}{a}+\frac{1}{b}+\frac{1}{c}+\frac{1}{d}}} < \text{OR} < \dfrac{ad}{bc} \cdot e^{z_{\alpha/2}\sqrt{\frac{1}{a}+\frac{1}{b}+\frac{1}{c}+\frac{1}{d}}}$

Ch. 9: Linear Correlation/Regression

Correlation $r = \dfrac{n\Sigma xy - (\Sigma x)(\Sigma y)}{\sqrt{n(\Sigma x^2) - (\Sigma x)^2}\sqrt{n(\Sigma y^2) - (\Sigma y)^2}}$

$b_1 = \dfrac{n\Sigma xy - (\Sigma x)(\Sigma y)}{n(\Sigma x^2) - (\Sigma x)^2}$

$b_0 = \bar{y} - b_1\bar{x}$ or $b_0 = \dfrac{(\Sigma y)(\Sigma x^2) - (\Sigma x)(\Sigma xy)}{n(\Sigma x^2) - (\Sigma x)^2}$

$\hat{y} = b_0 + b_1 x$ Estimated eq. of regression line

$r^2 = \dfrac{\text{explained variation}}{\text{total variation}}$

$s_e = \sqrt{\dfrac{\Sigma(y - \hat{y})^2}{n-2}}$ or $\sqrt{\dfrac{\Sigma y^2 - b_0\Sigma y - b_1\Sigma xy}{n-2}}$

$\hat{y} - E < y < \hat{y} + E$

where $E = t_{\alpha/2}s_e\sqrt{1 + \dfrac{1}{n} + \dfrac{n(x_0 - \bar{x})^2}{n(\Sigma x^2) - (\Sigma x)^2}}$

Formulas and Tables

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Ch. 11: One-Way Analysis of a Variance

$F = \dfrac{ns_{\bar{x}}^2}{s_p^2}$ k samples each of size n (num. df = $k - 1$; den. df = $k(n-1)$)

$F = \dfrac{\text{MS(treatment)}}{\text{MS(error)}}$ $\leftarrow$ df = $k - 1$ $\leftarrow$ df = $N - k$

$\text{MS(treatment)} = \dfrac{\text{SS(treatment)}}{k-1}$

$\text{MS(error)} = \dfrac{\text{SS(error)}}{N-k}$ $\quad$ $\text{MS(total)} = \dfrac{\text{SS(total)}}{N-1}$

$\text{SS(treatment)} = n_1(\bar{x}_1 - \bar{\bar{x}})^2 + \cdots + n_k(\bar{x}_k - \bar{\bar{x}})^2$

$\text{SS(error)} = (n_1 - 1)s_1^2 + \cdots + (n_k - 1)s_k^2$

$\text{SS(total)} = \Sigma(x - \bar{\bar{x}})^2$

$\text{SS(total)} = \text{SS(treatment)} + \text{SS(error)}$

Ch. 11: Two-Way Analysis of Variance

Interaction: $F = \dfrac{\text{MS(interaction)}}{\text{MS(error)}}$

Row factor: $F = \dfrac{\text{MS(row factor)}}{\text{MS(error)}}$

Column factor: $F = \dfrac{\text{MS(column factor)}}{\text{MS(error)}}$

Ch. 12: Nonparametric Tests

$z = \dfrac{(x + 0.5) - (n/2)}{\sqrt{n}/2}$ Sign test for $n > 25$

$z = \dfrac{T - n(n+1)/4}{\sqrt{\dfrac{n(n+1)(2n+1)}{24}}}$ Wilcoxon signed-ranks (matched pairs and $n > 30$)

$z = \dfrac{R - \mu_R}{\sigma_R} = \dfrac{R - \dfrac{n_1(n_1+n_2+1)}{2}}{\sqrt{\dfrac{n_1 n_2(n_1+n_2+1)}{12}}}$ Wilcoxon rank-sum (two independent samples)

$H = \dfrac{12}{N(N+1)}\left(\dfrac{R_1^2}{n_1} + \dfrac{R_2^2}{n_2} + \ldots + \dfrac{R_k^2}{n_k}\right) - 3(N+1)$

Kruskal-Wallis (chi-square df = $k - 1$)

$r_s = 1 - \dfrac{6\Sigma d^2}{n(n^2-1)}$ Rank correlation

$\left(\text{critical value for } n > 30\text{: } \dfrac{\pm z}{\sqrt{n-1}}\right)$

TABLE A-6
Critical Values of the Pearson Correlation Coefficient r

n	$\alpha = .05$	$\alpha = .01$
4	.950	.999
5	.878	.959
6	.811	.917
7	.754	.875
8	.707	.834
9	.666	.798
10	.632	.765
11	.602	.735
12	.576	.708
13	.553	.684
14	.532	.661
15	.514	.641
16	.497	.623
17	.482	.606
18	.468	.590
19	.456	.575
20	.444	.561
25	.396	.505
30	.361	.463
35	.335	.430
40	.312	.402
45	.294	.378
50	.279	.361
60	.254	.330
70	.236	.305
80	.220	.286
90	.207	.269
100	.196	.256

NOTE: To test H_0: $\rho = 0$ against H_1: $\rho \neq 0$, reject H_0 if the absolute value of r is greater than the critical value in the table.

Appendix A Tables

TABLE A-1 Binomial Probabilities

		p												
n	x	.01	.05	.10	.20	.30	.40	.50	.60	.70	.80	.90	.95	.99	x
2	0	.980	.902	.810	.640	.490	.360	.250	.160	.090	.040	.010	.002	0+	0
	1	.020	.095	.180	.320	.420	.480	.500	.480	.420	.320	.180	.095	.020	1
	2	0+	.002	.010	.040	.090	.160	.250	.360	.490	.640	.810	.902	.980	2
3	0	.970	.857	.729	.512	.343	.216	.125	.064	.027	.008	.001	0+	0+	0
	1	.029	.135	.243	.384	.441	.432	.375	.288	.189	.096	.027	.007	0+	1
	2	0+	.007	.027	.096	.189	.288	.375	.432	.441	.384	.243	.135	.029	2
	3	0+	0+	.001	.008	.027	.064	.125	.216	.343	.512	.729	.857	.970	3
4	0	.961	.815	.656	.410	.240	.130	.062	.026	.008	.002	0+	0+	0+	0
	1	.039	.171	.292	.410	.412	.346	.250	.154	.076	.026	.004	0+	0+	1
	2	.001	.014	.049	.154	.265	.346	.375	.346	.265	.154	.049	.014	.001	2
	3	0+	0+	.004	.026	.076	.154	.250	.346	.412	.410	.292	.171	.039	3
	4	0+	0+	0+	.002	.008	.026	.062	.130	.240	.410	.656	.815	.961	4
5	0	.951	.774	.590	.328	.168	.078	.031	.010	.002	0+	0+	0+	0+	0
	1	.048	.204	.328	.410	.360	.259	.156	.077	.028	.006	0+	0+	0+	1
	2	.001	.021	.073	.205	.309	.346	.312	.230	.132	.051	.008	.001	0+	2
	3	0+	.001	.008	.051	.132	.230	.312	.346	.309	.205	.073	.021	.001	3
	4	0+	0+	0+	.006	.028	.077	.156	.259	.360	.410	.328	.204	.048	4
	5	0+	0+	0+	0+	.002	.010	.031	.078	.168	.328	.590	.774	.951	5
6	0	.941	.735	.531	.262	.118	.047	.016	.004	.001	0+	0+	0+	0+	0
	1	.057	.232	.354	.393	.303	.187	.094	.037	.010	.002	0+	0+	0+	1
	2	.001	.031	.098	.246	.324	.311	.234	.138	.060	.015	.001	0+	0+	2
	3	0+	.002	.015	.082	.185	.276	.312	.276	.185	.082	.015	.002	0+	3
	4	0+	0+	.001	.015	.060	.138	.234	.311	.324	.246	.098	.031	.001	4
	5	0+	0+	0+	.002	.010	.037	.094	.187	.303	.393	.354	.232	.057	5
	6	0+	0+	0+	0+	.001	.004	.016	.047	.118	.262	.531	.735	.941	6
7	0	.932	.698	.478	.210	.082	.028	.008	.002	0+	0+	0+	0+	0+	0
	1	.066	.257	.372	.367	.247	.131	.055	.017	.004	0+	0+	0+	0+	1
	2	.002	.041	.124	.275	.318	.261	.164	.077	.025	.004	0+	0+	0+	2
	3	0+	.004	.023	.115	.227	.290	.273	.194	.097	.029	.003	0+	0+	3
	4	0+	0+	.003	.029	.097	.194	.273	.290	.227	.115	.023	.004	0+	4
	5	0+	0+	0+	.004	.025	.077	.164	.261	.318	.275	.124	.041	.002	5
	6	0+	0+	0+	0+	.004	.017	.055	.131	.247	.367	.372	.257	.066	6
	7	0+	0+	0+	0+	0+	.002	.008	.028	.082	.210	.478	.698	.932	7
8	0	.923	.663	.430	.168	.058	.017	.004	.001	0+	0+	0+	0+	0+	0
	1	.075	.279	.383	.336	.198	.090	.031	.008	.001	0+	0+	0+	0+	1
	2	.003	.051	.149	.294	.296	.209	.109	.041	.010	.001	0+	0+	0+	2
	3	0+	.005	.033	.147	.254	.279	.219	.124	.047	.009	0+	0+	0+	3
	4	0+	0+	.005	.046	.136	.232	.273	.232	.136	.046	.005	0+	0+	4
	5	0+	0+	0+	.009	.047	.124	.219	.279	.254	.147	.033	.005	0+	5
	6	0+	0+	0+	.001	.010	.041	.109	.209	.296	.294	.149	.051	.003	6
	7	0+	0+	0+	0+	.001	.008	.031	.090	.198	.336	.383	.279	.075	7
	8	0+	0+	0+	0+	0+	.001	.004	.017	.058	.168	.430	.663	.923	8

NOTE: 0+ represents a positive probability less than 0.0005.

(continued)

TABLE A-1 Binomial Probabilities (*continued*)

		p													
n	*x*	.01	.05	.10	.20	.30	.40	.50	.60	.70	.80	.90	.95	.99	*x*
9	0	.914	.630	.387	.134	.040	.010	.002	0+	0+	0+	0+	0+	0+	0
	1	.083	.299	.387	.302	.156	.060	.018	.004	0+	0+	0+	0+	0+	1
	2	.003	.063	.172	.302	.267	.161	.070	.021	.004	0+	0+	0+	0+	2
	3	0+	.008	.045	.176	.267	.251	.164	.074	.021	.003	0+	0+	0+	3
	4	0+	.001	.007	.066	.172	.251	.246	.167	.074	.017	.001	0+	0+	4
	5	0+	0+	.001	.017	.074	.167	.246	.251	.172	.066	.007	.001	0+	5
	6	0+	0+	0+	.003	.021	.074	.164	.251	.267	.176	.045	.008	0+	6
	7	0+	0+	0+	0+	.004	.021	.070	.161	.267	.302	.172	.063	.003	7
	8	0+	0+	0+	0+	0+	.004	.018	.060	.156	.302	.387	.299	.083	8
	9	0+	0+	0+	0+	0+	0+	.002	.010	.040	.134	.387	.630	.914	9
10	0	.904	.599	.349	.107	.028	.006	.001	0+	0+	0+	0+	0+	0+	0
	1	.091	.315	.387	.268	.121	.040	.010	.002	0+	0+	0+	0+	0+	1
	2	.004	.075	.194	.302	.233	.121	.044	.011	.001	0+	0+	0+	0+	2
	3	0+	.010	.057	.201	.267	.215	.117	.042	.009	.001	0+	0+	0+	3
	4	0+	.001	.011	.088	.200	.251	.205	.111	.037	.006	0+	0+	0+	4
	5	0+	0+	.001	.026	.103	.201	.246	.201	.103	.026	.001	0+	0+	5
	6	0+	0+	0+	.006	.037	.111	.205	.251	.200	.088	.011	.001	0+	6
	7	0+	0+	0+	.001	.009	.042	.117	.215	.267	.201	.057	.010	0+	7
	8	0+	0+	0+	0+	.001	.011	.044	.121	.233	.302	.194	.075	.004	8
	9	0+	0+	0+	0+	0+	.002	.010	.040	.121	.268	.387	.315	.091	9
	10	0+	0+	0+	0+	0+	0+	.001	.006	.028	.107	.349	.599	.904	10
11	0	.895	.569	.314	.086	.020	.004	0+	0+	0+	0+	0+	0+	0+	0
	1	.099	.329	.384	.236	.093	.027	.005	.001	0+	0+	0+	0+	0+	1
	2	.005	.087	.213	.295	.200	.089	.027	.005	.001	0+	0+	0+	0+	2
	3	0+	.014	.071	.221	.257	.177	.081	.023	.004	0+	0+	0+	0+	3
	4	0+	.001	.016	.111	.220	.236	.161	.070	.017	.002	0+	0+	0+	4
	5	0+	0+	.002	.039	.132	.221	.226	.147	.057	.010	0+	0+	0+	5
	6	0+	0+	0+	.010	.057	.147	.226	.221	.132	.039	.002	0+	0+	6
	7	0+	0+	0+	.002	.017	.070	.161	.236	.220	.111	.016	.001	0+	7
	8	0+	0+	0+	0+	.004	.023	.081	.177	.257	.221	.071	.014	0+	8
	9	0+	0+	0+	0+	.001	.005	.027	.089	.200	.295	.213	.087	.005	9
	10	0+	0+	0+	0+	0+	.001	.005	.027	.093	.236	.384	.329	.099	10
	11	0+	0+	0+	0+	0+	0+	0+	.004	.020	.086	.314	.569	.895	11
12	0	.886	.540	.282	.069	.014	.002	0+	0+	0+	0+	0+	0+	0+	0
	1	.107	.341	.377	.206	.071	.017	.003	0+	0+	0+	0+	0+	0+	1
	2	.006	.099	.230	.283	.168	.064	.016	.002	0+	0+	0+	0+	0+	2
	3	0+	.017	.085	.236	.240	.142	.054	.012	.001	0+	0+	0+	0+	3
	4	0+	.002	.021	.133	.231	.213	.121	.042	.008	.001	0+	0+	0+	4
	5	0+	0+	.004	.053	.158	.227	.193	.101	.029	.003	0+	0+	0+	5
	6	0+	0+	0+	.016	.079	.177	.226	.177	.079	.016	0+	0+	0+	6
	7	0+	0+	0+	.003	.029	.101	.193	.227	.158	.053	.004	0+	0+	7
	8	0+	0+	0+	.001	.008	.042	.121	.213	.231	.133	.021	.002	0+	8
	9	0+	0+	0+	0+	.001	.012	.054	.142	.240	.236	.085	.017	0+	9
	10	0+	0+	0+	0+	0+	.002	.016	.064	.168	.283	.230	.099	.006	10
	11	0+	0+	0+	0+	0+	0+	.003	.017	.071	.206	.377	.341	.107	11
	12	0+	0+	0+	0+	0+	0+	0+	.002	.014	.069	.282	.540	.886	12

NOTE: 0+ represents a positive probability less than 0.0005.

(continued)

TABLE A-1 Binomial Probabilities (*continued*)

n	x	.01	.05	.10	.20	.30	.40	.50	.60	.70	.80	.90	.95	.99	x
13	0	.878	.513	.254	.055	.010	.001	0+	0+	0+	0+	0+	0+	0+	0
	1	.115	.351	.367	.179	.054	.011	.002	0+	0+	0+	0+	0+	0+	1
	2	.007	.111	.245	.268	.139	.045	.010	.001	0+	0+	0+	0+	0+	2
	3	0+	.021	.100	.246	.218	.111	.035	.006	.001	0+	0+	0+	0+	3
	4	0+	.003	.028	.154	.234	.184	.087	.024	.003	0+	0+	0+	0+	4
	5	0+	0+	.006	.069	.180	.221	.157	.066	.014	.001	0+	0+	0+	5
	6	0+	0+	.001	.023	.103	.197	.209	.131	.044	.006	0+	0+	0+	6
	7	0+	0+	0+	.006	.044	.131	.209	.197	.103	.023	.001	0+	0+	7
	8	0+	0+	0+	.001	.014	.066	.157	.221	.180	.069	.006	0+	0+	8
	9	0+	0+	0+	0+	.003	.024	.087	.184	.234	.154	.028	.003	0+	9
	10	0+	0+	0+	0+	.001	.006	.035	.111	.218	.246	.100	.021	0+	10
	11	0+	0+	0+	0+	0+	.001	.010	.045	.139	.268	.245	.111	.007	11
	12	0+	0+	0+	0+	0+	0+	.002	.011	.054	.179	.367	.351	.115	12
	13	0+	0+	0+	0+	0+	0+	0+	.001	.010	.055	.254	.513	.878	13
	0	.869	.488	.229	.044	.007	.001	0+	0+	0+	0+	0+	0+	0+	0
	1	.123	.359	.356	.154	.041	.007	.001	0+	0+	0+	0+	0+	0+	1
	2	.008	.123	.257	.250	.113	.032	.006	.001	0+	0+	0+	0+	0+	2
	3	0+	.026	.114	.250	.194	.085	.022	.003	0+	0+	0+	0+	0+	3
	4	0+	.004	.035	.172	.229	.155	.061	.014	.001	0+	0+	0+	0+	4
	5	0+	0+	.008	.086	.196	.207	.122	.041	.007	0+	0+	0+	0+	5
	6	0+	0+	.001	.032	.126	.207	.183	.092	.023	.002	0+	0+	0+	6
	7	0+	0+	0+	.009	.062	.157	.209	.157	.062	.009	0+	0+	0+	7
	8	0+	0+	0+	.002	.023	.092	.183	.207	.126	.032	.001	0+	0+	8
	9	0+	0+	0+	0+	.007	.041	.122	.207	.196	.086	.008	0+	0+	9
	10	0+	0+	0+	0+	.001	.014	.061	.155	.229	.172	.035	.004	0+	10
	11	0+	0+	0+	0+	0+	.003	.022	.085	.194	.250	.114	.026	0+	11
	12	0+	0+	0+	0+	0+	.001	.006	.032	.113	.250	.257	.123	.008	12
	13	0+	0+	0+	0+	0+	0+	.001	.007	.041	.154	.356	.359	.123	13
	14	0+	0+	0+	0+	0+	0+	0+	.001	.007	.044	.229	.488	.869	14
15	0	.860	.463	.206	.035	.005	0+	0+	0+	0+	0+	0+	0+	0+	0
	1	.130	.366	.343	.132	.031	.005	0+	0+	0+	0+	0+	0+	0+	1
	2	.009	.135	.267	.231	.092	.022	.003	0+	0+	0+	0+	0+	0+	2
	3	0+	.031	.129	.250	.170	.063	.014	.002	0+	0+	0+	0+	0+	3
	4	0+	.005	.043	.188	.219	.127	.042	.007	.001	0+	0+	0+	0+	4
	5	0+	.001	.010	.103	.206	.186	.092	.024	.003	0+	0+	0+	0+	5
	6	0+	0+	.002	.043	.147	.207	.153	.061	.012	.001	0+	0+	0+	6
	7	0+	0+	0+	.014	.081	.177	.196	.118	.035	.003	0+	0+	0+	7
	8	0+	0+	0+	.003	.035	.118	.196	.177	.081	.014	0+	0+	0+	8
	9	0+	0+	0+	.001	.012	.061	.153	.207	.147	.043	.002	0+	0+	9
	10	0+	0+	0+	0+	.003	.024	.092	.186	.206	.103	.010	.001	0+	10
	11	0+	0+	0+	0+	.001	.007	.042	.127	.219	.188	.043	.005	0+	11
	12	0+	0+	0+	0+	0+	.002	.014	.063	.170	.250	.129	.031	0+	12
	13	0+	0+	0+	0+	0+	0+	.003	.022	.092	.231	.267	.135	.009	13
	14	0+	0+	0+	0+	0+	0+	0+	.005	.031	.132	.343	.366	.130	14
	15	0+	0+	0+	0+	0+	0+	0+	0+	.005	.035	.206	.463	.860	15

NOTE: 0+ represents a positive probability less than 0.0005.

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NEGATIVE *z* Scores

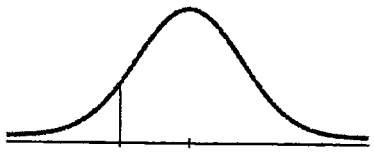
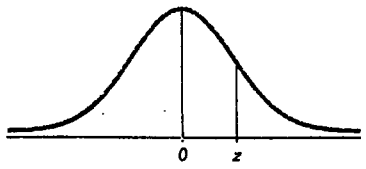


TABLE A-2 Standard Normal (z) Distribution: Cumulative Area from the LEFT

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
−3.50 and lower	.0001									
−3.4	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0002
−3.3	.0005	.0005	.0005	.0004	.0004	.0004	.0004	.0004	.0004	.0003
−3.2	.0007	.0007	.0006	.0006	.0006	.0006	.0006	.0005	.0005	.0005
−3.1	.0010	.0009	.0009	.0009	.0008	.0008	.0008	.0008	.0007	.0007
−3.0	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010
−2.9	.0019	.0018	.0018	.0017	.0016	.0016	.0015	.0015	.0014	.0014
−2.8	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
−2.7	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0028	.0027	.0026
−2.6	.0047	.0045	.0044	.0043	.0041	.0040	.0039	.0038	.0037	.0036
−2.5	.0062	.0060	.0059	.0057	.0055	.0054	.0052	.0051 *	.0049	.0048
−2.4	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
−2.3	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
−2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
−2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
−2.0	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
−1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
−1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
−1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
−1.6	.0548	.0537	.0526	.0516	.0505	* .0495	.0485	.0475	.0465	.0455
−1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
−1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681
−1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
−1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
−1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
−1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
−0.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
−0.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
−0.7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
−0.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
−0.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
−0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
−0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
−0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
−0.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
−0.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641

NOTE: For values of z below −3.49, use 0.0001 for the area.
*Use these common values that result from interpolation:

z score	Area
−1.645	0.0500
−2.575	0.0050



POSITIVE *z* Scores

TABLE A-2 (*continued*) Cumulative Area from the LEFT

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.5879
0.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
0.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
0.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
0.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495 *	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949 *	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995
3.3	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998
3.50 and up	.9999									

NOTE: For values of z above 3.49, use 0.9999 for the area.
*Use these common values that result from interpolation:

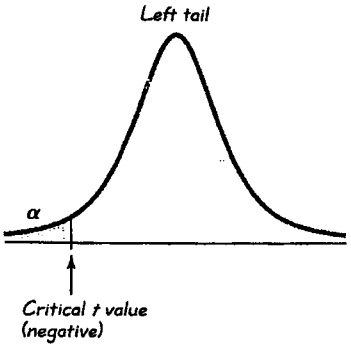
z score	Area
1.645	0.9500
2.575	0.9950

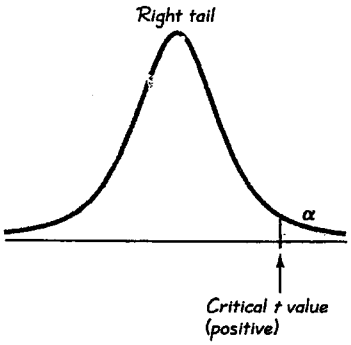
Common Critical Values

Confidence Level	Critical Value
0.90	1.645
0.95	1.96
0.99	2.575

TABLE A-3 t Distribution: Critical t Values

	Area in One Tail				
	0.005	0.01	0.025	0.05	0.10
Degrees of Freedom	Area in Two Tails				
	0.01	0.02	0.05	0.10	0.20
1	63.657	31.821	12.706	6.314	3.078
2	9.925	6.965	4.303	2.920	1.886
3	5.841	4.541	3.182	2.353	1.638
4	4.604	3.747	2.776	2.132	1.533
5	4.032	3.365	2.571	2.015	1.476
6	3.707	3.143	2.447	1.943	1.440
7	3.499	2.998	2.365	1.895	1.415
8	3.355	2.896	2.306	1.860	1.397
9	3.250	2.821	2.262	1.833	1.383
10	3.169	2.764	2.228	1.812	1.372
11	3.106	2.718	2.201	1.796	1.363
12	3.055	2.681	2.179	1.782	1.356
13	3.012	2.650	2.160	1.771	1.350
14	2.977	2.624	2.145	1.761	1.345
15	2.947	2.602	2.131	1.753	1.341
16	2.921	2.583	2.120	1.746	1.337
17	2.898	2.567	2.110	1.740	1.333
18	2.878	2.552	2.101	1.734	1.330
19	2.861	2.539	2.093	1.729	1.328
20	2.845	2.528	2.086	1.725	1.325
21	2.831	2.518	2.080	1.721	1.323
22	2.819	2.508	2.074	1.717	1.321
23	2.807	2.500	2.069	1.714	1.319
24	2.797	2.492	2.064	1.711	1.318
25	2.787	2.485	2.060	1.708	1.316
26	2.779	2.479	2.056	1.706	1.315
27	2.771	2.473	2.052	1.703	1.314
28	2.763	2.467	2.048	1.701	1.313
29	2.756	2.462	2.045	1.699	1.311
30	2.750	2.457	2.042	1.697	1.310
31	2.744	2.453	2.040	1.696	1.309
32	2.738	2.449	2.037	1.694	1.309
34	2.728	2.441	2.032	1.691	1.307
36	2.719	2.434	2.028	1.688	1.306
38	2.712	2.429	2.024	1.686	1.304
40	2.704	2.423	2.021	1.684	1.303
45	2.690	2.412	2.014	1.679	1.301
50	2.678	2.403	2.009	1.676	1.299
55	2.668	2.396	2.004	1.673	1.297
60	2.660	2.390	2.000	1.671	1.296
65	2.654	2.385	1.997	1.669	1.295
70	2.648	2.381	1.994	1.667	1.294
75	2.643	2.377	1.992	1.665	1.293
80	2.639	2.374	1.990	1.664	1.292
90	2.632	2.368	1.987	1.662	1.291
100	2.626	2.364	1.984	1.660	1.290
200	2.601	2.345	1.972	1.653	1.286
300	2.592	2.339	1.968	1.650	1.284
400	2.588	2.336	1.966	1.649	1.284
500	2.586	2.334	1.965	1.648	1.283
750	2.582	2.331	1.963	1.647	1.283
1000	2.581	2.330	1.962	1.646	1.282
2000	2.578	2.328	1.961	1.646	1.282
Large	2.576	2.326	1.960	1.645	1.282





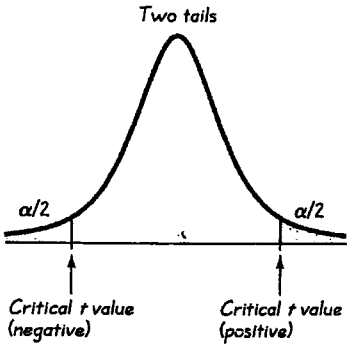


TABLE A-4 Chi-Square (χ^2) Distribution

Degrees of Freedom	Area to the Right of the Critical Value									
	0.995	0.99	0.975	0.95	0.90	0.10	0.05	0.025	0.01	0.005
1	—	—	0.001	0.004	0.016	2.706	3.841	5.024	6.635	7.879
2	0.010	0.020	0.051	0.103	0.211	4.605	5.991	7.378	9.210	10.597
3	0.072	0.115	0.216	0.352	0.584	6.251	7.815	9.348	11.345	12.838
4	0.207	0.297	0.484	0.711	1.064	7.779	9.488	11.143	13.277	14.860
5	0.412	0.554	0.831	1.145	1.610	9.236	11.071	12.833	15.086	16.750
6	0.676	0.872	1.237	1.635	2.204	10.645	12.592	14.449	16.812	18.548
7	0.989	1.239	1.690	2.167	2.833	12.017	14.067	16.013	18.475	20.278
8	1.344	1.646	2.180	2.733	3.490	13.362	15.507	17.535	20.090	21.955
9	1.735	2.088	2.700	3.325	4.168	14.684	16.919	19.023	21.666	23.589
10	2.156	2.558	3.247	3.940	4.865	15.987	18.307	20.483	23.209	25.188
11	2.603	3.053	3.816	4.575	5.578	17.275	19.675	21.920	24.725	26.757
12	3.074	3.571	4.404	5.226	6.304	18.549	21.026	23.337	26.217	28.299
13	3.565	4.107	5.009	5.892	7.042	19.812	22.362	24.736	27.688	29.819
14	4.075	4.660	5.629	6.571	7.790	21.064	23.685	26.119	29.141	31.319
15	4.601	5.229	6.262	7.261	8.547	22.307	24.996	27.488	30.578	32.801
16	5.142	5.812	6.908	7.962	9.312	23.542	26.296	28.845	32.000	34.267
17	5.697	6.408	7.564	8.672	10.085	24.769	27.587	30.191	33.409	35.718
18	6.265	7.015	8.231	9.390	10.865	25.989	28.869	31.526	34.805	37.156
19	6.844	7.633	8.907	10.117	11.651	27.204	30.144	32.852	36.191	38.582
20	7.434	8.260	9.591	10.851	12.443	28.412	31.410	34.170	37.566	39.997
21	8.034	8.897	10.283	11.591	13.240	29.615	32.671	35.479	38.932	41.401
22	8.643	9.542	10.982	12.338	14.042	30.813	33.924	36.781	40.289	42.796
23	9.260	10.196	11.689	13.091	14.848	32.007	35.172	38.076	41.638	44.181
24	9.886	10.856	12.401	13.848	15.659	33.196	36.415	39.364	42.980	45.559
25	10.520	11.524	13.120	14.611	16.473	34.382	37.652	40.646	44.314	46.928
26	11.160	12.198	13.844	15.379	17.292	35.563	38.885	41.923	45.642	48.290
27	11.808	12.879	14.573	16.151	18.114	36.741	40.113	43.194	46.963	49.645
28	12.461	13.565	15.308	16.928	18.939	37.916	41.337	44.461	48.278	50.993
29	13.121	14.257	16.047	17.708	19.768	39.087	42.557	45.722	49.588	52.336
30	13.787	14.954	16.791	18.493	20.599	40.256	43.773	46.979	50.892	53.672
40	20.707	22.164	24.433	26.509	29.051	51.805	55.758	59.342	63.691	66.766
50	27.991	29.707	32.357	34.764	37.689	63.167	67.505	71.420	76.154	79.490
60	35.534	37.485	40.482	43.188	46.459	74.397	79.082	83.298	88.379	91.952
70	43.275	45.442	48.758	51.739	55.329	85.527	90.531	95.023	100.425	104.215
80	51.172	53.540	57.153	60.391	64.278	96.578	101.879	106.629	112.329	116.321
90	59.196	61.754	65.647	69.126	73.291	107.565	113.145	118.136	124.116	128.299
100	67.328	70.065	74.222	77.929	82.358	118.498	124.342	129.561	135.807	140.169

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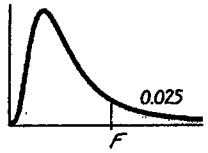
Degrees of Freedom

$n - 1$	for confidence intervals or hypothesis tests with a standard deviation or variance
$k - 1$	for multinomial experiments or goodness-of-fit with k categories
$(r - 1)(c - 1)$	for contingency tables with r rows and c columns
$k - 1$	for Kruskal-Wallis test with k samples

TABLE A-5 *F* Distribution ($\alpha = 0.025$ in the right tail)



Denominator degrees of freedom (df_2)	Numerator degrees of freedom (df_1)								
	1	2	3	4	5	6	7	8	9
1	647.79	799.50	864.16	899.58	921.85	937.11	948.22	956.66	963.28
2	38.506	39.000	39.165	39.248	39.298	39.331	39.335	39.373	39.387
3	17.443	16.044	15.439	15.101	14.885	14.735	14.624	14.540	14.473
4	12.218	10.649	9.9792	9.6045	9.3645	9.1973	9.0741	8.9796	8.9047
5	10.007	8.4336	7.7636	7.3879	7.1464	6.9777	6.8531	6.7572	6.6811
6	8.8131	7.2599	6.5988	6.2272	5.9876	5.8198	5.6955	5.5996	5.5234
7	8.0727	6.5415	5.8898	5.5226	5.2852	5.1186	4.9949	4.8993	4.8232
8	7.5709	6.0595	5.4160	5.0526	4.8173	4.6517	4.5286	4.4333	4.3572
9	7.2093	5.7147	5.0781	4.7181	4.4844	4.3197	4.1970	4.1020	4.0260
10	6.9367	5.4564	4.8256	4.4683	4.2361	4.0721	3.9498	3.8549	3.7790
11	6.7241	5.2559	4.6300	4.2751	4.0440	3.8807	3.7586	3.6638	3.5879
12	6.5538	5.0959	4.4742	4.1212	3.8911	3.7283	3.6065	3.5118	3.4358
13	6.4143	4.9653	4.3472	3.9959	3.7667	3.6043	3.4827	3.3880	3.3120
14	6.2979	4.8567	4.2417	3.8919	3.6634	3.5014	3.3799	3.2853	3.2093
15	6.1995	4.7650	4.1528	3.8043	3.5764	3.4147	3.2934	3.1987	3.1227
16	6.1151	4.6867	4.0768	3.7294	3.5021	3.3406	3.2194	3.1248	3.0488
17	6.0420	4.6189	4.0112	3.6648	3.4379	3.2767	3.1556	3.0610	2.9849
18	5.9781	4.5597	3.9539	3.6083	3.3820	3.2209	3.0999	3.0053	2.9291
19	5.9216	4.5075	3.9034	3.5587	3.3327	3.1718	3.0509	2.9563	2.8801
20	5.8715	4.4613	3.8587	3.5147	3.2891	3.1283	3.0074	2.9128	2.8365
21	5.8266	4.4199	3.8188	3.4754	3.2501	3.0895	2.9686	2.8740	2.7977
22	5.7863	4.3828	3.7829	3.4401	3.2151	3.0546	2.9338	2.8392	2.7628
23	5.7498	4.3492	3.7505	3.4083	3.1835	3.0232	2.9023	2.8077	2.7313
24	5.7166	4.3187	3.7211	3.3794	3.1548	2.9946	2.8738	2.7791	2.7027
25	5.6864	4.2909	3.6943	3.3530	3.1287	2.9685	2.8478	2.7531	2.6766
26	5.6586	4.2655	3.6697	3.3289	3.1048	2.9447	2.8240	2.7293	2.6528
27	5.6331	4.2421	3.6472	3.3067	3.0828	2.9228	2.8021	2.7074	2.6309
28	5.6096	4.2205	3.6264	3.2863	3.0626	2.9027	2.7820	2.6872	2.6106
29	5.5878	4.2006	3.6072	3.2674	3.0438	2.8840	2.7633	2.6686	2.5919
30	5.5675	4.1821	3.5894	3.2499	3.0265	2.8667	2.7460	2.6513	2.5746
40	5.4239	4.0510	3.4633	3.1261	2.9037	2.7444	2.6238	2.5289	2.4519
60	5.2856	3.9253	3.3425	3.0077	2.7863	2.6274	2.5068	2.4117	2.3344
120	5.1523	3.8046	3.2269	2.8943	2.6740	2.5154	2.3948	2.2994	2.2217
∞	5.0239	3.6889	3.1161	2.7858	2.5665	2.4082	2.2875	2.1918	2.1136

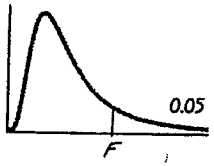
TABLE A-5 *F* Distribution ($\alpha = 0.025$ in the right tail) *(continued)*

Denominator degrees of freedom (df_2)	Numerator degrees of freedom (df_1)									
	10	12	15	20	24	30	40	60	120	∞
1	968.63	976.71	984.87	993.10	997.25	1001.4	1005.6	1009.8	1014.0	1018.3
2	39.398	39.415	39.431	39.448	39.456	39.465	39.473	39.481	39.490	39.498
3	14.419	14.337	14.253	14.167	14.124	14.081	14.037	13.992	13.947	13.902
4	8.8439	8.7512	8.6565	8.5599	8.5109	8.4613	8.4111	8.3604	8.3092	8.2573
5	6.6192	6.5245	6.4277	6.3286	6.2780	6.2269	6.1750	6.1225	6.0693	6.0153
6	5.4613	5.3662	5.2687	5.1684	5.1172	5.0652	5.0125	4.9589	4.9044	4.8491
7	4.7611	4.6658	4.5678	4.4667	4.4150	4.3624	4.3089	4.2544	4.1989	4.1423
8	4.2951	4.1997	4.1012	3.9995	3.9472	3.8940	3.8398	3.7844	3.7279	3.6702
9	3.9639	3.8682	3.7694	3.6669	3.6142	3.5604	3.5055	3.4493	3.3918	3.3329
10	3.7168	3.6209	3.5217	3.4185	3.3654	3.3110	3.2554	3.1984	3.1399	3.0798
11	3.5257	3.4296	3.3299	3.2261	3.1725	3.1176	3.0613	3.0035	2.9441	2.8828
12	3.3736	3.2773	3.1772	3.0728	3.0187	2.9633	2.9063	2.8478	2.7874	2.7249
13	3.2497	3.1532	3.0527	2.9477	2.8932	2.8372	2.7797	2.7204	2.6590	2.5955
14	3.1469	3.0502	2.9493	2.8437	2.7888	2.7324	2.6742	2.6142	2.5519	2.4872
15	3.0602	2.9633	2.8621	2.7559	2.7006	2.6437	2.5850	2.5242	2.4611	2.3953
16	2.9862	2.8890	2.7875	2.6808	2.6252	2.5678	2.5085	2.4471	2.3831	2.3163
17	2.9222	2.8249	2.7230	2.6158	2.5598	2.5020	2.4422	2.3801	2.3153	2.2474
18	2.8664	2.7689	2.6667	2.5590	2.5027	2.4445	2.3842	2.3214	2.2558	2.1869
19	2.8172	2.7196	2.6171	2.5089	2.4523	2.3937	2.3329	2.2696	2.2032	2.1333
20	2.7737	2.6758	2.5731	2.4645	2.4076	2.3486	2.2873	2.2234	2.1562	2.0853
21	2.7348	2.6368	2.5338	2.4247	2.3675	2.3082	2.2465	2.1819	2.1141	2.0422
22	2.6998	2.6017	2.4984	2.3890	2.3315	2.2718	2.2097	2.1446	2.0760	2.0032
23	2.6682	2.5699	2.4665	2.3567	2.2989	2.2389	2.1763	2.1107	2.0415	1.9677
24	2.6396	2.5411	2.4374	2.3273	2.2693	2.2090	2.1460	2.0799	2.0099	1.9353
25	2.6135	2.5149	2.4110	2.3005	2.2422	2.1816	2.1183	2.0516	1.9811	1.9055
26	2.5896	2.4908	2.3867	2.2759	2.2174	2.1565	2.0928	2.0257	1.9545	1.8781
27	2.5676	2.4688	2.3644	2.2533	2.1946	2.1334	2.0693	2.0018	1.9299	1.8527
28	2.5473	2.4484	2.3438	2.2324	2.1735	2.1121	2.0477	1.9797	1.9072	1.8291
29	2.5286	2.4295	2.3248	2.2131	2.1540	2.0923	2.0276	1.9591	1.8861	1.8072
30	2.5112	2.4120	2.3072	2.1952	2.1359	2.0739	2.0089	1.9400	1.8664	1.7867
40	2.3882	2.2882	2.1819	2.0677	2.0069	1.9429	1.8752	1.8028	1.7242	1.6371
60	2.2702	2.1692	2.0613	1.9445	1.8817	1.8152	1.7440	1.6668	1.5810	1.4821
120	2.1570	2.0548	1.9450	1.8249	1.7597	1.6899	1.6141	1.5299	1.4327	1.3104
∞	2.0483	1.9447	1.8326	1.7085	1.6402	1.5660	1.4835	1.3883	1.2684	1.0000

From Maxine Merrington and Catherine M. Thompson, "Tables of Percentage Points of the Inverted Beta (*F*) Distribution," *Biometrika 33* (1943): 80–84. Reproduced with permission of the Biometrika Trustees.

(continued)

TABLE A-5 *F* Distribution ($\alpha = 0.05$ in the right tail)



Denominator degrees of freedom (df_2)	Numerator degrees of freedom (df_1)								
	1	2	3	4	5	6	7	8	9
1	161.45	199.50	215.71	224.58	230.16	233.99	236.77	238.88	240.54
2	18.513	19.000	19.164	19.247	19.296	19.330	19.353	19.371	19.385
3	10.128	9.5521	9.2766	9.1172	9.0135	8.9406	8.8867	8.8452	8.8123
4	7.7086	6.9443	6.5914	6.3882	6.2561	6.1631	6.0942	6.0410	6.9988
5	6.6079	5.7861	5.4095	5.1922	5.0503	4.9503	4.8759	4.8183	4.7725
6	5.9874	5.1433	4.7571	4.5337	4.3874	4.2839	4.2067	4.1468	4.0990
7	5.5914	4.7374	4.3468	4.1203	3.9715	3.8660	3.7870	3.7257	3.6767
8	5.3177	4.4590	4.0662	3.8379	3.6875	3.5806	3.5005	3.4381	3.3881
9	5.1174	4.2565	3.8625	3.6331	3.4817	3.3738	3.2927	3.2296	3.1789
10	4.9646	4.1028	3.7083	3.4780	3.3258	3.2172	3.1355	3.0717	3.0204
11	4.8443	3.9823	3.5874	3.3567	3.2039	3.0946	3.0123	2.9480	2.8962
12	4.7472	3.8853	3.4903	3.2592	3.1059	2.9961	2.9134	2.8486	2.7964
13	4.6672	3.8056	3.4105	3.1791	3.0254	2.9153	2.8321	2.7669	2.7144
14	4.6001	3.7389	3.3439	3.1122	2.9582	2.8477	2.7642	2.6987	2.6458
15	4.5431	3.6823	3.2874	3.0556	2.9013	2.7905	2.7066	2.6408	2.5876
16	4.4940	3.6337	3.2389	3.0069	2.8524	2.7413	2.6572	2.5911	2.5377
17	4.4513	3.5915	3.1968	2.9647	2.8100	2.6987	2.6143	2.5480	2.4943
18	4.4139	3.5546	3.1599	2.9277	2.7729	2.6613	2.5767	2.5102	2.4563
19	4.3807	3.5219	3.1274	2.8951	2.7401	2.6283	2.5435	2.4768	2.4227
20	4.3512	3.4928	3.0984	2.8661	2.7109	2.5990	2.5140	2.4471	2.3928
21	4.3248	3.4668	3.0725	2.8401	2.6848	2.5727	2.4876	2.4205	2.3660
22	4.3009	3.4434	3.0491	2.8167	2.6613	2.5491	2.4638	2.3965	2.3419
23	4.2793	3.4221	3.0280	2.7955	2.6400	2.5277	2.4422	2.3748	2.3201
24	4.2597	3.4028	3.0088	2.7763	2.6207	2.5082	2.4226	2.3551	2.3002
25	4.2417	3.3852	2.9912	2.7587	2.6030	2.4904	2.4047	2.3371	2.2821
26	4.2252	3.3690	2.9752	2.7426	2.5868	2.4741	2.3883	2.3205	2.2655
27	4.2100	3.3541	2.9604	2.7278	2.5719	2.4591	2.3732	2.3053	2.2501
28	4.1960	3.3404	2.9467	2.7141	2.5581	2.4453	2.3593	2.2913	2.2360
29	4.1830	3.3277	2.9340	2.7014	2.5454	2.4324	2.3463	2.2783	2.2229
30	4.1709	3.3158	2.9223	2.6896	2.5336	2.4205	2.3343	2.2662	2.2107
40	4.0847	3.2317	2.8387	2.6060	2.4495	2.3359	2.2490	2.1802	2.1240
60	4.0012	3.1504	2.7581	2.5252	2.3683	2.2541	2.1665	2.0970	2.0401
120	3.9201	3.0718	2.6802	2.4472	2.2899	2.1750	2.0868	2.0164	1.9588
∞	3.8415	2.9957	2.6049	2.3719	2.2141	2.0986	2.0096	1.9384	1.8799

(continued)

TABLE A-5 *F* Distribution ($\alpha = 0.05$ in the right tail) *(continued)*

Denominator degrees of freedom (df_2)	Numerator degrees of freedom (df_1)									
	10	12	15	20	24	30	40	60	120	∞
1	241.88	243.91	245.95	248.01	249.05	250.10	251.14	252.20	253.25	254.31
2	19.396	19.413	19.429	19.446	19.454	19.462	19.471	19.479	19.487	19.496
3	8.7855	8.7446	8.7029	8.6602	8.6385	8.6166	8.5944	8.5720	8.5494	8.5264
4	5.9644	5.9117	5.8578	5.8025	5.7744	5.7459	5.7170	5.6877	5.6581	5.6281
5	4.7351	4.6777	4.6188	4.5581	4.5272	4.4957	4.4638	4.4314	4.3985	4.3650
6	4.0600	3.9999	3.9381	3.8742	3.8415	3.8082	3.7743	3.7398	3.7047	3.6689
7	3.6365	3.5747	3.5107	3.4445	3.4105	3.3758	3.3404	3.3043	3.2674	3.2298
8	3.3472	3.2839	3.2184	3.1503	3.1152	3.0794	3.0428	3.0053	2.9669	2.9276
9	3.1373	3.0729	3.0061	2.9365	2.9005	2.8637	2.8259	2.7872	2.7475	2.7067
10	2.9782	2.9130	2.8450	2.7740	2.7372	2.6996	2.6609	2.6211	2.5801	2.5379
11	2.8536	2.7876	2.7186	2.6464	2.6090	2.5705	2.5309	2.4901	2.4480	2.4045
12	2.7534	2.6866	2.6169	2.5436	2.5055	2.4663	2.4259	2.3842	2.3410	2.2962
13	2.6710	2.6037	2.5331	2.4589	2.4202	2.3803	2.3392	2.2966	2.2524	2.2064
14	2.6022	2.5342	2.4630	2.3879	2.3487	2.3082	2.2664	2.2229	2.1778	2.1307
15	2.5437	2.4753	2.4034	2.3275	2.2878	2.2468	2.2043	2.1601	2.1141	2.0658
16	2.4935	2.4247	2.3522	2.2756	2.2354	2.1938	2.1507	2.1058	2.0589	2.0096
17	2.4499	2.3807	2.3077	2.2304	2.1898	2.1477	2.1040	2.0584	2.0107	1.9604
18	2.4117	2.3421	2.2686	2.1906	2.1497	2.1071	2.0629	2.0166	1.9681	1.9168
19	2.3779	2.3080	2.2341	2.1555	2.1141	2.0712	2.0264	1.9795	1.9302	1.8780
20	2.3479	2.2776	2.2033	2.1242	2.0825	2.0391	1.9938	1.9464	1.8963	1.8432
21	2.3210	2.2504	2.1757	2.0960	2.0540	2.0102	1.9645	1.9165	1.8657	1.8117
22	2.2967	2.2258	2.1508	2.0707	2.0283	1.9842	1.9380	1.8894	1.8380	1.7831
23	2.2747	2.2036	2.1282	2.0476	2.0050	1.9605	1.9139	1.8648	1.8128	1.7570
24	2.2547	2.1834	2.1077	2.0267	1.9838	1.9390	1.8920	1.8424	1.7896	1.7330
25	2.2365	2.1649	2.0889	2.0075	1.9643	1.9192	1.8718	1.8217	1.7684	1.7110
26	2.2197	2.1479	2.0716	1.9898	1.9464	1.9010	1.8533	1.8027	1.7488	1.6906
27	2.2043	2.1323	2.0558	1.9736	1.9299	1.8842	1.8361	1.7851	1.7306	1.6717
28	2.1900	2.1179	2.0411	1.9586	1.9147	1.8687	1.8203	1.7689	1.7138	1.6541
29	2.1768	2.1045	2.0275	1.9446	1.9005	1.8543	1.8055	1.7537	1.6981	1.6376
30	2.1646	2.0921	2.0148	1.9317	1.8874	1.8409	1.7918	1.7396	1.6835	1.6223
40	2.0772	2.0035	1.9245	1.8389	1.7929	1.7444	1.6928	1.6373	1.5766	1.5089
60	1.9926	1.9174	1.8364	1.7480	1.7001	1.6491	1.5943	1.5343	1.4673	1.3893
120	1.9105	1.8337	1.7505	1.6587	1.6084	1.5543	1.4952	1.4290	1.3519	1.2539
∞	1.8307	1.7522	1.6664	1.5705	1.5173	1.4591	1.3940	1.3180	1.2214	1.0000

From Maxine Merrington and Catherine M. Thompson, "Tables of Percentage Points of the Inverted Beta (*F*) Distribution," *Biometrika 33* (1943): 80–84. Reproduced with permission of the Biometrika Trustees.

TABLE A-6 Critical Values of the Pearson Correlation Coefficient r

n	$\alpha = .05$	$\alpha = .01$
4	.950	.999
5	.878	.959
6	.811	.917
7	.754	.875
8	.707	.834
9	.666	.798
10	.632	.765
11	.602	.735
12	.576	.708
13	.553	.684
14	.532	.661
15	.514	.641
16	.497	.623
17	.482	.606
18	.468	.590
19	.456	.575
20	.444	.561
25	.396	.505
30	.361	.463
35	.335	.430
40	.312	.402
45	.294	.378
50	.279	.361
60	.254	.330
70	.236	.305
80	.220	.286
90	.207	.269
100	.196	.256

NOTE: To test H_0: $\rho = 0$ against H_1: $\rho \neq 0$, reject H_0 if the absolute value of r is greater than the critical value in the table.

TABLE A-7 Critical Values for the Sign Test

n	α .005 (one tail) .01 (two tails)	.01 (one tail) .02 (two tails)	.025 (one tail) .05 (two tails)	.05 (one tail) .10 (two tails)
1	*	*	*	*
2	*	*	*	*
3	*	*	*	*
4	*	*	*	*
5	*	*	*	0
6	*	*	0	0
7	*	0	0	0
8	0	0	0	1
9	0	0	1	1
10	0	0	1	1
11	0	1	1	2
12	1	1	2	2
13	1	1	2	3
14	1	2	2	3
15	2	2	3	3
16	2	2	3	4
17	2	3	4	4
18	3	3	4	5
19	3	4	4	5
20	3	4	5	5
21	4	4	5	6
22	4	5	5	6
23	4	5	6	7
24	5	5	6	7
25	5	6	7	7

NOTES:

1. * indicates that it is not possible to get a value in the critical region.
2. Reject the null hypothesis if the number of the less frequent sign (x) is less than or equal to the value in the table.
3. For values of n greater than 25, a normal approximation is used with

$$z = \frac{(x + 0.5) - \left(\frac{n}{2}\right)}{\frac{\sqrt{n}}{2}}$$

TABLE A-8 Critical Values of T for the Wilcoxon Signed-Ranks Test

	α			
n	.005 (one tail) .01 (two tails)	.01 (one tail) .02 (two tails)	.025 (one tail) .05 (two tails)	.05 (one tail) .10 (two tails)
5	*	*	*	1
6	*	*	1	2
7	*	0	2	4
8	0	2	4	6
9	2	3	6	8
10	3	5	8	11
11	5	7	11	14
12	7	10	14	17
13	10	13	17	21
14	13	16	21	26
15	16	20	25	30
16	19	24	30	36
17	23	28	35	41
18	28	33	40	47
19	32	38	46	54
20	37	43	52	60
21	43	49	59	68
22	49	56	66	75
23	55	62	73	83
24	61	69	81	92
25	68	77	90	101
26	76	85	98	110
27	84	93	107	120
28	92	102	117	130
29	100	111	127	141
30	109	120	137	152

NOTES:

1. * indicates that it is not possible to get a value in the critical region.
2. Reject the null hypothesis if the test statistic T is less than or equal to the critical value found in this table. Fail to reject the null hypothesis if the test statistic T is greater than the critical value found in the table.

LAMPIRAN JIB 213 (BIOSTATISTIK)

RUMUS

PUSAT PENGAJIAN PENDIDIKAN JARAK JAUH
UNIVERSITI SAINS MALAYSIA

JIB 213 – BIOSTATISTIK/BIOSTATISTIC

STATISTIK – RUMUS

1. Kebarangkalian (Probability)

(i) $P(A) = \frac{n(A)}{n(S)}$

(ii) $O \leq P(A) \leq 1$

(iii) $P(A') = 1 - P(A)$

(iv) $P(A \cap B) = P(A) \times P(B)$

(v) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

(vi) $P(B / A) = \frac{P(A \cap B)}{P(A)}$

2. Taburan Kebarangkalian

2.1. Taburan Binomial

$$P_{k,p}(x) = \binom{k}{x} p^x q^{k-x}$$

Min, $\mu = kp$
Varians $= \sigma^2 = kpq$

2.2. Taburan Poisson

$$P_\lambda(x) = \frac{\lambda^x e^{-\lambda}}{x!}$$

2.3. Taburan Normal

$$Z = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}}$$

3. **Ukuran Kecenderungan Memusat/ Measures of Central Tendency**

3.1. Purata Aritmetik (Arithmetic Mean)

(i) $\bar{x} = \frac{\sum x}{N}$

(ii) $\bar{x} = \frac{\sum fx}{\sum f}$

(iii) $\bar{x} = \bar{x}_a + \frac{\sum fd}{\sum f}$

(iv) $\bar{x} = \bar{x}_a + \left(\frac{\sum fd}{\sum f} \text{ x } C \right)$

(v) Median $= L + \left[\frac{\frac{1}{2} N - F}{f_m} \right] C$

(vi) Mod $= L + \left[\frac{d_1}{d_1 + d_2} \right] C$

4. Ukuran Serakan/ Measures of Dispersion

4.1. Varians bagi populasi,

(i) $$\sigma^2 = \frac{\Sigma(x-\mu)^2}{N}$$

(ii) $$\sigma = \sqrt{\frac{\Sigma(x-\bar{x})^2}{N}}$$

$$= \sqrt{\frac{\Sigma x^2}{N} - \left(\frac{\Sigma x}{N}\right)^2}$$

(iii) $$\sigma = \sqrt{\frac{\Sigma f(x-\bar{x})^2}{\Sigma f}}$$

$$= \sqrt{\frac{\Sigma fx^2}{\Sigma f} - \left(\frac{\Sigma fx}{\Sigma f}\right)^2}$$

(iv) $$\sigma = \sqrt{\frac{\Sigma fd^2}{\Sigma f} - \left[\frac{\Sigma fd}{\Sigma f}\right]^2}$$

4.2. Varians bagi sampel,

(i) $$s^2 = \frac{\Sigma(x-\bar{x})^2}{n-1}$$

(ii) $$s = \sqrt{\frac{\Sigma(x-\bar{x})^2}{n-1}}$$

5. **Pilihatur/ Permutation**

$$^{n}P_{r} = \frac{n!}{(n-r)!}$$
$$= n(n-1)(n-2)...(n-r+1)$$

6. **Gabungan/ Combination**

$$^{n}C_{r} = \frac{n!}{r!(n-r)!}$$

7. **Taburan Binomial/ Binomial Distribution**

(i) $E(X) = \mu = np$

(ii) $Var(X) = \sigma^2 = npq$

(iii) $\sigma = \sqrt{npq}$

(iv) $P(X = x) = {}^{n}C_{x}\ P^{x}\ q^{n-x}\ ,\quad x = 0,1,2....n$

8. **Taburan Normal Piawai/ Standard Normal Distribution**

(i) $Z \sim N(0,1) \Rightarrow\ z = \frac{\bar{x} - \mu}{\sigma}$

9. **Taburan Pensampelan/ Sampling Distribution**

9.1. Bagi populasi tak terhingga atau terhingga dengan pengembalian/ Normal of Infinite Population

(i) Min bagi taburan min sampel $\mu_{\bar{x}}$ ialah μ.

(ii) Varians bagi taburan min sampel $\sigma_{\bar{x}}^{2}$ ialah $\frac{\sigma^2}{n}$.

9.2. Bagi populasi terhingga tanpa pengembalian/ Small population

(i) Min bagi taburan min sampel $\mu_{\bar{x}}$ ialah μ.

(ii) Varians bagi taburan min sampel $\sigma_{\bar{x}}^{2}$ ialah $\frac{\sigma^2}{n}\left(\frac{N-n}{N-1}\right)$

10. **Anggaran Selang/ Interval Estimation**

10.1. Selang keyakinan $(1-\alpha)100\%$ bagi μ jika σ^2 diketahui :

$$\left(\bar{x} - z_{\frac{\alpha}{2}} \frac{\sigma}{\sqrt{n}} \, , \, \bar{x} + z_{\frac{\alpha}{2}} \frac{\sigma}{\sqrt{n}}\right)$$

10.2. Selang keyakinan $(1-\alpha)100\%$ bagi μ jika σ^2 tidak diketahui dan $n \geq 30$:

$$\left(\bar{x} - z_{\frac{\alpha}{2}} \frac{s}{\sqrt{n}} \, , \, \bar{x} + z_{\frac{\alpha}{2}} \frac{s}{\sqrt{n}}\right)$$

11. **Pengujian Hipotesis/ Hyphotesis Testing**

11.1. Statistik ujian $Z = \dfrac{\bar{X} - \mu}{\dfrac{\sigma}{\sqrt{N}}}$ jika σ^2 diketahui.

11.2. Statistik ujian $Z = \dfrac{\bar{X} - \mu}{\dfrac{s}{\sqrt{n}}}$ jika σ^2 tidak diketahui.

dan $n \geq 30$.

11.3. $n < 30$

$$t = \frac{\bar{x} - \mu}{s}$$

11.4. $$t = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{S\bar{x}_1 - \bar{x}_2}$$

11.5. $$S\bar{x}_1 - \bar{x}_2 = \sqrt{\frac{S_1^2 + S_2^2}{n}}$$

12. Perbandingan Sampel Berbilang/ K-Sample Test of Hypothesis; Analysis of Variance (ANOVA)

12.1. ANOVA Satu Hala / Model 1 ANOVA

(i) $SS_T = \sum X^2 - \frac{(\sum X)^2}{N}$; $SS_{Total} = \sum_i \sum_j X^2_{ij} - \frac{T^2_{..}}{N}$

(ii) $SS_{as} = \frac{(\sum X_1)^2}{n_1} + \frac{(\sum X_2)^2}{n_2} + \frac{(\sum X_3)^2}{n_3} + \ldots - \frac{(\sum X)^2}{N}$ or

$SS_{Treat} = \sum_i \frac{T^2_{i.}}{n_i} - \frac{T^2_{..}}{N}$

(iii) $SS_T = SS_{ds} + SS_{as}$ or $SS_{Total} = SS_{Treat} + SS_{error}$

(iv) $F_{pengiraan} = \frac{MS_{as}}{MS_{ds}}$ | $MS_{as} = \frac{SS_{as}}{K-1}$ | $MS_{ds} = \frac{SS_{ds}}{N-K}$

(v) F_{jadual} ANOVA Satu Hala , $F_{jadual} = F_{K-1,N-K}(\alpha)$

Punca Variasi	df
Perlakuan	K – 1
Baki	K(n – 1)
Jumlah	Kn - 1

(vi) Jadual ANOVA /

Sumber	dk	SS	MS	F
Antara Sel	(K – 1)	SS_{as}	SS_{as} / K - 1	$F = \frac{MS_{as}}{MS_{ds}}$
Dalam Sel	(N – K)	SS_{ds}	SS_{ds} / N - K	

ANOVA Table

Source of Variation	Some of Squares	df	MS	F
Treatments	SS_{Treat}	(k -1)	$\frac{SS_{Treat}}{k-1}$	$F = \frac{MS_{Treat}}{MS_{error}}$
Error	SS_{error}	(N -k)	$\frac{SS_{error}}{N-k}$	
Total	SS_{Total}	(N -1)		

12.2 ANOVA Dua Hala / Model II ANOVA

(i) SST = $\sum X^2 - \frac{(\sum X)^2}{N}$

(ii) SS_{as} = $\frac{(\sum X_1^2)}{n_1} + \frac{(\sum X_2)^2}{n_2} + \ldots \frac{(\sum X)^2}{N}$

@

$SS_{perlakuan\ /Treat}$

(iii) $SS_{blok\ /error}$ = $\frac{(\sum X_1^2)}{a_1} + \frac{(\sum X_2)^2}{a_2} + \ldots - \frac{(\sum X)^2}{N}$

(iv) $SS_{ralat\ baki}$ = $SS_T - SS_{as} - SS_{ds/\ blok}$ or $SS_{error} = SS_{Total} - SS_{Treat}$

(v) $F_{pengiraan}$ = $\frac{\text{Varians perlakuan}}{\text{Varian ralat (baki)}}$

(vi) $F_{pengiraan} = \dfrac{\text{Varian blok}}{\text{Varian ralat (baki)}}$

(vii) F_{jadual} ANOVA Dua Hala

Punca Variasi	df
Perlakuan	K – 1
Blok	n - 1
Baki	(K – 1) (n – 1)
Jumlah	Kn - 1

$F_{jadual} = F_{perlakuan(df_1),\ Baki(df_2)}(\alpha)$

atau/dan

$F_{Blok(df_1),\ Baki(df_2)}(\alpha)$

(viii) Jadual ANOVA Dua Hala

Sumber	dk	SS	MS	Fujian
Antara Sel (Perlakuan)	a – 1	SS_{as}	$\dfrac{SS_{as}}{a-1}$	$F_{perlakuan,\ baki\ (\alpha)}$
Dalam Sel (Blok)	n – 1	SS_{ds}	$\dfrac{SS_{ds}}{n-1}$	$F_{blok,\ baki\ (\alpha)}$
Ralat Baki	(a – 1) (n – 1)	SS_{baki}	$\dfrac{SS_{baki}}{(a-1)(n-1)}$	Fujian $= \dfrac{MS_{perlakuan}}{MS_{baki}}$
Jumlah	an – 1	SS_T		Fujian $= \dfrac{MS_{blok}}{MS_{baki}}$

F_{jadual} = (i) $F_{perlakuan,\ baki\ (\alpha)}$

(ii) $F_{blok,\ baki\ (\alpha)}$

13. **Ujian Chi-Square / Chi-Square Test**

Kekerapan Jangkaan, $E = \frac{\text{Row x Column}}{N}$ or $\frac{(\text{Total value, row})(\text{Total value, column})}{N}$

Khi Kuasa Dua, $\chi^2 = \sum_{i=1}^{k} \frac{(O_i - E_i)^2}{E_i}$

Degree of Freedom, df = bilangan kategori - 1 or
df = (row-1) (column-1)
= (r-1) (c-1)

14. Pekali Korelasi Pearson, r / Pearson Correlation, r

$$r = \frac{n\sum X_1 Y_1 - (\sum X_1)(\sum Y_1)}{\sqrt{\left[n\left(\sum X_1^2\right) - (\sum X_1)^2\right]\left[n\left(\sum Y_1^2\right) - (\sum Y_1)^2\right]}}$$

atau

$$r = \frac{\Sigma(X-\bar{X})(Y-\bar{Y})}{\sqrt{\left[\Sigma(X-\bar{X})^2(Y-\bar{Y})^2\right]}}$$

atau

$$r = \frac{\Sigma XY - \frac{(\Sigma X)(\Sigma Y)}{n}}{\sqrt{\left[\Sigma X^2 - \frac{(\Sigma X)^2}{n}\right]\left[\Sigma Y^2 - \frac{(\Sigma Y)^2}{n}\right]}}$$

15. Analisis varians dengan data terhilang oleh rumus berikut:

$$X_{pg} = \frac{aT + nB - S}{(a-1)(n-1)}$$

a = bilangan perlakuan
n = bilangan replikat
T = Jumlah perlakuan, X_p. iaitu untuk perlakuan yang mana kehilangan data berlaku.
B = Jumlah blok, $X_{.q}$ iaitu untuk blok yang mana kehilangan data berlaku.
S = Jumlah keseluruhan, iaitu X..

Pembetulan kuantiti *f* dari nilai MKD (Min kuasa Dua) dengan formula berikut:-

$$f = \frac{\left[B-(a-1)x_{pq}\right]^2}{a(n-1)^2}.$$

16. Regresi Linear / Linear Regression

$$\hat{b} = \frac{n\Sigma x_i y_i - \Sigma x_i \Sigma y_i}{n\Sigma x_i^2 - \left[\Sigma x_i\right]^2}$$

atau

$$\hat{b} = \frac{\Sigma(x_i - \bar{x})(y_i - \bar{y})}{\Sigma(x_i - \bar{x})^2}$$

$$\hat{a} = \bar{y} - \hat{b}\bar{x}.$$

17. Least Square Regression Equation

$$\hat{Y} = \bar{Y} + b(X - \bar{X})$$

$$b = \frac{\Sigma XY - \frac{(\Sigma X)(\Sigma Y)}{n}}{\Sigma X^2 - \frac{(\Sigma X)^2}{n}}$$

JIB 213
BIOSTATISTICS

Tables of Distributions and Critical Values

C

Tables of Distributions and Critical Values

C.1. Cumulative binomial distribution
C.2. Cumulative Poisson distribution
C.3. Cumulative standard normal distribution
C.4. Student's t distribution
C.5. Cumulative chi-square distribution
C.6. Wilcoxon signed-rank test cumulative distribution
C.7. Cumulative F distribution
C.8. Critical values for the Wilcoxon rank-sum test
C.9. Critical values for Duncan's multiple range test
C.10. Fisher's Z transformation of correlation coefficient r
C.11. Correlation coefficient r corresponding to Fisher's Z transformation
C.12. Cumulative distribution for Kendall's test (τ)
C.13. Critical values for the Spearman rank correlation coefficient r_s

TABLE C.1
Cumulative binomial distribution

$$F(d) = P(X \le d) = \sum_{x=0}^{d} \binom{n}{x} p^x (1-p)^{n-x}$$

		p										
n	***d***	**0.1**	**0.2**	**0.25**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.75**	**0.8**	**0.9**
5	0	0.5905	0.3277	0.2373	0.1681	0.0778	0.0313	0.0102	0.0024	0.0010	0.0003	0.0000
	1	0.9185	0.7373	0.6328	0.5282	0.3370	0.1875	0.0870	0.0308	0.0156	0.0067	0.0005
	2	0.9914	0.9421	0.8965	0.8369	0.6826	0.5000	0.3174	0.1631	0.1035	0.0579	0.0086
	3	0.9995	0.9933	0.9844	0.9692	0.9130	0.8125	0.6630	0.4718	0.3672	0.2627	0.0815
	4	1.0000	0.9997	0.9990	0.9976	0.9898	0.9688	0.9222	0.8319	0.7627	0.6723	0.4095
	5	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6	0	0.5314	0.2621	0.1780	0.1176	0.0467	0.0156	0.0041	0.0007	0.0002	0.0001	0.0000
	1	0.8857	0.6554	0.5339	0.4202	0.2333	0.1094	0.0410	0.0109	0.0046	0.0016	0.0001
	2	0.9842	0.9011	0.8306	0.7443	0.5443	0.3438	0.1792	0.0705	0.0376	0.0170	0.0013
	3	0.9987	0.9830	0.9624	0.9295	0.8208	0.6563	0.4557	0.2557	0.1694	0.0989	0.0159
	4	0.9999	0.9984	0.9954	0.9891	0.9590	0.8906	0.7667	0.5798	0.4661	0.3446	0.1143
	5	1.0000	0.9999	0.9998	0.9993	0.9959	0.9844	0.9533	0.8824	0.8220	0.7379	0.4686
	6	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
7	0	0.4783	0.2097	0.1335	0.0824	0.0280	0.0078	0.0016	0.0002	0.0001	0.0000	0.0000
	1	0.8503	0.5767	0.4449	0.3294	0.1586	0.0625	0.0188	0.0038	0.0013	0.0004	0.0000
	2	0.9743	0.8520	0.7564	0.6471	0.4199	0.2266	0.0963	0.0288	0.0129	0.0047	0.0002
	3	0.9973	0.9667	0.9294	0.8740	0.7102	0.5000	0.2898	0.1260	0.0706	0.0333	0.0027
	4	0.9998	0.9953	0.9871	0.9712	0.9037	0.7734	0.5801	0.3529	0.2436	0.1480	0.0257
	5	1.0000	0.9996	0.9987	0.9962	0.9812	0.9375	0.8414	0.6706	0.5551	0.4233	0.1497
	6	1.0000	1.0000	0.9999	0.9998	0.9984	0.9922	0.9720	0.9176	0.8665	0.7903	0.5217
	7	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
8	0	0.4305	0.1678	0.1001	0.0576	0.0168	0.0039	0.0007	0.0001	0.0000	0.0000	0.0000
	1	0.8131	0.5033	0.3671	0.2553	0.1064	0.0352	0.0085	0.0013	0.0004	0.0001	0.0000
	2	0.9619	0.7969	0.6785	0.5518	0.3154	0.1445	0.0498	0.0113	0.0042	0.0012	0.0000
	3	0.9950	0.9437	0.8862	0.8059	0.5941	0.3633	0.1737	0.0580	0.0273	0.0104	0.0004
	4	0.9996	0.9896	0.9727	0.9420	0.8263	0.6367	0.4059	0.1941	0.1138	0.0563	0.0050
	5	1.0000	0.9988	0.9958	0.9887	0.9502	0.8555	0.6846	0.4482	0.3215	0.2031	0.0381
	6	1.0000	0.9999	0.9996	0.9987	0.9915	0.9648	0.8936	0.7447	0.6329	0.4967	0.1869
	7	1.0000	1.0000	1.0000	0.9999	0.9993	0.9961	0.9832	0.9424	0.8999	0.8322	0.5695
	8	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
9	0	0.3874	0.1342	0.0751	0.0404	0.0101	0.0020	0.0003	0.0000	0.0000	0.0000	0.0000
	1	0.7748	0.4362	0.3003	0.1960	0.0705	0.0195	0.0038	0.0004	0.0001	0.0000	0.0000
	2	0.9470	0.7382	0.6007	0.4628	0.2318	0.0898	0.0250	0.0043	0.0013	0.0003	0.0000
	3	0.9917	0.9144	0.8343	0.7297	0.4826	0.2539	0.0994	0.0253	0.0100	0.0031	0.0001
	4	0.9991	0.9804	0.9511	0.9012	0.7334	0.5000	0.2666	0.0988	0.0489	0.0196	0.0009
	5	0.9999	0.9969	0.9900	0.9747	0.9006	0.7461	0.5174	0.2703	0.1657	0.0856	0.0083
	6	1.0000	0.9997	0.9987	0.9957	0.9750	0.9102	0.7682	0.5372	0.3993	0.2618	0.0530
	7	1.0000	1.0000	0.9999	0.9996	0.9962	0.9805	0.9295	0.8040	0.6997	0.5638	0.2252
	8	1.0000	1.0000	1.0000	1.0000	0.9997	0.9980	0.9899	0.9596	0.9249	0.8658	0.6126
	9	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

APPENDIX C: Tables of Distributions and Critical Values

		p										
n	***d***	**0.1**	**0.2**	**0.25**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.75**	**0.8**	**0.9**
10	0	0.3487	0.1074	0.0563	0.0282	0.0060	0.0010	0.0001	0.0000	0.0000	0.0000	0.0000
	1	0.7361	0.3758	0.2440	0.1493	0.0464	0.0107	0.0017	0.0001	0.0000	0.0000	0.0000
	2	0.9298	0.6778	0.5256	0.3828	0.1673	0.0547	0.0123	0.0016	0.0004	0.0001	0.0000
	3	0.9872	0.8791	0.7759	0.6496	0.3823	0.1719	0.0548	0.0106	0.0035	0.0009	0.0000
	4	0.9984	0.9672	0.9219	0.8497	0.6331	0.3770	0.1662	0.0473	0.0197	0.0064	0.0001
	5	0.9999	0.9936	0.9803	0.9527	0.8338	0.6230	0.3669	0.1503	0.0781	0.0328	0.0016
	6	1.0000	0.9991	0.9965	0.9894	0.9452	0.8281	0.6177	0.3504	0.2241	0.1209	0.0128
	7	1.0000	0.9999	0.9996	0.9984	0.9877	0.9453	0.8327	0.6172	0.4744	0.3222	0.0702
	8	1.0000	1.0000	1.0000	0.9999	0.9983	0.9893	0.9536	0.8507	0.7560	0.6242	0.2639
	9	1.0000	1.0000	1.0000	1.0000	0.9999	0.9990	0.9940	0.9718	0.9437	0.8926	0.6513
	10	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
11	0	0.3138	0.0859	0.0422	0.0198	0.0036	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000
	1	0.6974	0.3221	0.1971	0.1130	0.0302	0.0059	0.0007	0.0000	0.0000	0.0000	0.0000
	2	0.9104	0.6174	0.4552	0.3127	0.1189	0.0327	0.0059	0.0006	0.0001	0.0000	0.0000
	3	0.9815	0.8389	0.7133	0.5696	0.2963	0.1133	0.0293	0.0043	0.0012	0.0002	0.0000
	4	0.9972	0.9496	0.8854	0.7897	0.5328	0.2744	0.0994	0.0216	0.0076	0.0020	0.0000
	5	0.9997	0.9883	0.9657	0.9218	0.7535	0.5000	0.2465	0.0782	0.0343	0.0117	0.0003
	6	1.0000	0.9980	0.9924	0.9784	0.9006	0.7256	0.4672	0.2103	0.1146	0.0504	0.0028
	7	1.0000	0.9998	0.9988	0.9957	0.9707	0.8867	0.7037	0.4304	0.2867	0.1611	0.0185
	8	1.0000	1.0000	0.9999	0.9994	0.9941	0.9673	0.8811	0.6873	0.5448	0.3826	0.0896
	9	1.0000	1.0000	1.0000	1.0000	0.9993	0.9941	0.9698	0.8870	0.8029	0.6779	0.3026
	10	1.0000	1.0000	1.0000	1.0000	1.0000	0.9995	0.9964	0.9802	0.9578	0.9141	0.6862
	11	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12	0	0.2824	0.0687	0.0317	0.0138	0.0022	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000
	1	0.6590	0.2749	0.1584	0.0850	0.0196	0.0032	0.0003	0.0000	0.0000	0.0000	0.0000
	2	0.8891	0.5583	0.3907	0.2528	0.0834	0.0193	0.0028	0.0002	0.0000	0.0000	0.0000
	3	0.9744	0.7946	0.6488	0.4925	0.2253	0.0730	0.0153	0.0017	0.0004	0.0001	0.0000
	4	0.9957	0.9274	0.8424	0.7237	0.4382	0.1938	0.0573	0.0095	0.0028	0.0006	0.0000
	5	0.9995	0.9806	0.9456	0.8822	0.6652	0.3872	0.1582	0.0386	0.0143	0.0039	0.0001
	6	0.9999	0.9961	0.9857	0.9614	0.8418	0.6128	0.3348	0.1178	0.0544	0.0194	0.0005
	7	1.0000	0.9994	0.9972	0.9905	0.9427	0.8062	0.5618	0.2763	0.1576	0.0726	0.0043
	8	1.0000	0.9999	0.9996	0.9983	0.9847	0.9270	0.7747	0.5075	0.3512	0.2054	0.0256
	9	1.0000	1.0000	1.0000	0.9998	0.9972	0.9807	0.9166	0.7472	0.6093	0.4417	0.1109
	10	1.0000	1.0000	1.0000	1.0000	0.9997	0.9968	0.9804	0.9150	0.8416	0.7251	0.3410
	11	1.0000	1.0000	1.0000	1.0000	1.0000	0.9998	0.9978	0.9862	0.9683	0.9313	0.7176
	12	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
13	0	0.2542	0.0550	0.0238	0.0097	0.0013	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
	1	0.6213	0.2336	0.1267	0.0637	0.0126	0.0017	0.0001	0.0000	0.0000	0.0000	0.0000
	2	0.8661	0.5017	0.3326	0.2025	0.0579	0.0112	0.0013	0.0001	0.0000	0.0000	0.0000
	3	0.9658	0.7473	0.5843	0.4206	0.1686	0.0461	0.0078	0.0007	0.0001	0.0000	0.0000
	4	0.9935	0.9009	0.7940	0.6543	0.3530	0.1334	0.0321	0.0040	0.0010	0.0002	0.0000
	5	0.9991	0.9700	0.9198	0.8346	0.5744	0.2905	0.0977	0.0182	0.0056	0.0012	0.0000
	6	0.9999	0.9930	0.9757	0.9376	0.7712	0.5000	0.2288	0.0624	0.0243	0.0070	0.0001
	7	1.0000	0.9988	0.9944	0.9818	0.9023	0.7095	0.4256	0.1654	0.0802	0.0300	0.0009
	8	1.0000	0.9998	0.9990	0.9960	0.9679	0.8666	0.6470	0.3457	0.2060	0.0991	0.0065
	9	1.0000	1.0000	0.9999	0.9993	0.9922	0.9539	0.8314	0.5794	0.4157	0.2527	0.0342
	10	1.0000	1.0000	1.0000	0.9999	0.9987	0.9888	0.9421	0.7975	0.6674	0.4983	0.1339
	11	1.0000	1.0000	1.0000	1.0000	0.9999	0.9983	0.9874	0.9363	0.8733	0.7664	0.3787
	12	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9987	0.9903	0.9762	0.9450	0.7458
	13	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

		p										
n	***d***	**0.1**	**0.2**	**0.25**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.75**	**0.8**	**0.9**
14	0	0.2288	0.0440	0.0178	0.0068	0.0008	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
	1	0.5846	0.1979	0.1010	0.0475	0.0081	0.0009	0.0001	0.0000	0.0000	0.0000	0.0000
	2	0.8416	0.4481	0.2811	0.1608	0.0398	0.0065	0.0006	0.0000	0.0000	0.0000	0.0000
	3	0.9559	0.6982	0.5213	0.3552	0.1243	0.0287	0.0039	0.0002	0.0000	0.0000	0.0000
	4	0.9908	0.8702	0.7415	0.5842	0.2793	0.0898	0.0175	0.0017	0.0003	0.0000	0.0000
	5	0.9985	0.9561	0.8883	0.7805	0.4859	0.2120	0.0583	0.0083	0.0022	0.0004	0.0000
	6	0.9998	0.9884	0.9617	0.9067	0.6925	0.3953	0.1501	0.0315	0.0103	0.0024	0.0000
	7	1.0000	0.9976	0.9897	0.9685	0.8499	0.6047	0.3075	0.0933	0.0383	0.0116	0.0002
	8	1.0000	0.9996	0.9978	0.9917	0.9417	0.7880	0.5141	0.2195	0.1117	0.0439	0.0015
	9	1.0000	1.0000	0.9997	0.9983	0.9825	0.9102	0.7207	0.4158	0.2585	0.1298	0.0092
	10	1.0000	1.0000	1.0000	0.9998	0.9961	0.9713	0.8757	0.6448	0.4787	0.3018	0.0441
	11	1.0000	1.0000	1.0000	1.0000	0.9994	0.9935	0.9602	0.8392	0.7189	0.5519	0.1584
	12	1.0000	1.0000	1.0000	1.0000	0.9999	0.9991	0.9919	0.9525	0.8990	0.8021	0.4154
	13	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9992	0.9932	0.9822	0.9560	0.7712
	14	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
15	0	0.2059	0.0352	0.0134	0.0047	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	1	0.5490	0.1671	0.0802	0.0353	0.0052	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000
	2	0.8159	0.3980	0.2361	0.1268	0.0271	0.0037	0.0003	0.0000	0.0000	0.0000	0.0000
	3	0.9444	0.6482	0.4613	0.2969	0.0905	0.0176	0.0019	0.0001	0.0000	0.0000	0.0000
	4	0.9873	0.8358	0.6865	0.5155	0.2173	0.0592	0.0093	0.0007	0.0001	0.0000	0.0000
	5	0.9978	0.9389	0.8516	0.7216	0.4032	0.1509	0.0338	0.0037	0.0008	0.0001	0.0000
	6	0.9997	0.9819	0.9434	0.8689	0.6098	0.3036	0.0950	0.0152	0.0042	0.0008	0.0000
	7	1.0000	0.9958	0.9827	0.9500	0.7869	0.5000	0.2131	0.0500	0.0173	0.0042	0.0000
	8	1.0000	0.9992	0.9958	0.9848	0.9050	0.6964	0.3902	0.1311	0.0566	0.0181	0.0003
	9	1.0000	0.9999	0.9992	0.9963	0.9662	0.8491	0.5968	0.2784	0.1484	0.0611	0.0022
	10	1.0000	1.0000	0.9999	0.9993	0.9907	0.9408	0.7827	0.4845	0.3135	0.1642	0.0127
	11	1.0000	1.0000	1.0000	0.9999	0.9981	0.9824	0.9095	0.8392	0.7189	0.5519	0.1584
	12	1.0000	1.0000	1.0000	1.0000	0.9999	0.9991	0.9919	0.9525	0.8990	0.8021	0.4154
	13	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9992	0.9932	0.9822	0.9560	0.7712
	14	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9995	0.9953	0.9866	0.9648	0.7941
	15	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
16	0	0.1853	0.0281	0.0100	0.0033	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	1	0.5147	0.1407	0.0635	0.0261	0.0033	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000
	2	0.7892	0.3518	0.1971	0.0994	0.0183	0.0021	0.0001	0.0000	0.0000	0.0000	0.0000
	3	0.9316	0.5981	0.4050	0.2459	0.0651	0.0106	0.0009	0.0000	0.0000	0.0000	0.0000
	4	0.9830	0.7982	0.6302	0.4499	0.1666	0.0384	0.0049	0.0003	0.0000	0.0000	0.0000
	5	0.9967	0.9183	0.8103	0.6598	0.3288	0.1051	0.0191	0.0016	0.0003	0.0000	0.0000
	6	0.9995	0.9733	0.9204	0.8247	0.5272	0.2272	0.0583	0.0071	0.0016	0.0002	0.0000
	7	0.9999	0.9930	0.9729	0.9256	0.7161	0.4018	0.1423	0.0257	0.0075	0.0015	0.0000
	8	1.0000	0.9985	0.9925	0.9743	0.8577	0.5982	0.2839	0.0744	0.0271	0.0070	0.0001
	9	1.0000	0.9998	0.9984	0.9929	0.9417	0.7728	0.4728	0.1753	0.0796	0.0267	0.0005
	10	1.0000	1.0000	0.9997	0.9984	0.9809	0.8949	0.6712	0.3402	0.1897	0.0817	0.0033
	11	1.0000	1.0000	1.0000	0.9997	0.9951	0.9616	0.8334	0.5501	0.3698	0.2018	0.0170
	12	1.0000	1.0000	1.0000	1.0000	0.9991	0.9894	0.9349	0.7541	0.5950	0.4019	0.0684
	13	1.0000	1.0000	1.0000	1.0000	0.9999	0.9979	0.9817	0.9006	0.8029	0.6482	0.2108
	14	1.0000	1.0000	1.0000	1.0000	1.0000	0.9997	0.9967	0.9739	0.9365	0.8593	0.4853
	15	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9997	0.9967	0.9900	0.9719	0.8147
	16	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

APPENDIX C: Tables of Distributions and Critical Values

		p										
n	***d***	**0.1**	**0.2**	**0.25**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.75**	**0.8**	**0.9**
17	0	0.1668	0.0225	0.0075	0.0023	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	1	0.4818	0.1182	0.0501	0.0193	0.0021	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
	2	0.7618	0.3096	0.1637	0.0774	0.0123	0.0012	0.0001	0.0000	0.0000	0.0000	0.0000
	3	0.9174	0.5489	0.3530	0.2019	0.0464	0.0064	0.0005	0.0000	0.0000	0.0000	0.0000
	4	0.9779	0.7582	0.5739	0.3887	0.1260	0.0245	0.0025	0.0001	0.0000	0.0000	0.0000
	5	0.9953	0.8943	0.7653	0.5968	0.2639	0.0717	0.0106	0.0007	0.0001	0.0000	0.0000
	6	0.9992	0.9623	0.8929	0.7752	0.4478	0.1662	0.0348	0.0032	0.0006	0.0001	0.0000
	7	0.9999	0.9891	0.9598	0.8954	0.6405	0.3145	0.0919	0.0127	0.0031	0.0005	0.0000
	o	1.0000	0.9974	0.9876	0.9597	0.8011	0.5000	0.1989	0.0403	0.0124	0.0026	0.0000
	9	1.0000	0.9995	0.9969	0.9873	0.9081	0.6855	0.3595	0.1046	0.0402	0.0109	0.0001
	10	1.0000	0.9999	0.9994	0.9968	0.9652	0.8338	0.5522	0.2248	0.1071	0.0377	0.0008
	11	1.0000	1.0000	0.9999	0.9993	0.9894	0.9283	0.7361	0.4032	0.2347	0.1057	0.0047
	12	1.0000	1.0000	1.0000	0.9999	0.9975	0.9755	0.8740	0.6113	0.4261	0.2418	0.0221
	13	1.0000	1.0000	1.0000	1.0000	0.9995	0.9936	0.9536	0.7981	0.6470	0.4511	0.0826
	14	1.0000	1.0000	1.0000	1.0000	0.9999	0.9988	0.9877	0.9226	0.8363	0.6904	0.2382
	15	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9979	0.9807	0.9499	0.8818	0.5182
	16	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9998	0.9977	0.9925	0.9775	0.8332
	17	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
18	0	0.1501	0.0180	0.0056	0.0016	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	1	0.4503	0.0991	0.0395	0.0142	0.0013	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
	2	0.7338	0.2713	0.1353	0.0600	0.0082	0.0007	0.0000	0.0000	0.0000	0.0000	0.0000
	3	0.9018	0.5010	0.3057	0.1646	0.0328	0.0038	0.0002	0.0000	0.0000	0.0000	0.0000
	4	0.9718	0.7164	0.5187	0.3327	0.0942	0.0154	0.0013	0.0000	0.0000	0.0000	0.0000
	5	0.9936	0.8671	0.7175	0.5344	0.2088	0.0481	0.0058	0.0003	0.0000	0.0000	0.0000
	6	0.9988	0.9487	0.8610	0.7217	0.3743	0.1189	0.0203	0.0014	0.0002	0.0000	0.0000
	7	0.9998	0.9837	0.9431	0.8593	0.5634	0.2403	0.0576	0.0061	0.0012	0.0002	0.0000
	8	1.0000	0.9957	0.9807	0.9404	0.7368	0.4073	0.1347	0.0210	0.0054	0.0009	0.0000
	9	1.0000	0.9991	0.9946	0.9790	0.8653	0.5927	0.2632	0.0596	0.0193	0.0043	0.0000
	10	1.0000	0.9998	0.9988	0.9939	0.9424	0.7597	0.4366	0.1407	0.0569	0.0163	0.0002
	11	1.0000	1.0000	0.9998	0.9986	0.9797	0.8811	0.6257	0.2783	0.1390	0.0513	0.0012
	12	1.0000	1.0000	1.0000	0.9997	0.9942	0.9519	0.7912	0.4656	0.2825	0.1329	0.0064
	13	1.0000	1.0000	1.0000	1.0000	0.9987	0.9846	0.9058	0.6673	0.4813	0.2836	0.0282
	14	1.0000	1.0000	1.0000	1.0000	0.9998	0.9962	0.9672	0.8354	0.6943	0.4990	0.0982
	15	1.0000	1.0000	1.0000	1.0000	1.0000	0.9993	0.9918	0.9400	0.8647	0.7287	0.2662
	16	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9987	0.9858	0.9605	0.9009	0.5497
	17	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9984	0.9944	0.9820	0.8499
	18	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

		p										
n	***d***	**0.1**	**0.2**	**0.25**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.75**	**0.8**	**0.9**
19	0	0.1351	0.0144	0.0042	0.0011	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	1	0.4203	0.0829	0.0310	0.0104	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	2	0.7054	0.2369	0.1113	0.0462	0.0055	0.0004	0.0000	0.0000	0.0000	0.0000	0.0000
	3	0.8850	0.4551	0.2631	0.1332	0.0230	0.0022	0.0001	0.0000	0.0000	0.0000	0.0000
	4	0.9648	0.6733	0.4654	0.2822	0.0696	0.0096	0.0006	0.0000	0.0000	0.0000	0.0000
	5	0.9914	0.8369	0.6678	0.4739	0.1629	0.0318	0.0031	0.0001	0.0000	0.0000	0.0000
	6	0.9983	0.9324	0.8251	0.6655	0.3081	0.0835	0.0116	0.0006	0.0001	0.0000	0.0000
	7	0.9997	0.9767	0.9225	0.8180	0.4878	0.1796	0.0352	0.0028	0.0005	0.0000	0.0000
	8	1.0000	0.9933	0.9713	0.9161	0.6675	0.3238	0.0885	0.0105	0.0023	0.0003	0.0000
	9	1.0000	0.9984	0.9911	0.9674	0.8139	0.5000	0.1861	0.0326	0.0089	0.0016	0.0000
	10	1.0000	0.9997	0.9977	0.9895	0.9115	0.6762	0.3325	0.0839	0.0287	0.0067	0.0000
	11	1.0000	1.0000	0.9995	0.9972	0.9648	0.8204	0.5122	0.1820	0.0775	0.0233	0.0003
	12	1.0000	1.0000	0.9999	0.9994	0.9884	0.9165	0.6919	0.3345	0.1749	0.0676	0.0017
	13	1.0000	1.0000	1.0000	0.9999	0.9969	0.9682	0.8371	0.5261	0.3322	0.1631	0.0086
	14	1.0000	1.0000	1.0000	1.0000	0.9994	0.9904	0.9304	0.7178	0.5346	0.3267	0.0352
	15	1.0000	1.0000	1.0000	1.0000	0.9999	0.9978	0.9770	0.8668	0.7369	0.5449	0.1150
	16	1.0000	1.0000	1.0000	1.0000	1.0000	0.9996	0.9945	0.9538	0.8887	0.7631	0.2946
	17	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9992	0.9896	0.9690	0.9171	0.5797
	18	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9989	0.9958	0.9856	0.8649
	19	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
20	0	0.1216	0.0115	0.0032	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	1	0.3917	0.0692	0.0243	0.0076	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	2	0.6769	0.2061	0.0913	0.0355	0.0036	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000
	3	0.8670	0.4114	0.2252	0.1071	0.0160	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000
	4	0.9568	0.6296	0.4148	0.2375	0.0510	0.0059	0.0003	0.0000	0.0000	0.0000	0.0000
	5	0.9887	0.8042	0.6172	0.4164	0.1256	0.0207	0.0016	0.0000	0.0000	0.0000	0.0000
	6	0.9976	0.9133	0.7858	0.6080	0.2500	0.0577	0.0065	0.0003	0.0000	0.0000	0.0000
	7	0.9996	0.9679	0.8982	0.7723	0.4159	0.1316	0.0210	0.0013	0.0002	0.0000	0.0000
	8	0.9999	0.9900	0.9591	0.8867	0.5956	0.2517	0.0565	0.0051	0.0009	0.0001	0.0000
	9	1.0000	0.9974	0.9861	0.9520	0.7553	0.4119	0.1275	0.0171	0.0039	0.0006	0.0000
	10	1.0000	0.9994	0.9961	0.9829	0.8725	0.5881	0.2447	0.0480	0.0139	0.0026	0.0000
	11	1.0000	0.9999	0.9991	0.9949	0.9435	0.7483	0.4044	0.1133	0.0409	0.0100	0.0001
	12	1.0000	1.0000	0.9998	0.9987	0.9790	0.8684	0.5841	0.2277	0.1018	0.0321	0.0004
	13	1.0000	1.0000	1.0000	0.9997	0.9935	0.9423	0.7500	0.3920	0.2142	0.0867	0.0024
	14	1.0000	1.0000	1.0000	1.0000	0.9984	0.9793	0.8744	0.5836	0.3828	0.1958	0.0113
	15	1.0000	1.0000	1.0000	1.0000	0.9997	0.9941	0.9490	0.7625	0.5852	0.3704	0.0432
	16	1.0000	1.0000	1.0000	1.0000	1.0000	0.9987	0.9840	0.8929	0.7748	0.5886	0.1330
	17	1.0000	1.0000	1.0000	1.0000	1.0000	0.9998	0.9964	0.9645	0.9087	0.7939	0.3231
	18	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9995	0.9924	0.9757	0.9308	0.6083
	19	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9992	0.9968	0.9885	0.8784
	20	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

APPENDIX C: Tables of Distributions and Critical Values

TABLE C.2
Cumulative Poisson distribution

$$F(t) = P(X \leq t) = \sum_{x=0}^{t} \frac{e^{-\mu}\mu^x}{x!}$$

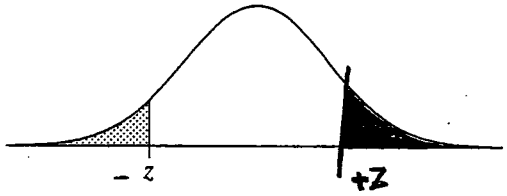
	μ									
t	0.5	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0
0	0.6065	0.3679	0.1353	0.0498	0.0183	0.0067	0.0025	0.0009	0.0003	0.0001
1	0.9098	0.7358	0.4060	0.1991	0.0916	0.0404	0.0174	0.0073	0.0030	0.0012
2	0.9856	0.9197	0.6767	0.4232	0.2381	0.1247	0.0620	0.0296	0.0138	0.0062
3	0.9982	0.9810	0.8571	0.6472	0.4335	0.2650	0.1512	0.0818	0.0424	0.0212
4	0.9998	0.9963	0.9473	0.8153	0.6288	0.4405	0.2851	0.1730	0.0996	0.0550
5	1.0000	0.9994	0.9834	0.9161	0.7851	0.6160	0.4457	0.3007	0.1912	0.1157
6	1.0000	0.9999	0.9955	0.9665	0.8893	0.7622	0.6063	0.4497	0.3134	0.2068
7	1.0000	1.0000	0.9989	0.9881	0.9489	0.8666	0.7440	0.5987	0.4530	0.3239
8	1.0000	1.0000	0.9998	0.9962	0.9786	0.9319	0.8472	0.7291	0.5925	0.4557
9	1.0000	1.0000	1.0000	0.9989	0.9919	0.9682	0.9161	0.8305	0.7166	0.5874
10	1.0000	1.0000	1.0000	0.9997	0.9972	0.9863	0.9574	0.9015	0.8159	0.7060
11	1.0000	1.0000	1.0000	0.9999	0.9991	0.9945	0.9799	0.9467	0.8881	0.8030
12	1.0000	1.0000	1.0000	1.0000	0.9997	0.9980	0.9912	0.9730	0.9362	0.8758
13	1.0000	1.0000	1.0000	1.0000	0.9999	0.9993	0.9964	0.9872	0.9658	0.9261
14	1.0000	1.0000	1.0000	1.0000	1.0000	0.9998	0.9986	0.9943	0.9827	0.9585
15	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9995	0.9976	0.9918	0.9780
16	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9998	0.9990	0.9963	0.9889
17	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9996	0.9984	0.9947
18	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9993	0.9976
19	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9997	0.9989
20	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9996

APPENDIX C: Tables of Distributions and Critical Values

	μ					
t	10	11	12	13	14	15
0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1	0.0005	0.0002	0.0001	0.0000	0.0000	0.0000
2	0.0028	0.0012	0.0005	0.0002	0.0001	0.0000
3	0.0103	0.0049	0.0023	0.0011	0.0005	0.0002
4	0.0293	0.0151	0.0076	0.0037	0.0018	0.0009
5	0.0671	0.0375	0.0203	0.0107	0.0055	0.0028
6	0.1301	0.0786	0.0458	0.0259	0.0142	0.0076
7	0.2202	0.1432	0.0895	0.0540	0.0316	0.0180
8	0.3328	0.2320	0.1550	0.0998	0.0621	0.0374
9	0.4579	0.3405	0.2424	0.1658	0.1094	0.0699
10	0.5830	0.4599	0.3472	0.2517	0.1757	0.1185
11	0.6968	0.5793	0.4616	0.3532	0.2600	0.1848
12	0.7916	0.6887	0.5760	0.4631	0.3585	0.2676
13	0.8645	0.7813	0.6815	0.5730	0.4644	0.3632
14	0.9165	0.8540	0.7720	0.6751	0.5704	0.4657
15	0.9513	0.9074	0.8444	0.7636	0.6694	0.5681
16	0.9730	0.9441	0.8987	0.8355	0.7559	0.6641
17	0.9857	0.9678	0.9370	0.8905	0.8272	0.7489
18	0.9928	0.9823	0.9626	0.9302	0.8826	0.8195
19	0.9965	0.9907	0.9787	0.9573	0.9235	0.8752
20	0.9984	0.9953	0.9884	0.9750	0.9521	0.9170
21	0.9993	0.9977	0.9939	0.9859	0.9712	0.9469
22	0.9997	0.9990	0.9970	0.9924	0.9833	0.9673
23	0.9999	0.9995	0.9985	0.9960	0.9907	0.9805
24	1.0000	0.9998	0.9993	0.9980	0.9950	0.9888
25	1.0000	0.9999	0.9997	0.9990	0.9974	0.9938
26	1.0000	1.0000	0.9999	0.9995	0.9987	0.9967
27	1.0000	1.0000	0.9999	0.9998	0.9994	0.9983
28	1.0000	1.0000	1.0000	0.9999	0.9997	0.9991
29	1.0000	1.0000	1.0000	1.0000	0.9999	0.9996

TABLE C.3
Cumulative standard normal distribution

$$F(z) = P(Z \leq z) = \int_{-\infty}^{z} \frac{1}{\sqrt{2\pi}} e^{x^2/2}\, dx$$



	Area									
z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
−3.9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
−3.8	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
−3.7	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
−3.6	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
−3.5	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
−3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
−3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
−3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
−3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
−3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
−2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
−2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
−2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
−2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
−2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
−2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
−2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
−2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
−2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
−2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
−1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
−1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
−1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
−1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
−1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
−1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
−1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
−1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
−1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
−1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
−0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
−0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
−0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
−0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
−0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
−0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
−0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
−0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
−0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
−0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641

APPENDIX C: Tables of Distributions and Critical Values

	Area									
z	**0.00**	**0.01**	**0.02**	**0.03**	**0.04**	**0.05**	**0.06**	**0.07**	**0.08**	**0.09**
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998
3.5	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998
3.6	0.9998	0.9998	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.7	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.8	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.9	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

TABLE C.4
Student's *t* distribution

1-tail / 2-tail	0.25 / 0.50	0.10 / 0.20	0.05 / 0.10	0.025 / 0.05	0.01 / 0.02	0.005 / 0.010	0.0025 / 0.005	0.001 / 0.002	0.0005 / 0.001	1-tail / 2-tail
df: 1	1.000	3.078	6.314	12.71	31.82	63.66	127.3	636.6	1273	df: 1
2	0.816	1.886	2.920	4.303	6.965	9.925	14.09	31.60	44.70	2
3	0.765	1.638	2.353	3.182	4.541	5.841	7.453	12.92	16.33	3
4	0.741	1.533	2.132	2.776	3.747	4.604	5.598	8.610	10.31	4
5	0.727	1.476	2.015	2.571	3.365	4.032	4.773	6.869	7.976	5
6	0.718	1.440	1.943	2.447	3.143	3.707	4.317	5.959	6.788	6
7	0.711	1.415	1.895	2.365	2.998	3.499	4.029	5.408	6.082	7
8	0.706	1.397	1.860	2.306	2.896	3.355	3.833	5.041	5.617	8
9	0.703	1.383	1.833	2.262	2.821	3.250	3.690	4.781	5.291	9
10	0.700	1.372	1.812	2.228	2.764	3.169	3.581	4.587	5.049	10
11	0.697	1.363	1.796	2.201	2.718	3.106	3.497	4.437	4.863	11
12	0.695	1.356	1.782	2.179	2.681	3.055	3.428	4.318	4.717	12
13	0.694	1.350	1.771	2.160	2.650	3.012	3.372	4.221	4.597	13
14	0.692	1.345	1.761	2.145	2.624	2.977	3.326	4.140	4.499	14
15	0.691	1.341	1.753	2.131	2.602	2.947	3.286	4.073	4.417	15
16	0.690	1.337	1.746	2.120	2.583	2.921	3.252	4.015	4.346	16
17	0.689	1.333	1.740	2.110	2.567	2.898	3.222	3.965	4.286	17
18	0.688	1.330	1.734	2.101	2.552	2.878	3.197	3.922	4.233	18
19	0.688	1.328	1.729	2.093	2.539	2.861	3.174	3.883	4.187	19
20	0.687	1.325	1.725	2.086	2.528	2.845	3.153	3.850	4.146	20
21	0.686	1.323	1.721	2.080	2.518	2.831	3.135	3.819	4.109	21
22	0.686	1.321	1.717	2.074	2.508	2.819	3.119	3.792	4.077	22
23	0.685	1.319	1.714	2.069	2.500	2.807	3.104	3.768	4.047	23
24	0.685	1.318	1.711	2.064	2.492	2.797	3.091	3.745	4.021	24
25	0.684	1.316	1.708	2.060	2.485	2.787	3.078	3.725	3.997	25
26	0.684	1.315	1.706	2.056	2.479	2.779	3.067	3.707	3.974	26
27	0.684	1.314	1.703	2.052	2.473	2.771	3.057	3.689	3.954	27
28	0.683	1.313	1.701	2.048	2.467	2.763	3.047	3.674	3.935	28
29	0.683	1.311	1.699	2.045	2.462	2.756	3.038	3.660	3.918	29
30	0.683	1.310	1.697	2.042	2.457	2.750	3.030	3.646	3.902	30
31	0.682	1.309	1.696	2.040	2.453	2.744	3.022	3.633	3.887	31
32	0.682	1.309	1.694	2.037	2.449	2.738	3.015	3.622	3.873	32
33	0.682	1.308	1.692	2.035	2.445	2.733	3.008	3.611	3.860	33
34	0.682	1.307	1.691	2.032	2.441	2.728	3.002	3.601	3.848	34
35	0.682	1.306	1.690	2.030	2.438	2.724	2.996	3.591	3.836	35
36	0.681	1.306	1.688	2.028	2.434	2.719	2.990	3.582	3.825	36
37	0.681	1.305	1.687	2.026	2.431	2.715	2.985	3.574	3.816	37
38	0.681	1.304	1.686	2.024	2.429	2.712	2.980	3.566	3.806	38
39	0.681	1.304	1.685	2.023	2.426	2.708	2.976	3.558	3.797	39
40	0.681	1.303	1.684	2.021	2.423	2.704	2.971	3.551	3.788	40
41	0.681	1.303	1.683	2.020	2.421	2.701	2.967	3.544	3.780	41
42	0.680	1.302	1.682	2.018	2.418	2.698	2.963	3.538	3.773	42
43	0.680	1.302	1.681	2.017	2.416	2.695	2.959	3.532	3.765	43
44	0.680	1.301	1.680	2.015	2.414	2.692	2.956	3.526	3.758	44
45	0.680	1.301	1.679	2.014	2.412	2.690	2.952	3.520	3.752	45

APPENDIX C: Tables of Distributions and Critical Values

1-tail 2-tail	0.25 0.50	0.10 0.20	0.05 0.10	0.025 0.05	0.01 0.02	0.005 0.010	0.0025 0.005	0.001 0.002	0.0005 0.001	1-tail 2-tail
df: 46	0.680	1.300	1.679	2.013	2.410	2.687	2.949	3.515	3.746	df: 46
47	0.680	1.300	1.678	2.012	2.408	2.685	2.946	3.510	3.740	47
48	0.680	1.299	1.677	2.011	2.407	2.682	2.943	3.505	3.734	48
49	0.680	1.299	1.677	2.010	2.405	2.680	2.940	3.500	3.728	49
50	0.679	1.299	1.676	2.009	2.403	2.678	2.937	3.496	3.723	50
51	0.679	1.298	1.675	2.008	2.402	2.676	2.934	3.492	3.718	51
52	0.679	1.298	1.675	2.007	2.400	2.674	2.932	3.488	3.713	52
53	0.679	1.298	1.674	2.006	2.399	2.672	2.929	3.484	3.709	53
54	0.679	1.297	1.674	2.005	2.397	2.670	2.927	3.480	3.704	54
55	0.679	1.297	1.673	2.004	2.396	2.668	2.925	3.476	3.700	55
56	0.679	1.297	1.673	2.003	2.395	2.667	2.923	3.473	3.696	56
57	0.679	1.297	1.672	2.002	2.394	2.665	2.920	3.469	3.692	57
58	0.679	1.296	1.672	2.002	2.392	2.663	2.918	3.466	3.688	58
59	0.679	1.296	1.671	2.001	2.391	2.662	2.916	3.463	3.684	59
60	0.679	1.296	1.671	2.000	2.390	2.660	2.915	3.460	3.681	60
61	0.679	1.296	1.670	2.000	2.389	2.659	2.913	3.457	3.677	61
62	0.678	1.295	1.670	1.999	2.388	2.657	2.911	3.454	3.674	62
63	0.678	1.295	1.669	1.998	2.387	2.656	2.909	3.452	3.671	63
64	0.678	1.295	1.669	1.998	2.386	2.655	2.908	3.449	3.668	64
65	0.678	1.295	1.669	1.997	2.385	2.654	2.906	3.447	3.665	65
66	0.678	1.295	1.668	1.997	2.384	2.652	2.904	3.444	3.662	66
67	0.678	1.294	1.668	1.996	2.383	2.651	2.903	3.442	3.659	67
68	0.678	1.294	1.668	1.995	2.382	2.650	2.902	3.439	3.656	68
69	0.678	1.294	1.667	1.995	2.382	2.649	2.900	3.437	3.653	69
70	0.678	1.294	1.667	1.994	2.381	2.648	2.899	3.435	3.651	70
71	0.678	1.294	1.667	1.994	2.380	2.647	2.897	3.433	3.648	71
72	0.678	1.293	1.666	1.993	2.379	2.646	2.896	3.431	3.646	72
73	0.678	1.293	1.666	1.993	2.379	2.645	2.895	3.429	3.644	73
74	0.678	1.293	1.666	1.993	2.378	2.644	2.894	3.427	3.641	74
75	0.678	1.293	1.665	1.992	2.377	2.643	2.892	3.425	3.639	75
76	0.678	1.293	1.665	1.992	2.376	2.642	2.891	3.423	3.637	76
77	0.678	1.293	1.665	1.991	2.376	2.641	2.890	3.421	3.635	77
78	0.678	1.292	1.665	1.991	2.375	2.640	2.889	3.420	3.633	78
79	0.678	1.292	1.664	1.990	2.374	2.639	2.888	3.418	3.631	79
80	0.678	1.292	1.664	1.990	2.374	2.639	2.887	3.416	3.629	80
81	0.678	1.292	1.664	1.990	2.373	2.638	2.886	3.415	3.627	81
82	0.677	1.292	1.664	1.989	2.373	2.637	2.885	3.413	3.625	82
83	0.677	1.292	1.663	1.989	2.372	2.636	2.884	3.412	3.623	83
84	0.677	1.292	1.663	1.989	2.372	2.636	2.883	3.410	3.622	84
85	0.677	1.292	1.663	1.988	2.371	2.635	2.882	3.409	3.620	85
86	0.677	1.291	1.663	1.988	2.370	2.634	2.881	3.407	3.618	86
90	0.677	1.291	1.662	1.987	2.368	2.632	2.878	3.402	3.612	90
95	0.677	1.291	1.661	1.985	2.366	2.629	2.874	3.396	3.605	95
100	0.677	1.290	1.660	1.984	2.364	2.626	2.871	3.390	3.598	100
∞	0.674	1.282	1.645	1.960	2.326	2.576	2.807	3.090	3.290	∞

APPENDIX C: Tables of Distributions and Critical Values

TABLE C.5
Cumulative chi-square distribution

$$F(\chi^2) = P(\chi^2 \leq X^2)$$

df	0.005	0.01	0.025	0.05	0.10	0.90	0.95	0.975	0.99	0.995
1	0.0000393	0.000157	0.000982	0.00393	0.0158	2.71	3.84	5.02	6.63	7.88
2	0.0100	0.0201	0.0506	0.103	0.211	4.61	5.99	7.38	9.21	10.6
3	0.0717	0.115	0.216	0.352	0.584	6.25	7.81	9.35	11.3	12.8
4	0.207	0.297	0.484	0.711	1.06	7.78	9.49	11.1	13.3	14.9
5	0.412	0.554	0.831	1.15	1.61	9.24	11.1	12.8	15.1	16.7
6	0.676	0.872	1.24	1.64	2.20	10.6	12.6	14.4	16.8	18.5
7	0.989	1.24	1.69	2.17	2.83	12.0	14.1	16.0	18.5	20.3
8	1.34	1.65	2.18	2.73	3.49	13.4	15.5	17.5	20.1	22.0
9	1.73	2.09	2.70	3.33	4.17	14.7	16.9	19.0	21.7	23.6
10	2.16	2.56	3.25	3.94	4.87	16.0	18.3	20.5	23.2	25.2
11	2.60	3.05	3.82	4.57	5.58	17.3	19.7	21.9	24.7	26.8
12	3.07	3.57	4.40	5.23	6.30	18.5	21.0	23.3	26.2	28.3
13	3.57	4.11	5.01	5.89	7.04	19.8	22.4	24.7	27.7	29.8
14	4.07	4.66	5.63	6.57	7.79	21.1	23.7	26.1	29.1	31.3
15	4.60	5.23	6.26	7.26	8.55	22.3	25.0	27.5	30.6	32.8
16	5.14	5.81	6.91	7.96	9.31	23.5	26.3	28.8	32.0	34.3
17	5.70	6.41	7.56	8.67	10.1	24.8	27.6	30.2	33.4	35.7
18	6.26	7.01	8.23	9.39	10.9	26.0	28.9	31.5	34.8	37.2
19	6.84	7.63	8.91	10.1	11.7	27.2	30.1	32.9	36.2	38.6
20	7.43	8.26	9.59	10.9	12.4	28.4	31.4	34.2	37.6	40.0
21	8.03	8.90	10.3	11.6	13.2	29.6	32.7	35.5	38.9	41.4
22	8.64	9.54	11.0	12.3	14.0	30.8	33.9	36.8	40.3	42.8
23	9.26	10.2	11.7	13.1	14.8	32.0	35.2	38.1	41.6	44.2
24	9.89	10.9	12.4	13.8	15.7	33.2	36.4	39.4	43.0	45.6
25	10.5	11.5	13.1	14.6	16.5	34.4	37.7	40.6	44.3	46.9
26	11.2	12.2	13.8	15.4	17.3	35.6	38.9	41.9	45.6	48.3
27	11.8	12.9	14.6	16.2	18.1	36.7	40.1	43.2	47.0	49.6
28	12.5	13.6	15.3	16.9	18.9	37.9	41.3	44.5	48.3	51.0
29	13.1	14.3	16.0	17.7	19.8	39.1	42.6	45.7	49.6	52.3
30	13.8	15.0	16.8	18.5	20.6	40.3	43.8	47.0	50.9	53.7
31	14.5	15.7	17.5	19.3	21.4	41.4	45.0	48.2	52.2	55.0
32	15.1	16.4	18.3	20.1	22.3	42.6	46.2	49.5	53.5	56.3
33	15.8	17.1	19.0	20.9	23.1	43.7	47.4	50.7	54.8	57.6
34	16.5	17.8	19.8	21.7	24.0	44.9	48.6	52.0	56.1	59.0
35	17.2	18.5	20.6	22.5	24.8	46.1	49.8	53.2	57.3	60.3
36	17.9	19.2	21.3	23.3	25.6	47.2	51.0	54.4	58.6	61.6
37	18.6	20.0	22.1	24.1	26.5	48.4	52.2	55.7	59.9	62.9
38	19.3	20.7	22.9	24.9	27.3	49.5	53.4	56.9	61.2	64.2
39	20.0	21.4	23.7	25.7	28.2	50.7	54.6	58.1	62.4	65.5
40	20.7	22.2	24.4	26.5	29.1	51.8	55.8	59.3	63.7	66.8

TABLE C.6
Wilcoxon signed-rank test cumulative distribution

$F(w) = P(W \leq w)$

	n										
w	5	6	7	8	9	10	11	12	13	14	15
0	0.0313	0.0156	0.0078	0.0039	0.0020	0.0010	0.0005	0.0002	0.0001	0.0001	0.0000
1	0.0625	0.0313	0.0156	0.0078	0.0039	0.0020	0.0010	0.0005	0.0002	0.0001	0.0001
2	0.0938	0.0469	0.0234	0.0117	0.0059	0.0029	0.0015	0.0007	0.0004	0.0002	0.0001
3	0.1563	0.0781	0.0391	0.0195	0.0098	0.0049	0.0024	0.0012	0.0006	0.0003	0.0002
4	0.2188	0.1094	0.0547	0.0273	0.0137	0.0068	0.0034	0.0017	0.0009	0.0004	0.0002
5	0.3125	0.1563	0.0781	0.0391	0.0195	0.0098	0.0049	0.0024	0.0012	0.0006	0.0003
6	0.4063	0.2188	0.1094	0.0547	0.0273	0.0137	0.0068	0.0034	0.0017	0.0009	0.0004
7	0.5000	0.2813	0.1484	0.0742	0.0371	0.0186	0.0093	0.0046	0.0023	0.0012	0.0006
8	0.5938	0.3438	0.1875	0.0977	0.0488	0.0244	0.0122	0.0061	0.0031	0.0015	0.0008
9	0.6875	0.4219	0.2344	0.1250	0.0645	0.0322	0.0161	0.0081	0.0040	0.0020	0.0010
10	0.7813	0.5000	0.2891	0.1563	0.0820	0.0420	0.0210	0.0105	0.0052	0.0026	0.0013
11	0.8438	0.5781	0.3438	0.1914	0.1016	0.0527	0.0269	0.0134	0.0067	0.0034	0.0017
12	0.9063	0.6563	0.4063	0.2305	0.1250	0.0654	0.0337	0.0171	0.0085	0.0043	0.0021
13	0.9375	0.7188	0.4688	0.2734	0.1504	0.0801	0.0415	0.0212	0.0107	0.0054	0.0027
14	0.9688	0.7813	0.5313	0.3203	0.1797	0.0967	0.0508	0.0261	0.0133	0.0067	0.0034
15	1.0000	0.8438	0.5938	0.3711	0.2129	0.1162	0.0615	0.0320	0.0164	0.0083	0.0042
16		0.8906	0.6563	0.4219	0.2480	0.1377	0.0737	0.0386	0.0199	0.0101	0.0051
17		0.9219	0.7109	0.4727	0.2852	0.1611	0.0874	0.0461	0.0239	0.0123	0.0062
18		0.9531	0.7656	0.5273	0.3262	0.1875	0.1030	0.0549	0.0287	0.0148	0.0075
19		0.9688	0.8125	0.5781	0.3672	0.2158	0.1201	0.0647	0.0341	0.0176	0.0090
20		0.9844	0.8516	0.6289	0.4102	0.2461	0.1392	0.0757	0.0402	0.0209	0.0108
21		1.0000	0.8906	0.6797	0.4551	0.2783	0.1602	0.0881	0.0471	0.0247	0.0128
22			0.9219	0.7266	0.5000	0.3125	0.1826	0.1018	0.0549	0.0290	0.0151
23			0.9453	0.7695	0.5449	0.3477	0.2065	0.1167	0.0636	0.0338	0.0177
24			0.9609	0.8086	0.5898	0.3848	0.2324	0.1331	0.0732	0.0392	0.0206
25			0.9766	0.8438	0.6328	0.4229	0.2598	0.1506	0.0839	0.0453	0.0240
26			0.9844	0.8750	0.6738	0.4609	0.2886	0.1697	0.0955	0.0520	0.0277
27			0.9922	0.9023	0.7148	0.5000	0.3188	0.1902	0.1082	0.0594	0.0319
28			1.0000	0.9258	0.7520	0.5391	0.3501	0.2119	0.1219	0.0676	0.0365
29				0.9453	0.7871	0.5771	0.3823	0.2349	0.1367	0.0765	0.0416
30				0.9609	0.8203	0.6152	0.4155	0.2593	0.1527	0.0863	0.0473
31				0.9727	0.8496	0.6523	0.4492	0.2847	0.1698	0.0969	0.0535
32				0.9805	0.8750	0.6875	0.4829	0.3110	0.1879	0.1083	0.0603
33				0.9883	0.8984	0.7217	0.5171	0.3386	0.2072	0.1206	0.0677
34				0.9922	0.9180	0.7539	0.5508	0.3667	0.2274	0.1338	0.0757
35				0.9961	0.9355	0.7842	0.5845	0.3955	0.2487	0.1479	0.0844
36				1.0000	0.9512	0.8125	0.6177	0.4250	0.2709	0.1629	0.0938
37					0.9629	0.8389	0.6499	0.4548	0.2939	0.1788	0.1039
38					0.9727	0.8623	0.6812	0.4849	0.3177	0.1955	0.1147
39					0.9805	0.8838	0.7114	0.5151	0.3424	0.2131	0.1262
40					0.9863	0.9033	0.7402	0.5452	0.3677	0.2316	0.1384
41					0.9902	0.9199	0.7676	0.5750	0.3934	0.2508	0.1514
42					0.9941	0.9346	0.7935	0.6045	0.4197	0.2708	0.1651
43					0.9961	0.9473	0.8174	0.6333	0.4463	0.2915	0.1796
44					0.9980	0.9580	0.8398	0.6614	0.4730	0.3129	0.1947
45					1.0000	0.9678	0.8608	0.6890	0.5000	0.3349	0.2106

APPENDIX C: Tables of Distributions and Critical Values

	n						*n*				
w	16	17	18	19	20	*w*	16	17	18	19	20
0	0.0000	0.0000	0.0000	0.0000	0.0000	50	0.1877	0.1123	0.0649	0.0364	0.0200
1	0.0000	0.0000	0.0000	0.0000	0.0000	51	0.2019	0.1217	0.0708	0.0399	0.0220
2	0.0000	0.0000	0.0000	0.0000	0.0000	52	0.2166	0.1317	0.0770	0.0437	0.0242
3	0.0001	0.0000	0.0000	0.0000	0.0000	53	0.2319	0.1421	0.0837	0.0478	0.0266
4	0.0001	0.0001	0.0000	0.0000	0.0000	54	0.2477	0.1530	0.0907	0.0521	0.0291
5	0.0002	0.0001	0.0000	0.0000	0.0000	55	0.2641	0.1645	0.0982	0.0567	0.0319
6	0.0002	0.0001	0.0001	0.0000	0.0000	56	0.2809	0.1764	0.1061	0.0616	0.0348
7	0.0003	0.0001	0.0001	0.0000	0.0000	57	0.2983	0.1889	0.1144	0.0668	0.0379
8	0.0004	0.0002	0.0001	0.0000	0.0000	58	0.3161	0.2019	0.1231	0.0723	0.0413
9	0.0005	0.0003	0.0001	0.0001	0.0000	59	0.3343	0.2153	0.1323	0.0782	0.0448
10	0.0007	0.0003	0.0002	0.0001	0.0000	60	0.3529	0.2293	0.1419	0.0844	0.0487
11	0.0008	0.0004	0.0002	0.0001	0.0001	61	0.3718	0.2437	0.1519	0.0909	0.0527
12	0.0011	0.0005	0.0003	0.0001	0.0001	62	0.3910	0.2585	0.1624	0.0978	0.0570
13	0.0013	0.0007	0.0003	0.0002	0.0001	63	0.4104	0.2738	0.1733	0.1051	0.0615
14	0.0017	0.0008	0.0004	0.0002	0.0001	64	0.4301	0.2895	0.1846	0.1127	0.0664
15	0.0021	0.0010	0.0005	0.0003	0.0001	65	0.4500	0.3056	0.1964	0.1206	0.0715
16	0.0026	0.0013	0.0006	0.0003	0.0002	66	0.4699	0.3221	0.2086	0.1290	0.0768
17	0.0031	0.0016	0.0008	0.0004	0.0002	67	0.4900	0.3389	0.2211	0.1377	0.0825
18	0.0038	0.0019	0.0010	0.0005	0.0002	68	0.5100	0.3559	0.2341	0.1467	0.0884
19	0.0046	0.0023	0.0012	0.0006	0.0003	69	0.5301	0.3733	0.2475	0.1562	0.0947
20	0.0055	0.0028	0.0014	0.0007	0.0004	70	0.5500	0.3910	0.2613	0.1660	0.1012
21	0.0065	0.0033	0.0017	0.0008	0.0004	71	0.5699	0.4088	0.2754	0.1762	0.1081
22	0.0078	0.0040	0.0020	0.0010	0.0005	72	0.5896	0.4268	0.2899	0.1868	0.1153
23	0.0091	0.0047	0.0024	0.0012	0.0006	73	0.6090	0.4450	0.3047	0.1977	0.1227
24	0.0107	0.0055	0.0028	0.0014	0.0007	74	0.6282	0.4633	0.3198	0.2090	0.1305
25	0.0125	0.0064	0.0033	0.0017	0.0008	75	0.6471	0.4816	0.3353	0.2207	0.1387
26	0.0145	0.0075	0.0038	0.0020	0.0010	76	0.6657	0.5000	0.3509	0.2327	0.1471
27	0.0168	0.0087	0.0045	0.0023	0.0012	77	0.6839	0.5184	0.3669	0.2450	0.1559
28	0.0193	0.0101	0.0052	0.0027	0.0014	78	0.7017	0.5367	0.3830	0.2576	0.1650
29	0.0222	0.0116	0.0060	0.0031	0.0016	79	0.7191	0.5550	0.3994	0.2706	0.1744
30	0.0253	0.0133	0.0069	0.0036	0.0018	80	0.7359	0.5732	0.4159	0.2839	0.1841
31	0.0288	0.0153	0.0080	0.0041	0.0021	81	0.7523	0.5912	0.4325	0.2974	0.1942
32	0.0327	0.0174	0.0091	0.0047	0.0024	82	0.7681	0.6090	0.4493	0.3113	0.2045
33	0.0370	0.0198	0.0104	0.0054	0.0028	83	0.7834	0.6267	0.4661	0.3254	0.2152
34	0.0416	0.0224	0.0118	0.0062	0.0032	84	0.7981	0.6441	0.4831	0.3397	0.2262
35	0.0467	0.0253	0.0134	0.0070	0.0036	85	0.8123	0.6611	0.5000	0.3543	0.2375
36	0.0523	0.0284	0.0152	0.0080	0.0042	86	0.8258	0.6779	0.5169	0.3690	0.2490
37	0.0583	0.0319	0.0171	0.0090	0.0047	87	0.8387	0.6944	0.5339	0.3840	0.2608
38	0.0649	0.0357	0.0192	0.0102	0.0053	88	0.8511	0.7105	0.5507	0.3991	0.2729
39	0.0719	0.0398	0.0216	0.0115	0.0060	89	0.8628	0.7262	0.5675	0.4144	0.2853
40	0.0795	0.0443	0.0241	0.0129	0.0068	90	0.8739	0.7415	0.5841	0.4298	0.2979
41	0.0877	0.0492	0.0269	0.0145	0.0077	91	0.8844	0.7563	0.6006	0.4453	0.3108
42	0.0964	0.0544	0.0300	0.0162	0.0086	92	0.8943	0.7707	0.6170	0.4609	0.3238
43	0.1057	0.0601	0.0333	0.0180	0.0096	93	0.9036	0.7847	0.6331	0.4765	0.3371
44	0.1156	0.0662	0.0368	0.0201	0.0107	94	0.9123	0.7981	0.6491	0.4922	0.3506
45	0.1261	0.0727	0.0407	0.0223	0.0120	95	0.9205	0.8111	0.6647	0.5078	0.3643
46	0.1372	0.0797	0.0449	0.0247	0.0133	96	0.9281	0.8236	0.6802	0.5235	0.3781
47	0.1489	0.0871	0.0494	0.0273	0.0148	97	0.9351	0.8355	0.6953	0.5391	0.3921
48	0.1613	0.0950	0.0542	0.0301	0.0164	98	0.9417	0.8470	0.7101	0.5547	0.4062
49	0.1742	0.1034	0.0594	0.0331	0.0181	99	0.9477	0.8579	0.7246	0.5702	0.4204

	n						n				
w	21	22	23	24	25	w	21	22	23	24	25
≤29	≤ 0.0008	≤ 0.0004	≤ 0.0002	≤ 0.0001	≤ 0.0001						
30	0.0009	0.0005	0.0002	0.0001	0.0001	80	0.1145	0.0687	0.0401	0.0228	0.0128
31	0.0011	0.0005	0.0003	0.0001	0.0001	81	0.1214	0.0733	0.0429	0.0245	0.0137
32	0.0012	0.0006	0.0003	0.0002	0.0001	82	0.1286	0.0780	0.0459	0.0263	0.0148
33	0.0014	0.0007	0.0004	0.0002	0.0001	83	0.1361	0.0829	0.0490	0.0282	0.0159
34	0.0016	0.0008	0.0004	0.0002	0.0001	84	0.1439	0.0881	0.0523	0.0302	0.0171
35	0.0019	0.0010	0.0005	0.0002	0.0001	85	0.1519	0.0935	0.0557	0.0323	0.0183
36	0.0021	0.0011	0.0006	0.0003	0.0001	86	0.1602	0.0991	0.0593	0.0346	0.0197
37	0.0024	0.0013	0.0006	0.0003	0.0002	87	0.1688	0.1050	0.0631	0.0369	0.0211
38	0.0028	0.0014	0.0007	0.0004	0.0002	88	0.1777	0.1111	0.0671	0.0394	0.0226
39	0.0031	0.0016	0.0008	0.0004	0.0002	89	0.1869	0.1174	0.0712	0.0420	0.0241
40	0.0036	0.0018	0.0009	0.0005	0.0002	90	0.1963	0.1239	0.0755	0.0447	0.0258
41	0.0040	0.0021	0.0011	0.0005	0.0003	91	0.2060	0.1308	0.0801	0.0475	0.0275
42	0.0045	0.0023	0.0012	0.0006	0.0003	92	0.2160	0.1378	0.0848	0.0505	0.0294
43	0.0051	0.0026	0.0014	0.0007	0.0004	93	0.2262	0.1451	0.0897	0.0537	0.0313
44	0.0057	0.0030	0.0015	0.0008	0.0004	94	0.2367	0.1527	0.0948	0.0570	0.0334
45	0.0063	0.0033	0.0017	0.0009	0.0005	95	0.2474	0.1604	0.1001	0.0604	0.0355
46	0.0071	0.0037	0.0019	0.0010	0.0005	96	0.2584	0.1685	0.1056	0.0640	0.0377
47	0.0079	0.0042	0.0022	0.0011	0.0006	97	0.2696	0.1767	0.1113	0.0678	0.0401
48	0.0088	0.0046	0.0024	0.0013	0.0006	98	0.2810	0.1853	0.1172	0.0717	0.0426
49	0.0097	0.0052	0.0027	0.0014	0.0007	99	0.2927	0.1940	0.1234	0.0758	0.0452
50	0.0108	0.0057	0.0030	0.0016	0.0008	100	0.3046	0.2030	0.1297	0.0800	0.0479
51	0.0119	0.0064	0.0034	0.0018	0.0009	101	0.3166	0.2122	0.1363	0.0844	0.0507
52	0.0132	0.0070	0.0037	0.0020	0.0010	102	0.3289	0.2217	0.1431	0.0890	0.0537
53	0.0145	0.0078	0.0041	0.0022	0.0011	103	0.3414	0.2314	0.1501	0.0938	0.0567
54	0.0160	0.0086	0.0046	0.0024	0.0013	104	0.3540	0.2413	0.1573	0.0987	0.0600
55	0.0175	0.0095	0.0051	0.0027	0.0014	105	0.3667	0.2514	0.1647	0.1038	0.0633
56	0.0192	0.0104	0.0056	0.0029	0.0015	106	0.3796	0.2618	0.1723	0.1091	0.0668
57	0.0210	0.0115	0.0061	0.0033	0.0017	107	0.3927	0.2723	0.1802	0.1146	0.0705
58	0.0230	0.0126	0.0068	0.0036	0.0019	108	0.4058	0.2830	0.1883	0.1203	0.0742
59	0.0251	0.0138	0.0074	0.0040	0.0021	109	0.4191	0.2940	0.1965	0.1261	0.0782
60	0.0273	0.0151	0.0082	0.0044	0.0023	110	0.4324	0.3051	0.2050	0.1322	0.0822
61	0.0298	0.0164	0.0089	0.0048	0.0025	111	0.4459	0.3164	0.2137	0.1384	0.0865
62	0.0323	0.0179	0.0098	0.0053	0.0028	112	0.4593	0.3278	0.2226	0.1448	0.0909
63	0.0351	0.0195	0.0107	0.0058	0.0031	113	0.4729	0.3394	0.2317	0.1514	0.0954
64	0.0380	0.0212	0.0117	0.0063	0.0034	114	0.4864	0.3512	0.2410	0.1583	0.1001
65	0.0411	0.0231	0.0127	0.0069	0.0037	115	0.5000	0.3631	0.2505	0.1653	0.1050
66	0.0444	0.0250	0.0138	0.0075	0.0040	116	0.5136	0.3751	0.2601	0.1724	0.1100
67	0.0479	0.0271	0.0150	0.0082	0.0044	117	0.5271	0.3873	0.2700	0.1798	0.1152
68	0.0516	0.0293	0.0163	0.0089	0.0048	118	0.5407	0.3995	0.2800	0.1874	0.1205
69	0.0555	0.0317	0.0177	0.0097	0.0053	119	0.5541	0.4119	0.2902	0.1951	0.1261
70	0.0597	0.0342	0.0192	0.0106	0.0057	120	0.5676	0.4243	0.3005	0.2031	0.1317
71	0.0640	0.0369	0.0208	0.0115	0.0062	121	0.5809	0.4368	0.3110	0.2112	0.1376
72	0.0686	0.0397	0.0224	0.0124	0.0068	122	0.5942	0.4494	0.3217	0.2195	0.1436
73	0.0735	0.0427	0.0242	0.0135	0.0074	123	0.6073	0.4620	0.3325	0.2279	0.1498
74	0.0786	0.0459	0.0261	0.0146	0.0080	124	0.6204	0.4746	0.3434	0.2366	0.1562
75	0.0839	0.0492	0.0281	0.0157	0.0087	125	0.6333	0.4873	0.3545	0.2454	0.1627
76	0.0895	0.0527	0.0303	0.0170	0.0094	126	0.6460	0.5000	0.3657	0.2544	0.1694
77	0.0953	0.0564	0.0325	0.0183	0.0101	127	0.6586	0.5127	0.3770	0.2635	0.1763
78	0.1015	0.0603	0.0349	0.0197	0.0110	128	0.6711	0.5254	0.3884	0.2728	0.1833
79	0.1078	0.0644	0.0374	0.0212	0.0118	129	0.6834	0.5380	0.3999	0.2823	0.1905
						130	0.6954	0.5506	0.4115	0.2919	0.1979

APPENDIX C: Tables of Distributions and Critical Values

TABLE C.7
Cumulative F distribution

$P(F_{\nu_1,\nu_2}) \leq 0.90$

ν_2 \ ν_1	1	2	3	4	5	6	7	8	9	10	12	15
1	39.86	49.50	53.59	55.83	57.24	58.20	58.91	59.44	59.86	60.19	60.71	61.22
2	8.53	9.00	9.16	9.24	9.29	9.33	9.35	9.37	9.38	9.39	9.41	9.42
3	5.54	5.46	5.39	5.34	5.31	5.28	5.27	5.25	5.24	5.23	5.22	5.20
4	4.54	4.32	4.19	4.11	4.05	4.01	3.98	3.95	3.94	3.92	3.90	3.87
5	4.06	3.78	3.62	3.52	3.45	3.40	3.37	3.34	3.32	3.30	3.27	3.24
6	3.78	3.46	3.29	3.18	3.11	3.05	3.01	2.98	2.96	2.94	2.90	2.87
7	3.59	3.26	3.07	2.96	2.88	2.83	2.78	2.75	2.72	2.70	2.67	2.63
8	3.46	3.11	2.92	2.81	2.73	2.67	2.62	2.59	2.56	2.54	2.50	2.46
9	3.36	3.01	2.81	2.69	2.61	2.55	2.51	2.47	2.44	2.42	2.38	2.34
10	3.29	2.92	2.73	2.61	2.52	2.46	2.41	2.38	2.35	2.32	2.28	2.24
11	3.23	2.86	2.66	2.54	2.45	2.39	2.34	2.30	2.27	2.25	2.21	2.17
12	3.18	2.81	2.61	2.48	2.39	2.33	2.28	2.24	2.21	2.19	2.15	2.10
13	3.14	2.76	2.56	2.43	2.35	2.28	2.23	2.20	2.16	2.14	2.10	2.05
14	3.10	2.73	2.52	2.39	2.31	2.24	2.19	2.15	2.12	2.10	2.05	2.01
15	3.07	2.70	2.49	2.36	2.27	2.21	2.16	2.12	2.09	2.06	2.02	1.97
16	3.05	2.67	2.46	2.33	2.24	2.18	2.13	2.09	2.06	2.03	1.99	1.94
17	3.03	2.64	2.44	2.31	2.22	2.15	2.10	2.06	2.03	2.00	1.96	1.91
18	3.01	2.62	2.42	2.29	2.20	2.13	2.08	2.04	2.00	1.98	1.93	1.89
19	2.99	2.61	2.40	2.27	2.18	2.11	2.06	2.02	1.98	1.96	1.91	1.86
20	2.97	2.59	2.38	2.25	2.16	2.09	2.04	2.00	1.96	1.94	1.89	1.84
21	2.96	2.57	2.36	2.23	2.14	2.08	2.02	1.98	1.95	1.92	1.87	1.83
22	2.95	2.56	2.35	2.22	2.13	2.06	2.01	1.97	1.93	1.90	1.86	1.81
23	2.94	2.55	2.34	2.21	2.11	2.05	1.99	1.95	1.92	1.89	1.84	1.80
24	2.93	2.54	2.33	2.19	2.10	2.04	1.98	1.94	1.91	1.88	1.83	1.78
25	2.92	2.53	2.32	2.18	2.09	2.02	1.97	1.93	1.89	1.87	1.82	1.77
26	2.91	2.52	2.31	2.17	2.08	2.01	1.96	1.92	1.88	1.86	1.81	1.76
27	2.90	2.51	2.30	2.17	2.07	2.00	1.95	1.91	1.87	1.85	1.80	1.75
28	2.89	2.50	2.29	2.16	2.06	2.00	1.94	1.90	1.87	1.84	1.79	1.74
29	2.89	2.50	2.28	2.15	2.06	1.99	1.93	1.89	1.86	1.83	1.78	1.73
30	2.88	2.49	2.28	2.14	2.05	1.98	1.93	1.88	1.85	1.82	1.77	1.72
40	2.84	2.44	2.23	2.09	2.00	1.93	1.87	1.83	1.79	1.76	1.71	1.66
50	2.81	2.41	2.20	2.06	1.97	1.90	1.84	1.80	1.76	1.73	1.68	1.63
60	2.79	2.39	2.18	2.04	1.95	1.87	1.82	1.77	1.74	1.71	1.66	1.60
70	2.78	2.38	2.16	2.03	1.93	1.86	1.80	1.76	1.72	1.69	1.64	1.59
80	2.77	2.37	2.15	2.02	1.92	1.85	1.79	1.75	1.71	1.68	1.63	1.57
90	2.76	2.36	2.15	2.01	1.91	1.84	1.78	1.74	1.70	1.67	1.62	1.56
100	2.76	2.36	2.14	2.00	1.91	1.83	1.78	1.73	1.69	1.66	1.61	1.56
120	2.75	2.35	2.13	1.99	1.90	1.82	1.77	1.72	1.68	1.65	1.60	1.55
150	2.74	2.34	2.12	1.98	1.89	1.81	1.76	1.71	1.67	1.64	1.59	1.53
∞	2.71	2.30	2.08	1.94	1.85	1.77	1.72	1.67	1.63	1.60	1.55	1.49

APPENDIX C: Tables of Distributions and Critical Values

$P(F_{\nu_1,\nu_2}) \leq 0.90$

ν_2 \ ν_1	18	20	24	25	30	40	50	60	90	120	∞
1	61.57	61.74	62.00	62.05	62.26	62.53	62.69	62.79	62.97	63.06	63.33
2	9.44	9.44	9.45	9.45	9.46	9.47	9.47	9.47	9.48	9.48	9.49
3	5.19	5.18	5.18	5.17	5.17	5.16	5.15	5.15	5.15	5.14	5.13
4	3.85	3.84	3.83	3.83	3.82	3.80	3.80	3.79	3.78	3.78	3.76
5	3.22	3.21	3.19	3.19	3.17	3.16	3.15	3.14	3.13	3.12	3.11
6	2.85	2.84	2.82	2.81	2.80	2.78	2.77	2.76	2.75	2.74	2.72
7	2.61	2.59	2.58	2.57	2.56	2.54	2.52	2.51	2.50	2.49	2.47
8	2.44	2.42	2.40	2.40	2.38	2.36	2.35	2.34	2.32	2.32	2.29
9	2.31	2.30	2.28	2.27	2.25	2.23	2.22	2.21	2.19	2.18	2.16
10	2.22	2.20	2.18	2.17	2.16	2.13	2.12	2.11	2.09	2.08	2.06
11	2.14	2.12	2.10	2.10	2.08	2.05	2.04	2.03	2.01	2.00	1.97
12	2.08	2.06	2.04	2.03	2.01	1.99	1.97	1.96	1.94	1.93	1.90
13	2.02	2.01	1.98	1.98	1.96	1.93	1.92	1.90	1.89	1.88	1.85
14	1.98	1.96	1.94	1.93	1.91	1.89	1.87	1.86	1.84	1.83	1.80
15	1.94	1.92	1.90	1.89	1.87	1.85	1.83	1.82	1.80	1.79	1.76
16	1.91	1.89	1.87	1.86	1.84	1.81	1.79	1.78	1.76	1.75	1.72
17	1.88	1.86	1.84	1.83	1.81	1.78	1.76	1.75	1.73	1.72	1.69
18	1.85	1.84	1.81	1.80	1.78	1.75	1.74	1.72	1.70	1.69	1.66
19	1.83	1.81	1.79	1.78	1.76	1.73	1.71	1.70	1.68	1.67	1.63
20	1.81	1.79	1.77	1.76	1.74	1.71	1.69	1.68	1.65	1.64	1.61
21	1.79	1.78	1.75	1.74	1.72	1.69	1.67	1.66	1.63	1.62	1.59
22	1.78	1.76	1.73	1.73	1.70	1.67	1.65	1.64	1.62	1.60	1.57
23	1.76	1.74	1.72	1.71	1.69	1.66	1.64	1.62	1.60	1.59	1.55
24	1.75	1.73	1.70	1.70	1.67	1.66	1.64	1.62	1.61	1.58	1.57	1.53
25	1.74	1.72	1.69	1.68	1.66	1.65	1.63	1.61	1.59	1.57	1.56	1.52
26	1.72	1.71	1.68	1.67	1.65	1.61	1.59	1.58	1.56	1.54	1.50
27	1.71	1.70	1.67	1.66	1.64	1.60	1.58	1.57	1.54	1.53	1.49
28	1.70	1.69	1.66	1.65	1.63	1.59	1.57	1.56	1.53	1.52	1.48
29	1.69	1.68	1.65	1.64	1.62	1.58	1.56	1.55	1.52	1.51	1.47
30	1.69	1.67	1.64	1.63	1.61	1.57	1.55	1.54	1.51	1.50	1.46
40	1.62	1.61	1.57	1.57	1.54	1.51	1.48	1.47	1.44	1.42	1.38
50	1.59	1.57	1.54	1.53	1.50	1.46	1.44	1.42	1.39	1.38	1.33
60	1.56	1.54	1.51	1.50	1.48	1.44	1.41	1.40	1.36	1.35	1.29
70	1.55	1.53	1.49	1.49	1.46	1.42	1.39	1.37	1.34	1.32	1.27
80	1.53	1.51	1.48	1.47	1.44	1.40	1.38	1.36	1.33	1.31	1.24
90	1.52	1.50	1.47	1.46	1.43	1.39	1.36	1.35	1.31	1.29	1.23
100	1.52	1.49	1.46	1.45	1.42	1.38	1.35	1.34	1.30	1.28	1.21
120	1.50	1.48	1.45	1.44	1.41	1.37	1.34	1.32	1.28	1.26	1.19
150	1.49	1.47	1.43	1.43	1.40	1.35	1.33	1.30	1.27	1.25	1.17
∞	1.44	1.42	1.38	1.38	1.34	1.30	1.26	1.24	1.20	1.17	1.00

APPENDIX C: Tables of Distributions and Critical Values

$P(F_{\nu_1,\nu_2}) \leq 0.95$

ν_2 \ ν_1	1	2	3	4	5	6	7	8	9	10	12	15
1	161.4	199.5	215.7	224.6	230.2	234.0	236.8	238.9	240.5	241.9	243.9	245.9
2	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38	19.40	19.41	19.43
3	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79	8.74	8.70
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96	5.91	5.86
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74	4.68	4.62
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06	4.00	3.94
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64	3.57	3.51
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35	3.28	3.22
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14	3.07	3.01
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98	2.91	2.85
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.85	2.79	2.72
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75	2.69	2.62
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67	2.60	2.53
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65	2.60	2.53	2.46
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59	2.54	2.48	2.40
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49	2.42	2.35
17	4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.49	2.45	2.38	2.31
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41	2.34	2.27
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42	2.38	2.31	2.23
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39	2.35	2.28	2.20
21	4.32	3.47	3.07	2.84	2.68	2.57	2.49	2.42	2.37	2.32	2.25	2.18
22	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34	2.30	2.23	2.15
23	4.28	3.42	3.03	2.80	2.64	2.53	2.44	2.37	2.32	2.27	2.20	2.13
24	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30	2.25	2.18	2.11
25	4.24	3.39	2.99	2.76	2.60	2.49	2.40	2.34	2.28	2.24	2.16	2.09
26	4.23	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27	2.22	2.15	2.07
27	4.21	3.35	2.96	2.73	2.57	2.46	2.37	2.31	2.25	2.20	2.13	2.06
28	4.20	3.34	2.95	2.71	2.56	2.45	2.36	2.29	2.24	2.19	2.12	2.04
29	4.18	3.33	2.93	2.70	2.55	2.43	2.35	2.28	2.22	2.18	2.10	2.03
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.16	2.09	2.01
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.08	2.00	1.92
50	4.03	3.18	2.79	2.56	2.40	2.29	2.20	2.13	2.07	2.03	1.95	1.87
60	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04	1.99	1.92	1.84
70	3.98	3.13	2.74	2.50	2.35	2.23	2.14	2.07	2.02	1.97	1.89	1.81
80	3.96	3.11	2.72	2.49	2.33	2.21	2.13	2.06	2.00	1.95	1.88	1.79
90	3.95	3.10	2.71	2.47	2.32	2.20	2.11	2.04	1.99	1.94	1.86	1.78
100	3.94	3.09	2.70	2.46	2.31	2.19	2.10	2.03	1.97	1.93	1.85	1.77
120	3.92	3.07	2.68	2.45	2.29	2.18	2.09	2.02	1.96	1.91	1.83	1.75
150	3.90	3.06	2.66	2.43	2.27	2.16	2.07	2.00	1.94	1.89	1.82	1.73
∞	3.84	3.00	2.60	2.37	2.21	2.10	2.01	1.94	1.88	1.83	1.75	1.67

APPENDIX C: Tables of Distributions and Critical Values

$P(F_{\nu_1,\nu_2}) \leq 0.95$

ν_2 \ ν_1	18	20	24	25	30	40	50	60	90	120	∞
1	247.3	248.0	249.1	249.3	250.1	251.1	251.8	252.2	252.9	253.3	254.3
2	19.44	19.45	19.45	19.46	19.46	19.47	19.48	19.48	19.48	19.49	19.50
3	8.67	8.66	8.64	8.63	8.62	8.59	8.58	8.57	8.56	8.55	8.53
4	5.82	5.80	5.77	5.77	5.75	5.72	5.70	5.69	5.67	5.66	5.63
5	4.58	4.56	4.53	4.52	4.50	4.46	4.44	4.43	4.41	4.40	4.37
6	3.90	3.87	3.84	3.83	3.81	3.77	3.75	3.74	3.72	3.70	3.67
7	3.47	3.44	3.41	3.40	3.38	3.34	3.32	3.30	3.28	3.27	3.23
8	3.17	3.15	3.12	3.11	3.08	3.04	3.02	3.01	2.98	2.97	2.93
9	2.96	2.94	2.90	2.89	2.86	2.83	2.80	2.79	2.76	2.75	2.71
10	2.80	2.77	2.74	2.73	2.70	2.66	2.64	2.62	2.59	2.58	2.54
11	2.67	2.65	2.61	2.60	2.57	2.53	2.51	2.49	2.46	2.45	2.40
12	2.57	2.54	2.51	2.50	2.47	2.43	2.40	2.38	2.36	2.34	2.30
13	2.48	2.46	2.42	2.41	2.38	2.34	2.31	2.30	2.27	2.25	2.21
14	2.41	2.39	2.35	2.34	2.31	2.27	2.24	2.22	2.19	2.18	2.13
15	2.35	2.33	2.29	2.28	2.25	2.20	2.18	2.16	2.13	2.11	2.07
16	2.30	2.28	2.24	2.23	2.19	2.15	2.12	2.11	2.07	2.06	2.01
17	2.26	2.23	2.19	2.18	2.15	2.10	2.08	2.06	2.03	2.01	1.96
18	2.22	2.19	2.15	2.14	2.11	2.06	2.04	2.02	1.98	1.97	1.92
19	2.18	2.16	2.11	2.11	2.07	2.03	2.00	1.98	1.95	1.93	1.88
20	2.15	2.12	2.08	2.07	2.04	1.99	1.97	1.95	1.91	1.90	1.84
21	2.12	2.10	2.05	2.05	2.01	1.96	1.94	1.92	1.88	1.87	1.81
22	2.10	2.07	2.03	2.02	1.98	1.94	1.91	1.89	1.86	1.84	1.78
23	2.08	2.05	2.01	2.00	1.96	1.91	1.88	1.86	1.83	1.81	1.76
24	2.05	2.03	1.98	1.97	1.94	1.89	1.86	1.84	1.81	1.79	1.73
25	2.04	2.01	1.96	1.96	1.92	1.87	1.84	1.82	1.79	1.77	1.71
26	2.02	1.99	1.95	1.94	1.90	1.85	1.82	1.80	1.77	1.75	1.69
27	2.00	1.97	1.93	1.92	1.88	1.84	1.81	1.79	1.75	1.73	1.67
28	1.99	1.96	1.91	1.91	1.87	1.82	1.79	1.77	1.73	1.71	1.65
29	1.97	1.94	1.90	1.89	1.85	1.81	1.77	1.75	1.72	1.70	1.64
30	1.96	1.93	1.89	1.88	1.84	1.79	1.76	1.74	1.70	1.68	1.62
40	1.87	1.84	1.79	1.78	1.74	1.69	1.66	1.64	1.60	1.58	1.51
50	1.81	1.78	1.74	1.73	1.69	1.63	1.60	1.58	1.53	1.51	1.44
60	1.78	1.75	1.70	1.69	1.65	1.59	1.56	1.53	1.49	1.47	1.39
70	1.75	1.72	1.67	1.66	1.62	1.57	1.53	1.50	1.46	1.44	1.35
80	1.73	1.70	1.65	1.64	1.60	1.54	1.51	1.48	1.44	1.41	1.32
90	1.72	1.69	1.64	1.63	1.59	1.53	1.49	1.46	1.42	1.39	1.30
100	1.71	1.68	1.63	1.62	1.57	1.52	1.48	1.45	1.40	1.38	1.28
120	1.69	1.66	1.61	1.60	1.55	1.50	1.46	1.43	1.38	1.35	1.25
150	1.67	1.64	1.59	1.58	1.54	1.48	1.44	1.41	1.36	1.33	1.22
∞	1.60	1.57	1.52	1.51	1.46	1.39	1.35	1.32	1.26	1.22	1.00

APPENDIX C: Tables of Distributions and Critical Values

$P(F_{\nu_1,\nu_2}) \leq 0.975$

ν_2 \ ν_1	1	2	3	4	5	6	7	8	9	10	12	15
1	647.8	799.5	864.2	899.6	921.8	937.1	948.2	956.6	963.3	968.6	976.7	984.9
2	38.51	39.00	39.17	39.25	39.30	39.33	39.36	39.37	39.39	39.40	39.41	39.43
3	17.44	16.04	15.44	15.10	14.88	14.73	14.62	14.54	14.47	14.42	14.34	14.25
4	12.22	10.65	9.98	9.60	9.36	9.20	9.07	8.98	8.90	8.84	8.75	8.66
5	10.01	8.43	7.76	7.39	7.15	6.98	6.85	6.76	6.68	6.62	6.52	6.43
6	8.81	7.26	6.60	6.23	5.99	5.82	5.70	5.60	5.52	5.46	5.37	5.27
7	8.07	6.54	5.89	5.52	5.29	5.12	4.99	4.90	4.82	4.76	4.67	4.57
8	7.57	6.06	5.42	5.05	4.82	4.65	4.53	4.43	4.36	4.30	4.20	4.10
9	7.21	5.71	5.08	4.72	4.48	4.32	4.20	4.10	4.03	3.96	3.87	3.77
10	6.94	5.46	4.83	4.47	4.24	4.07	3.95	3.85	3.78	3.72	3.62	3.52
11	6.72	5.26	4.63	4.28	4.04	3.88	3.76	3.66	3.59	3.53	3.43	3.33
12	6.55	5.10	4.47	4.12	3.89	3.73	3.61	3.51	3.44	3.37	3.28	3.18
13	6.41	4.97	4.35	4.00	3.77	3.60	3.48	3.39	3.31	3.25	3.15	3.05
14	6.30	4.86	4.24	3.89	3.66	3.50	3.38	3.29	3.21	3.15	3.05	2.95
15	6.20	4.77	4.15	3.80	3.58	3.41	3.29	3.20	3.12	3.06	2.96	2.86
16	6.12	4.69	4.08	3.73	3.50	3.34	3.22	3.12	3.05	2.99	2.89	2.79
17	6.04	4.62	4.01	3.66	3.44	3.28	3.16	3.06	2.98	2.92	2.82	2.72
18	5.98	4.56	3.95	3.61	3.38	3.22	3.10	3.01	2.93	2.87	2.77	2.67
19	5.92	4.51	3.90	3.56	3.33	3.17	3.05	2.96	2.88	2.82	2.72	2.62
20	5.87	4.46	3.86	3.51	3.29	3.13	3.01	2.91	2.84	2.77	2.68	2.57
21	5.83	4.42	3.82	3.48	3.25	3.09	2.97	2.87	2.80	2.73	2.64	2.53
22	5.79	4.38	3.78	3.44	3.22	3.05	2.93	2.84	2.76	2.70	2.60	2.50
23	5.75	4.35	3.75	3.41	3.18	3.02	2.90	2.81	2.73	2.67	2.57	2.47
24	5.72	4.32	3.72	3.38	3.15	2.99	2.87	2.78	2.70	2.64	2.54	2.44
25	5.69	4.29	3.69	3.35	3.13	2.97	2.85	2.75	2.68	2.61	2.51	2.41
26	5.66	4.27	3.67	3.33	3.10	2.94	2.82	2.73	2.65	2.59	2.49	2.39
27	5.63	4.24	3.65	3.31	3.08	2.92	2.80	2.71	2.63	2.57	2.47	2.36
28	5.61	4.22	3.63	3.29	3.06	2.90	2.78	2.69	2.61	2.55	2.45	2.34
29	5.59	4.20	3.61	3.27	3.04	2.88	2.76	2.67	2.59	2.53	2.43	2.32
30	5.57	4.18	3.59	3.25	3.03	2.87	2.75	2.65	2.57	2.51	2.41	2.31
40	5.42	4.05	3.46	3.13	2.90	2.74	2.62	2.53	2.45	2.39	2.29	2.18
50	5.34	3.97	3.39	3.05	2.83	2.67	2.55	2.46	2.38	2.32	2.22	2.11
60	5.29	3.93	3.34	3.01	2.79	2.63	2.51	2.41	2.33	2.27	2.17	2.06
70	5.25	3.89	3.31	2.97	2.75	2.59	2.47	2.38	2.30	2.24	2.14	2.03
80	5.22	3.86	3.28	2.95	2.73	2.57	2.45	2.35	2.28	2.21	2.11	2.00
90	5.20	3.84	3.26	2.93	2.71	2.55	2.43	2.34	2.26	2.19	2.09	1.98
100	5.18	3.83	3.25	2.92	2.70	2.54	2.42	2.32	2.24	2.18	2.08	1.97
120	5.15	3.80	3.23	2.89	2.67	2.52	2.39	2.30	2.22	2.16	2.05	1.94
150	5.13	3.78	3.20	2.87	2.65	2.49	2.37	2.28	2.20	2.13	2.03	1.92
∞	5.02	3.69	3.12	2.79	2.57	2.41	2.29	2.19	2.11	2.05	1.94	1.83

APPENDIX C: Tables of Distributions and Critical Values

$P(F_{\nu_1,\nu_2}) \leq 0.975$

ν_2 \ ν_1	18	20	24	25	30	40	50	60	90	120	∞
1	990.3	993.1	997.3	998.1	1001	1006	1008	1010	1013	1014	1018
2	39.44	39.45	39.46	39.46	39.46	39.47	39.48	39.48	39.49	39.49	39.50
3	14.20	14.17	14.12	14.12	14.08	14.04	14.01	13.99	13.96	13.95	13.90
4	8.59	8.56	8.51	8.50	8.46	8.41	8.38	8.36	8.33	8.31	8.26
5	6.36	6.33	6.28	6.27	6.23	6.18	6.14	6.12	6.09	6.07	6.02
6	5.20	5.17	5.12	5.11	5.07	5.01	4.98	4.96	4.92	4.90	4.85
7	4.50	4.47	4.41	4.40	4.36	4.31	4.28	4.25	4.22	4.20	4.14
8	4.03	4.00	3.95	3.94	3.89	3.84	3.81	3.78	3.75	3.73	3.67
9	3.70	3.67	3.61	3.60	3.56	3.51	3.47	3.45	3.41	3.39	3.33
10	3.45	3.42	3.37	3.35	3.31	3.26	3.22	3.20	3.16	3.14	3.08
11	3.26	3.23	3.17	3.16	3.12	3.06	3.03	3.00	2.96	2.94	2.88
12	3.11	3.07	3.02	3.01	2.96	2.91	2.87	2.85	2.81	2.79	2.72
13	2.98	2.95	2.89	2.88	2.84	2.78	2.74	2.72	2.68	2.66	2.60
14	2.88	2.84	2.79	2.78	2.73	2.67	2.64	2.61	2.57	2.55	2.49
15	2.79	2.76	2.70	2.69	2.64	2.59	2.55	2.52	2.48	2.46	2.40
16	2.72	2.68	2.63	2.61	2.57	2.51	2.47	2.45	2.40	2.38	2.32
17	2.65	2.62	2.56	2.55	2.50	2.44	2.41	2.38	2.34	2.32	2.25
18	2.60	2.56	2.50	2.49	2.44	2.38	2.35	2.32	2.28	2.26	2.19
19	2.55	2.51	2.45	2.44	2.39	2.33	2.30	2.27	2.23	2.20	2.13
20	2.50	2.46	2.41	2.40	2.35	2.29	2.25	2.22	2.18	2.16	2.09
21	2.46	2.42	2.37	2.36	2.31	2.25	2.21	2.18	2.14	2.11	2.04
22	2.43	2.39	2.33	2.32	2.27	2.21	2.17	2.14	2.10	2.08	2.00
23	2.39	2.36	2.30	2.29	2.24	2.18	2.14	2.11	2.07	2.04	1.97
24	2.36	2.33	2.27	2.26	2.21	2.15	2.11	2.08	2.03	2.01	1.94
25	2.34	2.30	2.24	2.23	2.18	2.12	2.08	2.05	2.01	1.98	1.91
26	2.31	2.28	2.22	2.21	2.16	2.09	2.05	2.03	1.98	1.95	1.88
27	2.29	2.25	2.19	2.18	2.13	2.07	2.03	2.00	1.95	1.93	1.85
28	2.27	2.23	2.17	2.16	2.11	2.05	2.01	1.98	1.93	1.91	1.83
29	2.25	2.21	2.15	2.14	2.09	2.03	1.99	1.96	1.91	1.89	1.81
30	2.23	2.20	2.14	2.12	2.07	2.01	1.97	1.94	1.89	1.87	1.79
40	2.11	2.07	2.01	1.99	1.94	1.88	1.83	1.80	1.75	1.72	1.64
50	2.03	1.99	1.93	1.92	1.87	1.80	1.75	1.72	1.67	1.64	1.55
60	1.98	1.94	1.88	1.87	1.82	1.74	1.70	1.67	1.61	1.58	1.48
70	1.95	1.91	1.85	1.83	1.78	1.71	1.66	1.63	1.57	1.54	1.44
80	1.92	1.88	1.82	1.81	1.75	1.68	1.63	1.60	1.54	1.51	1.40
90	1.91	1.86	1.80	1.79	1.73	1.66	1.61	1.58	1.52	1.48	1.37
100	1.89	1.85	1.78	1.77	1.71	1.64	1.59	1.56	1.50	1.46	1.35
120	1.87	1.82	1.76	1.75	1.69	1.61	1.56	1.53	1.47	1.43	1.31
150	1.84	1.80	1.74	1.72	1.67	1.59	1.54	1.50	1.44	1.40	1.27
∞	1.75	1.71	1.64	1.63	1.57	1.48	1.43	1.39	1.31	1.27	1.00

APPENDIX C: Tables of Distributions and Critical Values

$P(F_{\nu_1,\nu_2}) \leq 0.99$

ν_2 \ ν_1	1	2	3	4	5	6	7	8	9	10	12	15
1	4052	4999	5404	5624	5764	5859	5928	5981	6022	6056	6107	6157
2	98.50	99.00	99.16	99.25	99.30	99.33	99.36	99.38	99.39	99.40	99.42	99.43
3	34.12	30.82	29.46	28.71	28.24	27.91	27.67	27.49	27.34	27.23	27.05	26.87
4	21.20	18.00	16.69	15.98	15.52	15.21	14.98	14.80	14.66	14.55	14.37	14.20
5	16.26	13.27	12.06	11.39	10.97	10.67	10.46	10.29	10.16	10.05	9.89	9.72
6	13.75	10.92	9.78	9.15	8.75	8.47	8.26	8.10	7.98	7.87	7.72	7.56
7	12.25	9.55	8.45	7.85	7.46	7.19	6.99	6.84	6.72	6.62	6.47	6.31
8	11.26	8.65	7.59	7.01	6.63	6.37	6.18	6.03	5.91	5.81	5.67	5.52
9	10.56	8.02	6.99	6.42	6.06	5.80	5.61	5.47	5.35	5.26	5.11	4.96
10	10.04	7.56	6.55	5.99	5.64	5.39	5.20	5.06	4.94	4.85	4.71	4.56
11	9.65	7.21	6.22	5.67	5.32	5.07	4.89	4.74	4.63	4.54	4.40	4.25
12	9.33	6.93	5.95	5.41	5.06	4.82	4.64	4.50	4.39	4.30	4.16	4.01
13	9.07	6.70	5.74	5.21	4.86	4.62	4.44	4.30	4.19	4.10	3.96	3.82
14	8.86	6.51	5.56	5.04	4.69	4.46	4.28	4.14	4.03	3.94	3.80	3.66
15	8.68	6.36	5.42	4.89	4.56	4.32	4.14	4.00	3.89	3.80	3.67	3.52
16	8.53	6.23	5.29	4.77	4.44	4.20	4.03	3.89	3.78	3.69	3.55	3.41
17	8.40	6.11	5.19	4.67	4.34	4.10	3.93	3.79	3.68	3.59	3.46	3.31
18	8.29	6.01	5.09	4.58	4.25	4.01	3.84	3.71	3.60	3.51	3.37	3.23
19	8.18	5.93	5.01	4.50	4.17	3.94	3.77	3.63	3.52	3.43	3.30	3.15
20	8.10	5.85	4.94	4.43	4.10	3.87	3.70	3.56	3.46	3.37	3.23	3.09
21	8.02	5.78	4.87	4.37	4.04	3.81	3.64	3.51	3.40	3.31	3.17	3.03
22	7.95	5.72	4.82	4.31	3.99	3.76	3.59	3.45	3.35	3.26	3.12	2.98
23	7.88	5.66	4.76	4.26	3.94	3.71	3.54	3.41	3.30	3.21	3.07	2.93
24	7.82	5.61	4.72	4.22	3.90	3.67	3.50	3.36	3.26	3.17	3.03	2.89
25	7.77	5.57	4.68	4.18	3.85	3.63	3.46	3.32	3.22	3.13	2.99	2.85
26	7.72	5.53	4.64	4.14	3.82	3.59	3.42	3.29	3.18	3.09	2.96	2.81
27	7.68	5.49	4.60	4.11	3.78	3.56	3.39	3.26	3.15	3.06	2.93	2.78
28	7.64	5.45	4.57	4.07	3.75	3.53	3.36	3.23	3.12	3.03	2.90	2.75
29	7.60	5.42	4.54	4.04	3.73	3.50	3.33	3.20	3.09	3.00	2.87	2.73
30	7.56	5.39	4.51	4.02	3.70	3.47	3.30	3.17	3.07	2.98	2.84	2.70
40	7.31	5.18	4.31	3.83	3.51	3.29	3.12	2.99	2.89	2.80	2.66	2.52
50	7.17	5.06	4.20	3.72	3.41	3.19	3.02	2.89	2.78	2.70	2.56	2.42
60	7.08	4.98	4.13	3.65	3.34	3.12	2.95	2.82	2.72	2.63	2.50	2.35
70	7.01	4.92	4.07	3.60	3.29	3.07	2.91	2.78	2.67	2.59	2.45	2.31
80	6.96	4.88	4.04	3.56	3.26	3.04	2.87	2.74	2.64	2.55	2.42	2.27
90	6.93	4.85	4.01	3.53	3.23	3.01	2.84	2.72	2.61	2.52	2.39	2.24
100	6.90	4.82	3.98	3.51	3.21	2.99	2.82	2.69	2.59	2.50	2.37	2.22
120	6.85	4.79	3.95	3.48	3.17	2.96	2.79	2.66	2.56	2.47	2.34	2.19
150	6.81	4.75	3.91	3.45	3.14	2.92	2.76	2.63	2.53	2.44	2.31	2.16
∞	6.64	4.61	3.78	3.32	3.02	2.80	2.64	2.51	2.41	2.32	2.18	2.04

APPENDIX C: Tables of Distributions and Critical Values

$P\{F_{\nu_1,\nu_2}) \leq 0.99$

ν_2 \ ν_1	18	20	24	25	30	40	50	60	90	120	∞
1	6191	6209	6234	6240	6260	6286	6302	6313	6331	6340	6366
2	99.44	99.45	99.46	99.46	99.47	99.48	99.48	99.48	99.49	99.49	99.50
3	26.75	26.69	26.60	26.58	26.50	26.41	26.35	26.32	26.25	26.22	26.13
4	14.08	14.02	13.93	13.91	13.84	13.75	13.69	13.65	13.59	13.56	13.46
5	9.61	9.55	9.47	9.45	9.38	9.29	9.24	9.20	9.14	9.11	9.02
6	7.45	7.40	7.31	7.30	7.23	7.14	7.09	7.06	7.00	6.97	6.88
7	6.21	6.16	6.07	6.06	5.99	5.91	5.86	5.82	5.77	5.74	5.65
8	5.41	5.36	5.28	5.26	5.20	5.12	5.07	5.03	4.97	4.95	4.86
9	4.86	4.81	4.73	4.71	4.65	4.57	4.52	4.48	4.43	4.40	4.31
10	4.46	4.41	4.33	4.31	4.25	4.17	4.12	4.08	4.03	4.00	3.91
11	4.15	4.10	4.02	4.01	3.94	3.86	3.81	3.78	3.72	3.69	3.60
12	3.91	3.86	3.78	3.76	3.70	3.62	3.57	3.54	3.48	3.45	3.36
13	3.72	3.66	3.59	3.57	3.51	3.43	3.38	3.34	3.28	3.25	3.17
14	3.56	3.51	3.43	3.41	3.35	3.27	3.22	3.18	3.12	3.09	3.00
15	3.42	3.37	3.29	3.28	3.21	3.13	3.08	3.05	2.99	2.96	2.87
16	3.31	3.26	3.18	3.16	3.10	3.02	2.97	2.93	2.87	2.84	2.75
17	3.21	3.16	3.08	3.07	3.00	2.92	2.87	2.83	2.78	2.75	2.65
18	3.13	3.08	3.00	2.98	2.92	2.84	2.78	2.75	2.69	2.66	2.57
19	3.05	3.00	2.92	2.91	2.84	2.76	2.71	2.67	2.61	2.58	2.49
20	2.99	2.94	2.86	2.84	2.78	2.69	2.64	2.61	2.55	2.52	2.42
21	2.93	2.88	2.80	2.79	2.72	2.64	2.58	2.55	2.49	2.46	2.36
22	2.88	2.83	2.75	2.73	2.67	2.58	2.53	2.50	2.43	2.40	2.31
23	2.83	2.78	2.70	2.69	2.62	2.54	2.48	2.45	2.39	2.35	2.26
24	2.79	2.74	2.66	2.64	2.58	2.49	2.44	2.40	2.34	2.31	2.21
25	2.75	2.70	2.62	2.60	2.54	2.45	2.40	2.36	2.30	2.27	2.17
26	2.72	2.66	2.58	2.57	2.50	2.42	2.36	2.33	2.26	2.23	2.13
27	2.68	2.63	2.55	2.54	2.47	2.38	2.33	2.29	2.23	2.20	2.10
28	2.65	2.60	2.52	2.51	2.44	2.35	2.30	2.26	2.20	2.17	2.06
29	2.63	2.57	2.49	2.48	2.41	2.33	2.27	2.23	2.17	2.14	2.03
30	2.60	2.55	2.47	2.45	2.39	2.30	2.25	2.21	2.14	2.11	2.01
40	2.42	2.37	2.29	2.27	2.20	2.11	2.06	2.02	1.95	1.92	1.80
50	2.32	2.27	2.18	2.17	2.10	2.01	1.95	1.91	1.84	1.80	1.68
60	2.25	2.20	2.12	2.10	2.03	1.94	1.88	1.84	1.76	1.73	1.60
70	2.20	2.15	2.07	2.05	1.98	1.89	1.83	1.78	1.71	1.67	1.54
80	2.17	2.12	2.03	2.01	1.94	1.85	1.79	1.75	1.67	1.63	1.49
90	2.14	2.09	2.00	1.99	1.92	1.82	1.76	1.72	1.64	1.60	1.46
100	2.12	2.07	1.98	1.97	1.89	1.80	1.74	1.69	1.61	1.57	1.43
120	2.09	2.03	1.95	1.93	1.86	1.76	1.70	1.66	1.58	1.53	1.38
150	2.06	2.00	1.92	1.90	1.83	1.73	1.66	1.62	1.54	1.49	1.33
∞	1.93	1.88	1.79	1.77	1.70	1.59	1.52	1.47	1.38	1.32	1.00

TABLE C.8

Critical values for the Wilcoxon rank-sum test

1-tail		$\alpha = 0.025$			$\alpha = 0.05$			1-tail		$\alpha = 0.025$			$\alpha = 0.05$		
2-tail		$\alpha = 0.05$			$\alpha = 0.10$			2-tail		$\alpha = 0.05$			$\alpha = 0.10$		
m	n	W	d	P	W	d	P	m	n	W	d	P	W	d	P
3	3				6 15	1	.0500	5	10	23 57	9	.0200	26 54	12	.0496
3	4				6 18	1	.0286	5	11	24 61	10	.0190	27 58	13	.0449
3	5	6 21	1	.0179	7 20	2	.0357	5	12	26 64	12	.0242	28 62	14	.0409
3	6	7 23	2	.0238	8 22	3	.0476	5	13	27 68	13	.0230	30 65	16	.0473
3	7	7 26	2	.0167	8 25	3	.0333	5	14	28 72	14	.0218	31 69	17	.0435
3	8	8 28	3	.0242	9 27	4	.0424	5	15	29 76	15	.0209	33 72	19	.0491
3	9	8 31	3	.0182	10 29	5	.0500	5	16	30 80	16	.0201	34 76	20	.0455
3	10	9 33	4	.0245	10 32	5	.0385	5	17	32 83	18	.0238	35 80	21	.0425
3	11	9 36	4	.0192	11 34	6	.0440	5	18	33 87	19	.0229	37 83	23	.0472
3	12	10 38	5	.0242	11 37	6	.0352	5	19	34 91	20	.0220	38 87	24	.0442
3	13	10 41	5	.0196	12 39	7	.0411	5	20	35 95	21	.0212	40 90	26	.0485
3	14	11 43	6	.0235	13 41	8	.0456	5	21	37 98	23	.0243	41 94	27	.0457
3	15	11 46	6	.0196	13 44	8	.0380	5	22	38 102	24	.0234	43 97	29	.0496
3	16	12 48	7	.0237	14 46	9	.0423	5	23	39 106	25	.0226	44 101	30	.0469
3	17	12 51	7	.0202	15 48	10	.0465	5	24	40 110	26	.0219	45 105	31	.0445
3	18	13 53	8	.0233	15 51	10	.0398	5	25	42 113	28	.0246	47 108	33	.0480
3	19	13 56	8	.0201	16 53	11	.0435	6	6	26 52	6	.0206	28 50	8	.0465
3	20	14 58	9	.0232	17 55	12	.0469	6	7	27 57	7	.0175	29 55	9	.0367
3	21	14 61	9	.0203	17 58	12	.0410	6	8	29 61	9	.0213	31 59	11	.0406
3	22	15 63	10	.0230	18 60	13	.0443	6	9	31 65	11	.0248	33 63	13	.0440
3	23	15 66	10	.0204	19 62	14	.0473	6	10	32 70	12	.0210	35 67	15	.0467
3	24	16 68	11	.0229	19 65	14	.0421	6	11	34 74	14	.0238	37 71	17	.0491
3	25	16 71	11	.0205	20 67	15	.0449	6	12	35 79	15	.0207	38 76	18	.0415
4	4	10 26	1	.0143	11 25	2	.0286	6	13	37 83	17	.0231	40 80	20	.0437
4	5	11 29	2	.0159	12 28	3	.0317	6	14	38 88	18	.0204	42 84	22	.0457
4	6	12 32	3	.0190	13 31	4	.0333	6	15	40 92	20	.0224	44 88	24	.0474
4	7	13 35	4	.0212	14 34	5	.0364	6	16	42 96	22	.0244	46 92	26	.0490
4	8	14 38	5	.0242	15 37	6	.0364	6	17	43 101	23	.0219	47 97	27	.0433
4	9	14 42	5	.0168	16 40	7	.0378	6	18	45 105	25	.0236	49 101	29	.0448
4	10	15 45	6	.0180	17 43	8	.0380	6	19	46 110	26	.0214	51 105	31	.0462
4	11	16 48	7	.0198	18 46	9	.0388	6	20	48 114	28	.0229	53 109	33	.0475
4	12	17 51	8	.0209	19 49	10	.0390	6	21	50 118	30	.0244	55 113	35	.0487
4	13	18 54	9	.0223	20 52	11	.0395	6	22	51 123	31	.0224	57 117	37	.0498
4	14	19 57	10	.0232	21 55	12	.0395	6	23	53 127	33	.0237	58 122	38	.0452
4	15	20 60	11	.0243	22 58	13	.0400	6	24	54 132	34	.0219	60 126	40	.0463
4	16	21 63	12	.0250	24 60	15	.0497	6	25	56 136	36	.0231	62 130	42	.0473
4	17	21 67	12	.0202	25 63	16	.0493	7	7	36 69	9	.0189	39 66	12	.0487
4	18	22 70	13	.0212	26 66	17	.0491	7	8	38 74	11	.0200	41 71	14	.0469
4	19	23 73	14	.0219	27 69	18	.0487	7	9	40 79	13	.0209	43 76	16	.0454
4	20	24 76	15	.0227	28 72	19	.0485	7	10	42 84	15	.0215	45 81	18	.0439
4	21	25 79	16	.0233	29 75	20	.0481	7	11	44 89	17	.0221	47 86	20	.0427
4	22	26 82	17	.0240	30 78	21	.0480	7	12	46 94	19	.0225	49 91	22	.0416
4	23	27 85	18	.0246	31 81	22	.0477	7	13	48 99	21	.0228	52 95	25	.0484
4	24	27 89	18	.0211	32 84	23	.0475	7	14	50 104	23	.0230	54 100	27	.0469
4	25	28 92	19	.0217	33 87	24	.0473	7	15	52 109	25	.0233	56 105	29	.0455
5	5	17 38	3	.0159	19 36	5	.0476	7	16	54 114	27	.0234	58 110	31	.0443
5	6	18 42	4	.0152	20 40	6	.0411	7	17	56 119	29	.0236	61 114	34	.0497
5	7	20 45	6	.0240	21 44	7	.0366	7	18	58 124	31	.0237	63 119	36	.0484
5	8	21 49	7	.0225	23 47	9	.0466	7	19	60 129	33	.0238	65 124	38	.0471
5	9	22 53	8	.0210	24 51	10	.0415	7	20	62 134	35	.0239	67 129	40	.0460

1-tail		$\alpha = 0.025$			$\alpha = 0.05$		
2-tail		$\alpha = 0.05$			$\alpha = 0.10$		
m	*n*	*W*	*d*	*P*	*W*	*d*	*P*
7	21	64 139	37	.0240	69 134	42	.0449
7	22	66 144	39	.0240	72 138	45	.0492
7	23	68 149	41	.0241	74 143	47	.0481
7	24	70 154	43	.0241	76 148	49	.0470
7	25	72 159	45	.0242	78 153	51	.0461
8	8	49 87	14	.0249	51 85	16	.0415
8	9	51 93	16	.0232	54 90	19	.0464
8	10	53 99	18	.0217	56 96	21	.0416
8	11	55 105	20	.0204	59 101	24	.0454
8	12	58 110	23	.0237	62 106	27	.0489
8	13	60 116	25	.0223	64 112	29	.0445
8	14	62 122	27	.0211	67 117	32	.0475
8	15	65 127	30	.0237	69 123	34	.0437
8	16	67 133	32	.0224	72 128	37	.0463
8	17	70 138	35	.0247	75 133	40	.0487
8	18	72 144	37	.0235	77 139	42	.0452
8	19	74 150	39	.0224	80 144	45	.0475
8	20	77 155	42	.0244	83 149	48	.0495
8	21	79 161	44	.0233	85 155	50	.0464
8	22	81 167	46	.0223	88 160	53	.0483
8	23	84 172	49	.0240	90 166	55	.0454
8	24	86 178	51	.0231	93 171	58	.0472
8	25	89 183	54	.0247	96 176	61	.0488
9	9	62 109	18	.0200	66 105	22	.0470
9	10	65 115	21	.0217	69 111	25	.0474
9	11	68 121	24	.0232	72 117	28	.0476
9	12	71 127	27	.0245	75 123	31	.0477
9	13	73 134	29	.0217	78 129	34	.0478
9	14	76 140	32	.0228	81 135	37	.0478
9	15	79 146	35	.0238	84 141	40	.0478
9	16	82 152	38	.0247	87 147	43	.0477
9	17	84 159	40	.0223	90 153	46	.0476
9	18	87 165	43	.0231	93 159	49	.0475
9	19	90 171	46	.0239	96 165	52	.0474
9	20	93 177	49	.0245	99 171	55	.0473
9	21	95 184	51	.0225	102 177	58	.0472
9	22	98 190	54	.0231	105 183	61	.0471
9	23	101 196	57	.0237	108 189	64	.0470
9	24	104 202	60	.0243	111 195	67	.0469
9	25	107 208	63	.0249	114 201	70	.0468
10	10	78 132	24	.0216	82 128	28	.0446
10	11	81 139	27	.0215	86 134	32	.0493
10	12	84 146	30	.0213	89 141	35	.0465
10	13	88 152	34	.0247	92 148	38	.0441
10	14	91 159	37	.0242	96 154	42	.0478
10	15	94 166	40	.0238	99 161	45	.0455
10	16	97 173	43	.0234	103 167	49	.0487
10	17	100 180	46	.0230	106 174	52	.0465
10	18	103 187	49	.0226	110 180	56	.0493
10	19	107 193	53	.0250	113 187	59	.0472

1-tail		$\alpha = 0.025$			$\alpha = 0.05$		
2-tail		$\alpha = 0.05$			$\alpha = 0.10$		
m	*n*	*W*	*d*	*P*	*W*	*d*	*P*
10	20	110 200	56	.0245	117 193	62	.0498
10	21	113 207	59	.0241	120 200	65	.0478
10	22	116 214	62	.0237	123 207	68	.0459
10	23	119 221	65	.0233	127 213	72	.0482
10	24	122 228	68	.0230	130 220	75	.0465
10	25	126 234	72	.0248	134 226	79	.0486
11	11	96 157	31	.0237	100 153	34	.0440
11	12	99 165	34	.0219	104 160	38	.0454
11	13	103 172	38	.0237	108 167	42	.0467
11	14	106 180	41	.0221	112 174	46	.0477
11	15	110 187	45	.0236	116 181	50	.0486
11	16	113 195	48	.0221	120 188	54	.0494
11	17	117 202	52	.0235	123 196	57	.0453
11	18	121 209	56	.0247	127 203	61	.0461
11	19	124 217	59	.0233	131 210	65	.0468
11	20	128 224	63	.0244	135 217	69	.0474
11	21	131 232	66	.0230	139 224	73	.0480
11	22	135 239	70	.0240	143 231	77	.0486
11	23	139 246	74	.0250	147 238	81	.0490
11	24	142 254	77	.0237	151 245	85	.0495
11	25	146 261	81	.0246	155 252	89	.0499
12	12	115 185	38	.0225	120 180	42	.0444
12	13	119 193	42	.0229	125 187	47	.0488
12	14	123 201	46	.0232	129 195	51	.0475
12	15	127 209	50	.0234	133 203	55	.0463
12	16	131 217	54	.0236	138 210	60	.0500
12	17	135 225	58	.0238	142 218	64	.0486
12	18	139 233	62	.0239	146 226	68	.0474
12	19	143 241	66	.0240	150 234	72	.0463
12	20	147 249	70	.0241	155 241	77	.0493
12	21	151 257	74	.0242	159 249	81	.0481
12	22	155 265	78	.0242	163 257	85	.0471
12	23	159 273	82	.0243	168 264	90	.0496
12	24	163 281	86	.0243	172 272	94	.0486
12	25	167 289	90	.0243	176 280	98	.0475
13	13	136 215	46	.0221	142 209	51	.0454
13	14	141 223	51	.0241	147 217	56	.0472
13	15	145 232	55	.0232	152 225	61	.0489
13	16	150 240	60	.0250	156 234	65	.0458
13	17	154 249	64	.0240	161 242	70	.0472
13	18	158 258	68	.0232	166 250	75	.0485
13	19	163 266	73	.0247	171 258	80	.0497
13	20	167 275	77	.0238	175 267	84	.0470
13	21	171 284	81	.0231	180 275	89	.0481
13	22	176 292	86	.0243	185 283	94	.0491
13	23	180 301	90	.0236	189 292	98	.0467
13	24	185 309	95	.0247	194 300	103	.0476
13	25	189 318	99	.0240	199 308	108	.0485
14	14	160 246	56	.0249	166 240	61	.0469
14	15	164 256	60	.0229	171 249	66	.0466

APPENDIX C: Tables of Distributions and Critical Values

1-tail		$\alpha = 0.025$			$\alpha = 0.05$		
2-tail		$\alpha = 0.05$			$\alpha = 0.10$		
m	n	W	d	P	W	d	P
14	16	169 265	65	.0236	176 258	72	.0463
14	17	174 274	70	.0242	182 266	78	.0500
14	18	179 283	75	.0247	187 275	83	.0495
14	19	183 293	79	.0230	192 284	88	.0489
14	20	188 302	84	.0235	197 293	93	.0484
14	21	193 311	89	.0239	202 302	98	.0480
14	22	198 320	94	.0243	207 311	103	.0475
14	23	203 329	99	.0247	212 320	108	.0471
14	24	207 339	103	.0233	218 328	114	.0498
14	25	212 348	108	.0236	223 337	119	.0492
15	15	184 281	65	.0227	192 273	73	.0488
15	16	190 290	71	.0247	197 283	78	.0466
15	17	195 300	76	.0243	203 292	84	.0485
15	18	200 310	81	.0239	208 302	89	.0465
15	19	205 320	86	.0235	214 311	95	.0482
15	20	210 330	91	.0232	220 320	101	.0497
15	21	216 339	97	.0247	225 330	106	.0478
15	22	221 349	102	.0243	231 339	112	.0492
15	23	226 359	107	.0239	236 349	117	.0474
15	24	231 369	112	.0235	242 358	123	.0486
15	25	237 378	118	.0248	248 367	129	.0499
16	16	211 317	76	.0234	219 309	84	.0469
16	17	217 327	82	.0243	225 319	90	.0471
16	18	222 338	87	.0231	231 329	96	.0473
16	19	228 348	93	.0239	237 339	102	.0474
16	20	234 358	99	.0247	243 349	108	.0475
16	21	239 369	104	.0235	249 359	114	.0475
16	22	245 379	110	.0242	255 369	120	.0476
16	23	251 389	116	.0248	261 379	126	.0476
16	24	256 400	121	.0238	267 389	132	.0476
16	25	262 410	127	.0243	273 399	138	.0476
17	17	240 355	88	.0243	249 346	97	.0493
17	18	246 366	94	.0243	255 357	103	.0479
17	19	252 377	100	.0243	262 367	110	.0499
17	20	258 388	106	.0242	268 378	116	.0485
17	21	264 399	112	.0242	274 389	122	.0473
17	22	270 410	118	.0241	281 399	129	.0490
17	23	276 421	124	.0240	287 410	135	.0477

1-tail		$\alpha = 0.025$			$\alpha = 0.05$		
2-tail		$\alpha = 0.05$			$\alpha = 0.10$		
m	n	W	d	P	W	d	P
17	24	282 432	130	.0239	294 420	141	.0492
17	25	288 443	136	.0238	300 431	147	.0480
18	18	270 396	100	.0235	280 386	109	.0485
18	19	277 407	107	.0246	287 397	116	.0490
18	20	283 419	113	.0238	294 408	123	.0495
18	21	290 430	120	.0247	301 419	130	.0499
18	22	296 442	126	.0240	307 431	136	.0474
18	23	303 453	133	.0248	314 442	143	.0478
18	24	309 465	139	.0240	321 453	150	.0481
18	25	316 476	146	.0248	328 464	157	.0484
19	19	303 438	114	.0248	313 428	123	.0482
19	20	309 451	120	.0234	320 440	130	.0474
19	21	316 463	127	.0236	328 451	138	.0494
19	22	323 475	134	.0238	335 463	145	.0486
19	23	330 487	141	.0240	342 475	152	.0478
19	24	337 499	148	.0241	350 486	160	.0496
19	25	344 511	155	.0243	357 498	167	.0488
20	20	337 483	128	.0245	348 472	138	.0482
20	21	344 496	135	.0241	356 484	146	.0490
20	22	351 509	142	.0236	364 496	154	.0497
20	23	359 521	150	.0246	371 509	161	.0478
20	24	366 534	157	.0242	379 521	169	.0484
20	25	373 547	164	.0237	387 533	177	.0490
21	21	373 530	143	.0245	385 518	154	.0486
21	22	381 543	151	.0249	393 531	162	.0482
21	23	388 557	158	.0238	401 544	170	.0478
21	24	396 570	166	.0242	410 556	179	.0497
21	25	404 583	174	.0245	418 569	187	.0492
22	22	411 579	159	.0247	424 566	171	.0491
22	23	419 593	167	.0244	432 580	179	.0477
22	24	427 607	175	.0242	441 593	188	.0486
22	25	435 621	183	.0240	450 606	197	.0494
23	23	451 630	176	.0249	465 616	189	.0499
23	24	459 645	184	.0242	474 630	198	.0497
23	25	468 659	193	.0246	483 644	207	.0495
24	24	492 684	193	.0241	507 669	207	.0486
24	25	501 699	202	.0241	517 683	217	.0496
25	25	536 739	212	.0247	552 723	227	.0497

TABLE C.9
Critical values for Duncan's multiple range test*

Least significant studentized ranges for testing p successive values out of a linearly ordered arrangement of k sample means from a normal population with ν degrees of freedom.

	$\alpha = 0.05$						$\alpha = 0.01$				
ν \ p	2	3	4	5	6	ν \ p	2	3	4	5	6
1	17.97	17.97	17.97	17.97	17.97	1	90.03	90.03	90.03	90.03	90.03
2	6.085	6.085	6.085	6.085	6.085	2	14.04	14.04	14.04	14.04	14.04
3	4.501	4.516	4.516	4.516	4.516	3	8.261	8.321	8.321	8.321	8.321
4	3.927	4.013	4.033	4.033	4.033	4	6.512	6.677	6.740	6.756	6.756
5	3.635	3.749	3.797	3.814	3.814	5	5.702	5.893	5.989	6.040	6.065
6	3.461	3.587	3.649	3.680	3.694	6	5.243	5.439	5.549	5.614	5.655
7	3.344	3.477	3.548	3.588	3.611	7	4.949	5.145	5.260	5.334	5.383
8	3.261	3.399	3.475	3.521	3.549	8	4.746	4.939	5.057	5.135	5.189
9	3.199	3.339	3.420	3.470	3.502	9	4.596	4.787	4.906	4.986	5.043
10	3.151	3.293	3.376	3.430	3.465	10	4.482	4.671	4.790	4.871	4.931
11	3.113	3.256	3.342	3.397	3.435	11	4.392	4.579	4.697	4.780	4.841
12	3.082	3.225	3.313	3.370	3.410	12	4.320	4.504	4.622	4.706	4.767
13	3.055	3.200	3.289	3.348	3.389	13	4.260	4.442	4.560	4.644	4.706
14	3.033	3.178	3.268	3.329	3.372	14	4.210	4.391	4.508	4.591	4.654
15	3.014	3.160	3.250	3.312	3.356	15	4.168	4.347	4.463	4.547	4.610
16	2.998	3.144	3.235	3.298	3.343	16	4.131	4.309	4.425	4.509	4.572
17	2.984	3.130	3.222	3.285	3.331	17	4.099	4.275	4.391	4.475	4.539
18	2.971	3.118	3.210	3.274	3.321	18	4.071	4.246	4.362	4.445	4.509
19	2.960	3.107	3.199	3.264	3.311	19	4.046	4.220	4.335	4.419	4.483
20	2.950	3.097	3.190	3.255	3.303	20	4.024	4.197	4.312	4.395	4.459
24	2.919	3.066	3.160	3.226	3.276	24	3.956	4.126	4.239	4.322	4.386
30	2.888	3.035	3.131	3.199	3.250	30	3.889	4.056	4.168	4.250	4.314
40	2.858	3.006	3.102	3.171	3.224	40	3.825	3.988	4.098	4.180	4.244
60	2.829	2.976	3.073	3.143	3.198	60	3.762	3.922	4.031	4.111	4.174
120	2.800	2.947	3.045	3.116	3.172	120	3.702	3.858	3.965	4.044	4.107
∞	2.772	2.918	3.017	3.089	3.146	∞	3.643	3.796	3.900	3.978	4.040

*Reproduced with kind permission from H. Leon Harter and N. Balakrishnan, 1998. *Tables for the Use of Range and Studentized Range in Tests of Hypotheses*, CRC Press, New York, 558–561.

APPENDIX C: Tables of Distributions and Critical Values

TABLE C.10
Fisher's Z transformation of correlation coefficient r

r	0	1	2	3	4	5	6	7	8	9	r
0.00	0.0000	0.0010	0.0020	0.0030	0.0040	0.0050	0.0060	0.0070	0.0080	0.0090	**0.00**
0.01	0.0100	0.0110	0.0120	0.0130	0.0140	0.0150	0.0160	0.0170	0.0180	0.0190	**0.01**
0.02	0.0200	0.0210	0.0220	0.0230	0.0240	0.0250	0.0260	0.0270	0.0280	0.0290	**0.02**
0.03	0.0300	0.0310	0.0320	0.0330	0.0340	0.0350	0.0360	0.0370	0.0380	0.0390	**0.03**
0.04	0.0400	0.0410	0.0420	0.0430	0.0440	0.0450	0.0460	0.0470	0.0480	0.0490	**0.04**
0.05	0.0500	0.0510	0.0520	0.0530	0.0541	0.0551	0.0561	0.0571	0.0581	0.0591	**0.05**
0.06	0.0601	0.0611	0.0621	0.0631	0.0641	0.0651	0.0661	0.0671	0.0681	0.0691	**0.06**
0.07	0.0701	0.0711	0.0721	0.0731	0.0741	0.0751	0.0761	0.0772	0.0782	0.0792	**0.07**
0.08	0.0802	0.0812	0.0822	0.0832	0.0842	0.0852	0.0862	0.0872	0.0882	0.0892	**0.08**
0.09	0.0902	0.0913	0.0923	0.0933	0.0943	0.0953	0.0963	0.0973	0.0983	0.0993	**0.09**
0.10	0.1003	0.1013	0.1024	0.1034	0.1044	0.1054	0.1064	0.1074	0.1084	0.1094	**0.10**
0.11	0.1104	0.1115	0.1125	0.1135	0.1145	0.1155	0.1165	0.1175	0.1186	0.1196	**0.11**
0.12	0.1206	0.1216	0.1226	0.1236	0.1246	0.1257	0.1267	0.1277	0.1287	0.1297	**0.12**
0.13	0.1307	0.1318	0.1328	0.1338	0.1348	0.1358	0.1368	0.1379	0.1389	0.1399	**0.13**
0.14	0.1409	0.1419	0.1430	0.1440	0.1450	0.1460	0.1471	0.1481	0.1491	0.1501	**0.14**
0.15	0.1511	0.1522	0.1532	0.1542	0.1552	0.1563	0.1573	0.1583	0.1593	0.1604	**0.15**
0.16	0.1614	0.1624	0.1634	0.1645	0.1655	0.1665	0.1676	0.1686	0.1696	0.1706	**0.16**
0.17	0.1717	0.1727	0.1737	0.1748	0.1758	0.1768	0.1779	0.1789	0.1799	0.1809	**0.17**
0.18	0.1820	0.1830	0.1841	0.1851	0.1861	0.1872	0.1882	0.1892	0.1903	0.1913	**0.18**
0.19	0.1923	0.1934	0.1944	0.1955	0.1965	0.1975	0.1986	0.1996	0.2007	0.2017	**0.19**
0.20	0.2027	0.2038	0.2048	0.2059	0.2069	0.2079	0.2090	0.2100	0.2111	0.2121	**0.20**
0.21	0.2132	0.2142	0.2153	0.2163	0.2174	0.2184	0.2195	0.2205	0.2216	0.2226	**0.21**
0.22	0.2237	0.2247	0.2258	0.2268	0.2279	0.2289	0.2300	0.2310	0.2321	0.2331	**0.22**
0.23	0.2342	0.2352	0.2363	0.2374	0.2384	0.2395	0.2405	0.2416	0.2427	0.2437	**0.23**
0.24	0.2448	0.2458	0.2469	0.2480	0.2490	0.2501	0.2512	0.2522	0.2533	0.2543	**0.24**
0.25	0.2554	0.2565	0.2575	0.2586	0.2597	0.2608	0.2618	0.2629	0.2640	0.2650	**0.25**
0.26	0.2661	0.2672	0.2683	0.2693	0.2704	0.2715	0.2726	0.2736	0.2747	0.2758	**0.26**
0.27	0.2769	0.2779	0.2790	0.2801	0.2812	0.2823	0.2833	0.2844	0.2855	0.2866	**0.27**
0.28	0.2877	0.2888	0.2899	0.2909	0.2920	0.2931	0.2942	0.2953	0.2964	0.2975	**0.28**
0.29	0.2986	0.2997	0.3008	0.3018	0.3029	0.3040	0.3051	0.3062	0.3073	0.3084	**0.29**
0.30	0.3095	0.3106	0.3117	0.3128	0.3139	0.3150	0.3161	0.3172	0.3183	0.3194	**0.30**
0.31	0.3205	0.3217	0.3228	0.3239	0.3250	0.3261	0.3272	0.3283	0.3294	0.3305	**0.31**
0.32	0.3316	0.3328	0.3339	0.3350	0.3361	0.3372	0.3383	0.3395	0.3406	0.3417	**0.32**
0.33	0.3428	0.3440	0.3451	0.3462	0.3473	0.3484	0.3496	0.3507	0.3518	0.3530	**0.33**
0.34	0.3541	0.3552	0.3564	0.3575	0.3586	0.3598	0.3609	0.3620	0.3632	0.3643	**0.34**
0.35	0.3654	0.3666	0.3677	0.3689	0.3700	0.3712	0.3723	0.3734	0.3746	0.3757	**0.35**
0.36	0.3769	0.3780	0.3792	0.3803	0.3815	0.3826	0.3838	0.3850	0.3861	0.3873	**0.36**
0.37	0.3884	0.3896	0.3907	0.3919	0.3931	0.3942	0.3954	0.3966	0.3977	0.3989	**0.37**
0.38	0.4001	0.4012	0.4024	0.4036	0.4047	0.4059	0.4071	0.4083	0.4094	0.4106	**0.38**
0.39	0.4118	0.4130	0.4142	0.4153	0.4165	0.4177	0.4189	0.4201	0.4213	0.4225	**0.39**
0.40	0.4236	0.4248	0.4260	0.4272	0.4284	0.4296	0.4308	0.4320	0.4332	0.4344	**0.40**
0.41	0.4356	0.4368	0.4380	0.4392	0.4404	0.4416	0.4428	0.4441	0.4453	0.4465	**0.41**
0.42	0.4477	0.4489	0.4501	0.4513	0.4526	0.4538	0.4550	0.4562	0.4574	0.4587	**0.42**
0.43	0.4599	0.4611	0.4624	0.4636	0.4648	0.4660	0.4673	0.4685	0.4698	0.4710	**0.43**
0.44	0.4722	0.4735	0.4747	0.4760	0.4772	0.4784	0.4797	0.4809	0.4822	0.4834	**0.44**
0.45	0.4847	0.4860	0.4872	0.4885	0.4897	0.4910	0.4922	0.4935	0.4948	0.4960	**0.45**
0.46	0.4973	0.4986	0.4999	0.5011	0.5024	0.5037	0.5049	0.5062	0.5075	0.5088	**0.46**
0.47	0.5101	0.5114	0.5126	0.5139	0.5152	0.5165	0.5178	0.5191	0.5204	0.5217	**0.47**
0.48	0.5230	0.5243	0.5256	0.5269	0.5282	0.5295	0.5308	0.5321	0.5334	0.5347	**0.48**
0.49	0.5361	0.5374	0.5387	0.5400	0.5413	0.5427	0.5440	0.5453	0.5466	0.5480	**0.49**

r	0	1	2	3	4	5	6	7	8	9	r
0.50	0.5493	0.5506	0.5520	0.5533	0.5547	0.5560	0.5573	0.5587	0.5600	0.5614	**0.50**
0.51	0.5627	0.5641	0.5654	0.5668	0.5682	0.5695	0.5709	0.5722	0.5736	0.5750	**0.51**
0.52	0.5763	0.5777	0.5791	0.5805	0.5818	0.5832	0.5846	0.5860	0.5874	0.5888	**0.52**
0.53	0.5901	0.5915	0.5929	0.5943	0.5957	0.5971	0.5985	0.5999	0.6013	0.6027	**0.53**
0.54	0.6042	0.6056	0.6070	0.6084	0.6098	0.6112	0.6127	0.6141	0.6155	0.6169	**0.54**
0.55	0.6184	0.6198	0.6213	0.6227	0.6241	0.6256	0.6270	0.6285	0.6299	0.6314	**0.55**
0.56	0.6328	0.6343	0.6358	0.6372	0.6387	0.6401	0.6416	0.6431	0.6446	0.6460	**0.56**
0.57	0.6475	0.6490	0.6505	0.6520	0.6535	0.6550	0.6565	0.6580	0.6595	0.6610	**0.57**
0.58	0.6625	0.6640	0.6655	0.6670	0.6685	0.6700	0.6716	0.6731	0.6746	0.6761	**0.58**
0.59	0.6777	0.6792	0.6807	0.6823	0.6838	0.6854	0.6869	0.6885	0.6900	0.6916	**0.59**
0.60	0.6931	0.6947	0.6963	0.6978	0.6994	0.7010	0.7026	0.7042	0.7057	0.7073	**0.60**
0.61	0.7089	0.7105	0.7121	0.7137	0.7153	0.7169	0.7185	0.7201	0.7218	0.7234	**0.61**
0.62	0.7250	0.7266	0.7283	0.7299	0.7315	0.7332	0.7348	0.7365	0.7381	0.7398	**0.62**
0.63	0.7414	0.7431	0.7447	0.7464	0.7481	0.7498	0.7514	0.7531	0.7548	0.7565	**0.63**
0.64	0.7582	0.7599	0.7616	0.7633	0.7650	0.7667	0.7684	0.7701	0.7718	0.7736	**0.64**
0.65	0.7753	0.7770	0.7788	0.7805	0.7823	0.7840	0.7858	0.7875	0.7893	0.7910	**0.65**
0.66	0.7928	0.7946	0.7964	0.7981	0.7999	0.8017	0.8035	0.8053	0.8071	0.8089	**0.66**
0.67	0.8107	0.8126	0.8144	0.8162	0.8180	0.8199	0.8217	0.8236	0.8254	0.8273	**0.67**
0.68	0.8291	0.8310	0.8328	0.8347	0.8366	0.8385	0.8404	0.8423	0.8441	0.8460	**0.68**
0.69	0.8480	0.8499	0.8518	0.8537	0.8556	0.8576	0.8595	0.8614	0.8634	0.8653	**0.69**
0.70	0.8673	0.8693	0.8712	0.8732	0.8752	0.8772	0.8792	0.8812	0.8832	0.8852	**0.70**
0.71	0.8872	0.8892	0.8912	0.8933	0.8953	0.8973	0.8994	0.9014	0.9035	0.9056	**0.71**
0.72	0.9076	0.9097	0.9118	0.9139	0.9160	0.9181	0.9202	0.9223	0.9245	0.9266	**0.72**
0.73	0.9287	0.9309	0.9330	0.9352	0.9373	0.9395	0.9417	0.9439	0.9461	0.9483	**0.73**
0.74	0.9505	0.9527	0.9549	0.9571	0.9594	0.9616	0.9639	0.9661	0.9684	0.9707	**0.74**
0.75	0.9730	0.9752	0.9775	0.9798	0.9822	0.9845	0.9868	0.9892	0.9915	0.9939	**0.75**
0.76	0.9962	0.9986	1.0010	1.0034	1.0058	1.0082	1.0106	1.0130	1.0154	1.0179	**0.76**
0.77	1.0203	1.0228	1.0253	1.0277	1.0302	1.0327	1.0352	1.0378	1.0403	1.0428	**0.77**
0.78	1.0454	1.0479	1.0505	1.0531	1.0557	1.0583	1.0609	1.0635	1.0661	1.0688	**0.78**
0.79	1.0714	1.0741	1.0768	1.0795	1.0822	1.0849	1.0876	1.0903	1.0931	1.0958	**0.79**
0.80	1.0986	1.1014	1.1042	1.1070	1.1098	1.1127	1.1155	1.1184	1.1212	1.1241	**0.80**
0.81	1.1270	1.1299	1.1329	1.1358	1.1388	1.1417	1.1447	1.1477	1.1507	1.1538	**0.81**
0.82	1.1568	1.1599	1.1630	1.1660	1.1692	1.1723	1.1754	1.1786	1.1817	1.1849	**0.82**
0.83	1.1881	1.1914	1.1946	1.1979	1.2011	1.2044	1.2077	1.2111	1.2144	1.2178	**0.83**
0.84	1.2212	1.2246	1.2280	1.2315	1.2349	1.2384	1.2419	1.2454	1.2490	1.2526	**0.84**
0.85	1.2562	1.2598	1.2634	1.2671	1.2707	1.2745	1.2782	1.2819	1.2857	1.2895	**0.85**
0.86	1.2933	1.2972	1.3011	1.3050	1.3089	1.3129	1.3169	1.3209	1.3249	1.3290	**0.86**
0.87	1.3331	1.3372	1.3414	1.3456	1.3498	1.3540	1.3583	1.3626	1.3670	1.3714	**0.87**
0.88	1.3758	1.3802	1.3847	1.3892	1.3938	1.3984	1.4030	1.4077	1.4124	1.4171	**0.88**
0.89	1.4219	1.4268	1.4316	1.4365	1.4415	1.4465	1.4516	1.4566	1.4618	1.4670	**0.89**
0.90	1.4722	1.4775	1.4828	1.4882	1.4937	1.4992	1.5047	1.5103	1.5160	1.5217	**0.90**
0.91	1.5275	1.5334	1.5393	1.5453	1.5513	1.5574	1.5636	1.5698	1.5762	1.5826	**0.91**
0.92	1.5890	1.5956	1.6022	1.6089	1.6157	1.6226	1.6296	1.6366	1.6438	1.6510	**0.92**
0.93	1.6584	1.6658	1.6734	1.6811	1.6888	1.6967	1.7047	1.7129	1.7211	1.7295	**0.93**
0.94	1.7380	1.7467	1.7555	1.7645	1.7736	1.7828	1.7923	1.8019	1.8117	1.8216	**0.94**
0.95	1.8318	1.8421	1.8527	1.8635	1.8745	1.8857	1.8972	1.9090	1.9210	1.9333	**0.95**
0.96	1.9459	1.9588	1.9721	1.9857	1.9996	2.0139	2.0287	2.0439	2.0595	2.0756	**0.96**
0.97	2.0923	2.1095	2.1273	2.1457	2.1649	2.1847	2.2054	2.2269	2.2494	2.2729	**0.97**
0.98	2.2976	2.3235	2.3507	2.3796	2.4101	2.4427	2.4774	2.5147	2.5550	2.5987	**0.98**
0.99	2.6467	2.6996	2.7587	2.8257	2.9031	2.9945	3.1063	3.2504	3.4534	3.8002	**0.99**

$$z = \tanh^{-1} r = 0.5 \ln\left(\frac{1+r}{1-r}\right)$$

APPENDIX C: Tables of Distributions and Critical Values

TABLE C.11
Correlation coefficient r corresponding to Fisher's Z transformation

z	0	1	2	3	4	5	6	7	8	9	z
0.00	0.0000	0.0010	0.0020	0.0030	0.0040	0.0050	0.0060	0.0070	0.0080	0.0090	**0.00**
0.01	0.0100	0.0110	0.0120	0.0130	0.0140	0.0150	0.0160	0.0170	0.0180	0.0190	**0.01**
0.02	0.0200	0.0210	0.0220	0.0230	0.0240	0.0250	0.0260	0.0270	0.0280	0.0290	**0.02**
0.03	0.0300	0.0310	0.0320	0.0330	0.0340	0.0350	0.0360	0.0370	0.0380	0.0390	**0.03**
0.04	0.0400	0.0410	0.0420	0.0430	0.0440	0.0450	0.0460	0.0470	0.0480	0.0490	**0.04**
0.05	0.0500	0.0510	0.0520	0.0530	0.0539	0.0549	0.0559	0.0569	0.0579	0.0589	**0.05**
0.06	0.0599	0.0609	0.0619	0.0629	0.0639	0.0649	0.0659	0.0669	0.0679	0.0689	**0.06**
0.07	0.0699	0.0709	0.0719	0.0729	0.0739	0.0749	0.0759	0.0768	0.0778	0.0788	**0.07**
0.08	0.0798	0.0808	0.0818	0.0828	0.0838	0.0848	0.0858	0.0868	0.0878	0.0888	**0.08**
0.09	0.0898	0.0907	0.0917	0.0927	0.0937	0.0947	0.0957	0.0967	0.0977	0.0987	**0.09**
0.10	0.0997	0.1007	0.1016	0.1026	0.1036	0.1046	0.1056	0.1066	0.1076	0.1086	**0.10**
0.11	0.1096	0.1105	0.1115	0.1125	0.1135	0.1145	0.1155	0.1165	0.1175	0.1184	**0.11**
0.12	0.1194	0.1204	0.1214	0.1224	0.1234	0.1244	0.1253	0.1263	0.1273	0.1283	**0.12**
0.13	0.1293	0.1303	0.1312	0.1322	0.1332	0.1342	0.1352	0.1361	0.1371	0.1381	**0.13**
0.14	0.1391	0.1401	0.1411	0.1420	0.1430	0.1440	0.1450	0.1460	0.1469	0.1479	**0.14**
0.15	0.1489	0.1499	0.1508	0.1518	0.1528	0.1538	0.1547	0.1557	0.1567	0.1577	**0.15**
0.16	0.1586	0.1596	0.1606	0.1616	0.1625	0.1635	0.1645	0.1655	0.1664	0.1674	**0.16**
0.17	0.1684	0.1694	0.1703	0.1713	0.1723	0.1732	0.1742	0.1752	0.1761	0.1771	**0.17**
0.18	0.1781	0.1790	0.1800	0.1810	0.1820	0.1829	0.1839	0.1849	0.1858	0.1868	**0.18**
0.19	0.1877	0.1887	0.1897	0.1906	0.1916	0.1926	0.1935	0.1945	0.1955	0.1964	**0.19**
0.20	0.1974	0.1983	0.1993	0.2003	0.2012	0.2022	0.2031	0.2041	0.2051	0.2060	**0.20**
0.21	0.2070	0.2079	0.2089	0.2098	0.2108	0.2117	0.2127	0.2137	0.2146	0.2156	**0.21**
0.22	0.2165	0.2175	0.2184	0.2194	0.2203	0.2213	0.2222	0.2232	0.2241	0.2251	**0.22**
0.23	0.2260	0.2270	0.2279	0.2289	0.2298	0.2308	0.2317	0.2327	0.2336	0.2346	**0.23**
0.24	0.2355	0.2364	0.2374	0.2383	0.2393	0.2402	0.2412	0.2421	0.2430	0.2440	**0.24**
0.25	0.2449	0.2459	0.2468	0.2477	0.2487	0.2496	0.2506	0.2515	0.2524	0.2534	**0.25**
0.26	0.2543	0.2552	0.2562	0.2571	0.2580	0.2590	0.2599	0.2608	0.2618	0.2627	**0.26**
0.27	0.2636	0.2646	0.2655	0.2664	0.2673	0.2683	0.2692	0.2701	0.2711	0.2720	**0.27**
0.28	0.2729	0.2738	0.2748	0.2757	0.2766	0.2775	0.2784	0.2794	0.2803	0.2812	**0.28**
0.29	0.2821	0.2831	0.2840	0.2849	0.2858	0.2867	0.2876	0.2886	0.2895	0.2904	**0.29**
0.30	0.2913	0.2922	0.2931	0.2941	0.2950	0.2959	0.2968	0.2977	0.2986	0.2995	**0.30**
0.31	0.3004	0.3013	0.3023	0.3032	0.3041	0.3050	0.3059	0.3068	0.3077	0.3086	**0.31**
0.32	0.3095	0.3104	0.3113	0.3122	0.3131	0.3140	0.3149	0.3158	0.3167	0.3176	**0.32**
0.33	0.3185	0.3194	0.3203	0.3212	0.3221	0.3230	0.3239	0.3248	0.3257	0.3266	**0.33**
0.34	0.3275	0.3284	0.3293	0.3302	0.3310	0.3319	0.3328	0.3337	0.3346	0.3355	**0.34**
0.35	0.3364	0.3373	0.3381	0.3390	0.3399	0.3408	0.3417	0.3426	0.3435	0.3443	**0.35**
0.36	0.3452	0.3461	0.3470	0.3479	0.3487	0.3496	0.3505	0.3514	0.3522	0.3531	**0.36**
0.37	0.3540	0.3549	0.3557	0.3566	0.3575	0.3584	0.3592	0.3601	0.3610	0.3618	**0.37**
0.38	0.3627	0.3636	0.3644	0.3653	0.3662	0.3670	0.3679	0.3688	0.3696	0.3705	**0.38**
0.39	0.3714	0.3722	0.3731	0.3739	0.3748	0.3757	0.3765	0.3774	0.3782	0.3791	**0.39**
0.40	0.3799	0.3808	0.3817	0.3825	0.3834	0.3842	0.3851	0.3859	0.3868	0.3876	**0.40**
0.41	0.3885	0.3893	0.3902	0.3910	0.3919	0.3927	0.3936	0.3944	0.3952	0.3961	**0.41**
0.42	0.3969	0.3978	0.3986	0.3995	0.4003	0.4011	0.4020	0.4028	0.4036	0.4045	**0.42**
0.43	0.4053	0.4062	0.4070	0.4078	0.4087	0.4095	0.4103	0.4112	0.4120	0.4128	**0.43**
0.44	0.4136	0.4145	0.4153	0.4161	0.4170	0.4178	0.4186	0.4194	0.4203	0.4211	**0.44**
0.45	0.4219	0.4227	0.4235	0.4244	0.4252	0.4260	0.4268	0.4276	0.4285	0.4293	**0.45**
0.46	0.4301	0.4309	0.4317	0.4325	0.4333	0.4342	0.4350	0.4358	0.4366	0.4374	**0.46**
0.47	0.4382	0.4390	0.4398	0.4406	0.4414	0.4422	0.4430	0.4438	0.4446	0.4454	**0.47**
0.48	0.4462	0.4470	0.4478	0.4486	0.4494	0.4502	0.4510	0.4518	0.4526	0.4534	**0.48**
0.49	0.4542	0.4550	0.4558	0.4566	0.4574	0.4582	0.4590	0.4598	0.4605	0.4613	**0.49**

APPENDIX C: Tables of Distributions and Critical Values

z	0	1	2	3	4	5	6	7	8	9	z
0.50	0.4621	0.4629	0.4637	0.4645	0.4653	0.4660	0.4668	0.4676	0.4684	0.4692	**0.50**
0.51	0.4699	0.4707	0.4715	0.4723	0.4731	0.4738	0.4746	0.4754	0.4762	0.4769	**0.51**
0.52	0.4777	0.4785	0.4792	0.4800	0.4808	0.4815	0.4823	0.4831	0.4839	0.4846	**0.52**
0.53	0.4854	0.4861	0.4869	0.4877	0.4884	0.4892	0.4900	0.4907	0.4915	0.4922	**0.53**
0.54	0.4930	0.4937	0.4945	0.4953	0.4960	0.4968	0.4975	0.4983	0.4990	0.4998	**0.54**
0.55	0.5005	0.5013	0.5020	0.5028	0.5035	0.5043	0.5050	0.5057	0.5065	0.5072	**0.55**
0.56	0.5080	0.5087	0.5095	0.5102	0.5109	0.5117	0.5124	0.5132	0.5139	0.5146	**0.56**
0.57	0.5154	0.5161	0.5168	0.5176	0.5183	0.5190	0.5198	0.5205	0.5212	0.5219	**0.57**
0.58	0.5227	0.5234	0.5241	0.5248	0.5256	0.5263	0.5270	0.5277	0.5285	0.5292	**0.58**
0.59	0.5299	0.5306	0.5313	0.5320	0.5328	0.5335	0.5342	0.5349	0.5356	0.5363	**0.59**
0.60	0.5370	0.5378	0.5385	0.5392	0.5399	0.5406	0.5413	0.5420	0.5427	0.5434	**0.60**
0.61	0.5441	0.5448	0.5455	0.5462	0.5469	0.5476	0.5483	0.5490	0.5497	0.5504	**0.61**
0.62	0.5511	0.5518	0.5525	0.5532	0.5539	0.5546	0.5553	0.5560	0.5567	0.5574	**0.62**
0.63	0.5581	0.5587	0.5594	0.5601	0.5608	0.5615	0.5622	0.5629	0.5635	0.5642	**0.63**
0.64	0.5649	0.5656	0.5663	0.5669	0.5676	0.5683	0.5690	0.5696	0.5703	0.5710	**0.64**
0.65	0.5717	0.5723	0.5730	0.5737	0.5744	0.5750	0.5757	0.5764	0.5770	0.5777	**0.65**
0.66	0.5784	0.5790	0.5797	0.5804	0.5810	0.5817	0.5823	0.5830	0.5837	0.5843	**0.66**
0.67	0.5850	0.5856	0.5863	0.5869	0.5876	0.5883	0.5889	0.5896	0.5902	0.5909	**0.67**
0.68	0.5915	0.5922	0.5928	0.5935	0.5941	0.5948	0.5954	0.5961	0.5967	0.5973	**0.68**
0.69	0.5980	0.5986	0.5993	0.5999	0.6005	0.6012	0.6018	0.6025	0.6031	0.6037	**0.69**
0.70	0.6044	0.6050	0.6056	0.6063	0.6069	0.6075	0.6082	0.6088	0.6094	0.6100	**0.70**
0.71	0.6107	0.6113	0.6119	0.6126	0.6132	0.6138	0.6144	0.6150	0.6157	0.6163	**0.71**
0.72	0.6169	0.6175	0.6181	0.6188	0.6194	0.6200	0.6206	0.6212	0.6218	0.6225	**0.72**
0.73	0.6231	0.6237	0.6243	0.6249	0.6255	0.6261	0.6267	0.6273	0.6279	0.6285	**0.73**
0.74	0.6291	0.6297	0.6304	0.6310	0.6316	0.6322	0.6328	0.6334	0.6340	0.6346	**0.74**
0.75	0.6351	0.6357	0.6363	0.6369	0.6375	0.6381	0.6387	0.6393	0.6399	0.6405	**0.75**
0.76	0.6411	0.6417	0.6423	0.6428	0.6434	0.6440	0.6446	0.6452	0.6458	0.6463	**0.76**
0.77	0.6469	0.6475	0.6481	0.6487	0.6492	0.6498	0.6504	0.6510	0.6516	0.6521	**0.77**
0.78	0.6527	0.6533	0.6539	0.6544	0.6550	0.6556	0.6561	0.6567	0.6573	0.6578	**0.78**
0.79	0.6584	0.6590	0.6595	0.6601	0.6607	0.6612	0.6618	0.6624	0.6629	0.6635	**0.79**
0.80	0.6640	0.6646	0.6652	0.6657	0.6663	0.6668	0.6674	0.6679	0.6685	0.6690	**0.80**
0.81	0.6696	0.6701	0.6707	0.6712	0.6718	0.6723	0.6729	0.6734	0.6740	0.6745	**0.81**
0.82	0.6751	0.6756	0.6762	0.6767	0.6772	0.6778	0.6783	0.6789	0.6794	0.6799	**0.82**
0.83	0.6805	0.6810	0.6815	0.6821	0.6826	0.6832	0.6837	0.6842	0.6847	0.6853	**0.83**
0.84	0.6858	0.6863	0.6869	0.6874	0.6879	0.6884	0.6890	0.6895	0.6900	0.6905	**0.84**
0.85	0.6911	0.6916	0.6921	0.6926	0.6932	0.6937	0.6942	0.6947	0.6952	0.6957	**0.85**
0.86	0.6963	0.6968	0.6973	0.6978	0.6983	0.6988	0.6993	0.6998	0.7004	0.7009	**0.86**
0.87	0.7014	0.7019	0.7024	0.7029	0.7034	0.7039	0.7044	0.7049	0.7054	0.7059	**0.87**
0.88	0.7064	0.7069	0.7074	0.7079	0.7084	0.7089	0.7094	0.7099	0.7104	0.7109	**0.88**
0.89	0.7114	0.7119	0.7124	0.7129	0.7134	0.7139	0.7143	0.7148	0.7153	0.7158	**0.89**
0.90	0.7163	0.7168	0.7173	0.7178	0.7182	0.7187	0.7192	0.7197	0.7202	0.7207	**0.90**
0.91	0.7211	0.7216	0.7221	0.7226	0.7230	0.7235	0.7240	0.7245	0.7249	0.7254	**0.91**
0.92	0.7259	0.7264	0.7268	0.7273	0.7278	0.7283	0.7287	0.7292	0.7297	0.7301	**0.92**
0.93	0.7306	0.7311	0.7315	0.7320	0.7325	0.7329	0.7334	0.7338	0.7343	0.7348	**0.93**
0.94	0.7352	0.7357	0.7361	0.7366	0.7371	0.7375	0.7380	0.7384	0.7389	0.7393	**0.94**
0.95	0.7398	0.7402	0.7407	0.7411	0.7416	0.7420	0.7425	0.7429	0.7434	0.7438	**0.95**
0.96	0.7443	0.7447	0.7452	0.7456	0.7461	0.7465	0.7469	0.7474	0.7478	0.7483	**0.96**
0.97	0.7487	0.7491	0.7496	0.7500	0.7505	0.7509	0.7513	0.7518	0.7522	0.7526	**0.97**
0.98	0.7531	0.7535	0.7539	0.7544	0.7548	0.7552	0.7557	0.7561	0.7565	0.7569	**0.98**
0.99	0.7574	0.7578	0.7582	0.7586	0.7591	0.7595	0.7599	0.7603	0.7608	0.7612	**0.99**

APPENDIX C: Tables of Distributions and Critical Values

z	0	1	2	3	4	5	6	7	8	9	z
1.0	0.7616	0.7620	0.7624	0.7629	0.7633	0.7637	0.7641	0.7645	0.7649	0.7653	**1.0**
1.1	0.8005	0.8009	0.8012	0.8016	0.8019	0.8023	0.8026	0.8030	0.8034	0.8037	**1.1**
1.2	0.8337	0.8340	0.8343	0.8346	0.8349	0.8352	0.8355	0.8358	0.8361	0.8364	**1.2**
1.3	0.8617	0.8620	0.8622	0.8625	0.8627	0.8630	0.8633	0.8635	0.8638	0.8640	**1.3**
1.4	0.8854	0.8856	0.8858	0.8860	0.8862	0.8864	0.8866	0.8869	0.8871	0.8873	**1.4**
1.5	0.9051	0.9053	0.9055	0.9057	0.9059	0.9060	0.9062	0.9064	0.9066	0.9068	**1.5**
1.6	0.9217	0.9218	0.9220	0.9221	0.9223	0.9224	0.9226	0.9227	0.9229	0.9230	**1.6**
1.7	0.9354	0.9355	0.9357	0.9358	0.9359	0.9360	0.9362	0.9363	0.9364	0.9365	**1.7**
1.8	0.9468	0.9469	0.9470	0.9471	0.9472	0.9473	0.9474	0.9475	0.9476	0.9477	**1.8**
1.9	0.9562	0.9563	0.9564	0.9565	0.9566	0.9567	0.9567	0.9568	0.9569	0.9570	**1.9**
2.0	0.9640	0.9641	0.9642	0.9642	0.9643	0.9644	0.9644	0.9645	0.9646	0.9647	**2.0**
2.1	0.9705	0.9705	0.9706	0.9706	0.9707	0.9707	0.9708	0.9709	0.9709	0.9710	**2.1**
2.2	0.9757	0.9758	0.9758	0.9759	0.9759	0.9760	0.9760	0.9761	0.9761	0.9762	**2.2**
2.3	0.9801	0.9801	0.9802	0.9802	0.9803	0.9803	0.9803	0.9804	0.9804	0.9804	**2.3**
2.4	0.9837	0.9837	0.9837	0.9838	0.9838	0.9838	0.9839	0.9839	0.9839	0.9840	**2.4**
2.5	0.9866	0.9866	0.9867	0.9867	0.9867	0.9867	0.9868	0.9868	0.9868	0.9869	**2.5**
2.6	0.9890	0.9890	0.9891	0.9891	0.9891	0.9891	0.9892	0.9892	0.9892	0.9892	**2.6**
2.7	0.9910	0.9910	0.9910	0.9911	0.9911	0.9911	0.9911	0.9911	0.9911	0.9912	**2.7**
2.8	0.9926	0.9926	0.9927	0.9927	0.9927	0.9927	0.9927	0.9927	0.9927	0.9928	**2.8**
2.9	0.9940	0.9940	0.9940	0.9940	0.9940	0.9940	0.9940	0.9940	0.9941	0.9941	**2.9**
3.0	0.9951	0.9951	0.9951	0.9951	0.9951	0.9951	0.9951	0.9951	0.9951	0.9951	**3.0**
3.1	0.9959	0.9960	0.9960	0.9960	0.9960	0.9960	0.9960	0.9960	0.9960	0.9960	**3.1**
3.2	0.9967	0.9967	0.9967	0.9967	0.9967	0.9967	0.9967	0.9967	0.9967	0.9967	**3.2**
3.3	0.9973	0.9973	0.9973	0.9973	0.9973	0.9973	0.9973	0.9973	0.9973	0.9973	**3.3**
3.4	0.9978	0.9978	0.9978	0.9978	0.9978	0.9978	0.9978	0.9978	0.9978	0.9978	**3.4**
3.5	0.9982	0.9982	0.9982	0.9982	0.9982	0.9982	0.9982	0.9982	0.9982	0.9982	**3.5**
3.6	0.9985	0.9985	0.9985	0.9985	0.9985	0.9985	0.9985	0.9985	0.9985	0.9985	**3.6**
3.7	0.9988	0.9988	0.9988	0.9988	0.9988	0.9988	0.9988	0.9988	0.9988	0.9988	**3.7**
3.8	0.9990	0.9990	0.9990	0.9990	0.9990	0.9990	0.9990	0.9990	0.9990	0.9990	**3.8**
3.9	0.9992	0.9992	0.9992	0.9992	0.9992	0.9992	0.9992	0.9992	0.9992	0.9992	**3.9**
4.0	0.9993	0.9993	0.9993	0.9993	0.9993	0.9993	0.9993	0.9993	0.9993	0.9993	**4.0**
4.1	0.9995	0.9995	0.9995	0.9995	0.9995	0.9995	0.9995	0.9995	0.9995	0.9995	**4.1**
4.2	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	**4.2**
4.3	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	**4.3**
4.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	**4.4**
4.5	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	**4.5**
4.6	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	**4.6**
4.7	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	**4.7**
4.8	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	**4.8**
4.9	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	**4.9**

$$r = \tanh z = \frac{e^{2z} - 1}{e^{2z} + 1}$$

TABLE C.12
Cumulative distribution for Kendall's test (τ)

$F(c) = P(C \leq c)$, where C is the test statistic (the number of concordances or discordances) for Kendall's test of correlation

	n											
c	4	5	6	7	8	9	10	11	12	13	14	15
0	0.0417	0.0083	0.0014	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1	0.1667	0.0417	0.0083	0.0014	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.3750	0.1167	0.0278	0.0054	0.0009	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3	0.6250	0.2417	0.0681	0.0151	0.0028	0.0004	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
4	0.8333	0.4083	0.1361	0.0345	0.0071	0.0012	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000
5	0.9583	0.5917	0.2347	0.0681	0.0156	0.0029	0.0005	0.0001	0.0000	0.0000	0.0000	0.0000
6	1.0000	0.7583	0.3597	0.1194	0.0305	0.0063	0.0011	0.0002	0.0000	0.0000	0.0000	0.0000
7		0.8833	0.5000	0.1907	0.0543	0.0124	0.0023	0.0004	0.0001	0.0000	0.0000	0.0000
8		0.9583	0.6403	0.2810	0.0894	0.0223	0.0046	0.0008	0.0001	0.0000	0.0000	0.0000
9		0.9917	0.7653	0.3863	0.1375	0.0376	0.0083	0.0016	0.0002	0.0000	0.0000	0.0000
10		1.0000	0.8639	0.5000	0.1994	0.0597	0.0143	0.0029	0.0005	0.0001	0.0000	0.0000
11			0.9319	0.6137	0.2742	0.0901	0.0233	0.0050	0.0009	0.0001	0.0000	0.0000
12			0.9722	0.7190	0.3598	0.1298	0.0363	0.0083	0.0016	0.0003	0.0000	0.0000
13			0.9917	0.8093	0.4524	0.1792	0.0542	0.0132	0.0027	0.0005	0.0001	0.0000
14			0.9986	0.8806	0.5476	0.2384	0.0779	0.0203	0.0044	0.0008	0.0001	0.0000
15			1.0000	0.9319	0.6402	0.3061	0.1082	0.0301	0.0069	0.0013	0.0002	0.0000
16				0.9655	0.7258	0.3807	0.1456	0.0433	0.0105	0.0021	0.0004	0.0001
17				0.9849	0.8006	0.4597	0.1904	0.0605	0.0155	0.0033	0.0006	0.0001
18				0.9946	0.8625	0.5403	0.2422	0.0823	0.0224	0.0051	0.0010	0.0002
19				0.9986	0.9106	0.6193	0.3003	0.1092	0.0314	0.0075	0.0015	0.0003
20				0.9998	0.9457	0.6939	0.3637	0.1415	0.0432	0.0108	0.0023	0.0004
21				1.0000	0.9695	0.7616	0.4309	0.1794	0.0580	0.0152	0.0034	0.0006
22					0.9844	0.8208	0.5000	0.2227	0.0763	0.0211	0.0049	0.0010
23					0.9929	0.8702	0.5691	0.2711	0.0985	0.0286	0.0069	0.0014
24					0.9972	0.9099	0.6363	0.3240	0.1248	0.0382	0.0096	0.0021
25					0.9991	0.9403	0.6997	0.3806	0.1554	0.0500	0.0132	0.0030
26					0.9998	0.9624	0.7578	0.4396	0.1904	0.0644	0.0178	0.0041
27					1.0000	0.9777	0.8096	0.5000	0.2295	0.0817	0.0236	0.0057
28					1.0000	0.9876	0.8544	0.5604	0.2726	0.1022	0.0308	0.0078
29						0.9937	0.8918	0.6194	0.3192	0.1259	0.0397	0.0104
30						0.9971	0.9221	0.6760	0.3687	0.1531	0.0505	0.0137
31						0.9988	0.9458	0.7289	0.4203	0.1837	0.0634	0.0179
32						0.9996	0.9637	0.7773	0.4733	0.2177	0.0786	0.0231
33						0.9999	0.9767	0.8206	0.5267	0.2549	0.0963	0.0295
34						1.0000	0.9857	0.8585	0.5797	0.2950	0.1166	0.0372
35						1.0000	0.9917	0.8908	0.6313	0.3377	0.1396	0.0463
36						1.0000	0.9954	0.9177	0.6808	0.3825	0.1654	0.0571
37							0.9977	0.9395	0.7274	0.4289	0.1940	0.0697
38							0.9989	0.9567	0.7705	0.4762	0.2253	0.0843
39							0.9995	0.9699	0.8096	0.5238	0.2591	0.1009
40							0.9998	0.9797	0.8446	0.5711	0.2953	0.1197
41							0.9999	0.9868	0.8752	0.6175	0.3336	0.1408
42							1.0000	0.9917	0.9015	0.6623	0.3736	0.1641
43							1.0000	0.9950	0.9237	0.7050	0.4150	0.1897
44							1.0000	0.9971	0.9420	0.7451	0.4572	0.2176

APPENDIX C: Tables of Distributions and Critical Values

	n						*n*				
c	16	17	18	19	20	*c*	16	17	18	19	20
≤20	≤ 0.0001	0.0000	0.0000	0.0000	0.0000	70	0.8249	0.5803	0.3270	0.1492	0.0563
21	0.0001	0.0000	0.0000	0.0000	0.0000	71	0.8471	0.6118	0.3544	0.1660	0.0642
22	0.0002	0.0000	0.0000	0.0000	0.0000	72	0.8675	0.6425	0.3826	0.1840	0.0729
23	0.0003	0.0000	0.0000	0.0000	0.0000	73	0.8859	0.6723	0.4114	0.2031	0.0825
24	0.0004	0.0001	0.0000	0.0000	0.0000	74	0.9025	0.7012	0.4407	0.2234	0.0929
25	0.0006	0.0001	0.0000	0.0000	0.0000	75	0.9174	0.7288	0.4703	0.2447	0.1043
26	0.0008	0.0001	0.0000	0.0000	0.0000	76	0.9305	0.7552	0.5000	0.2670	0.1166
27	0.0012	0.0002	0.0000	0.0000	0.0000	77	0.9420	0.7802	0.5297	0.2903	0.1299
28	0.0017	0.0003	0.0001	0.0000	0.0000	78	0.9520	0.8036	0.5593	0.3144	0.1442
29	0.0023	0.0005	0.0001	0.0000	0.0000	79	0.9606	0.8256	0.5886	0.3394	0.1594
30	0.0032	0.0006	0.0001	0.0000	0.0000	80	0.9679	0.8459	0.6174	0.3650	0.1757
31	0.0043	0.0009	0.0002	0.0000	0.0000	81	0.9742	0.8647	0.6456	0.3913	0.1929
32	0.0057	0.0012	0.0002	0.0000	0.0000	82	0.9794	0.8819	0.6730	0.4180	0.2111
33	0.0076	0.0017	0.0003	0.0001	0.0000	83	0.9837	0.8976	0.6995	0.4451	0.2303
34	0.0099	0.0023	0.0004	0.0001	0.0000	84	0.9872	0.9117	0.7251	0.4725	0.2503
35	0.0128	0.0030	0.0006	0.0001	0.0000	85	0.9901	0.9243	0.7496	0.5000	0.2712
36	0.0163	0.0040	0.0008	0.0002	0.0000	86	0.9924	0.9356	0.7729	0.5275	0.2929
37	0.0206	0.0052	0.0011	0.0002	0.0000	87	0.9943	0.9456	0.7949	0.5549	0.3154
38	0.0258	0.0067	0.0015	0.0003	0.0001	88	0.9957	0.9543	0.8157	0.5820	0.3386
39	0.0321	0.0086	0.0020	0.0004	0.0001	89	0.9968	0.9619	0.8352	0.6087	0.3623
40	0.0394	0.0109	0.0026	0.0005	0.0001	90	0.9977	0.9685	0.8533	0.6350	0.3866
41	0.0480	0.0137	0.0033	0.0007	0.0001	91	0.9983	0.9741	0.8700	0.6606	0.4113
42	0.0580	0.0170	0.0043	0.0009	0.0002	92	0.9988	0.9789	0.8855	0.6856	0.4364
43	0.0695	0.0211	0.0054	0.0012	0.0002	93	0.9992	0.9830	0.8996	0.7097	0.4618
44	0.0826	0.0259	0.0069	0.0016	0.0003	94	0.9994	0.9863	0.9124	0.7330	0.4872
45	0.0975	0.0315	0.0086	0.0020	0.0004	95	0.9996	0.9891	0.9240	0.7553	0.5128
46	0.1141	0.0381	0.0107	0.0026	0.0005	96	0.9997	0.9914	0.9345	0.7766	0.5382
47	0.1325	0.0457	0.0132	0.0033	0.0007	97	0.9998	0.9933	0.9438	0.7969	0.5636
48	0.1529	0.0544	0.0162	0.0041	0.0009	98	0.9999	0.9948	0.9521	0.8160	0.5887
49	0.1751	0.0644	0.0197	0.0052	0.0012	99	0.9999	0.9960	0.9594	0.8340	0.6134
50	0.1992	0.0757	0.0239	0.0064	0.0015	100	1.0000	0.9970	0.9658	0.8508	0.6377
51	0.2251	0.0883	0.0287	0.0079	0.0019	101	1.0000	0.9977	0.9713	0.8666	0.6614
52	0.2528	0.1024	0.0342	0.0097	0.0024	102	1.0000	0.9983	0.9761	0.8811	0.6846
53	0.2821	0.1181	0.0406	0.0118	0.0030	103	1.0000	0.9988	0.9803	0.8945	0.7071
54	0.3129	0.1353	0.0479	0.0143	0.0037	104	1.0000	0.9991	0.9838	0.9069	0.7288
55	0.3450	0.1541	0.0562	0.0172	0.0045	105	1.0000	0.9994	0.9868	0.9181	0.7497
56	0.3783	0.1744	0.0655	0.0206	0.0056	106	1.0000	0.9995	0.9893	0.9284	0.7697
57	0.4124	0.1964	0.0760	0.0245	0.0068	107	1.0000	0.9997	0.9914	0.9376	0.7889
58	0.4472	0.2198	0.0876	0.0290	0.0082	108	1.0000	0.9998	0.9931	0.9459	0.8071
59	0.4823	0.2448	0.1004	0.0342	0.0099	109	1.0000	0.9999	0.9946	0.9534	0.8243
60	0.5177	0.2712	0.1145	0.0400	0.0119	110	1.0000	0.9999	0.9957	0.9600	0.8406
61	0.5528	0.2988	0.1300	0.0466	0.0142	111	1.0000	0.9999	0.9967	0.9658	0.8558
62	0.5876	0.3277	0.1467	0.0541	0.0168	112	1.0000	1.0000	0.9974	0.9710	0.8701
63	0.6217	0.3575	0.1648	0.0624	0.0199	113	1.0000	1.0000	0.9980	0.9755	0.8834
64	0.6550	0.3882	0.1843	0.0716	0.0234	114	1.0000	1.0000	0.9985	0.9794	0.8957
65	0.6871	0.4197	0.2051	0.0819	0.0274	115	1.0000	1.0000	0.9989	0.9828	0.9071
66	0.7179	0.4516	0.2271	0.0931	0.0319	116	1.0000	1.0000	0.9992	0.9857	0.9175
67	0.7472	0.4838	0.2504	0.1055	0.0370	117	1.0000	1.0000	0.9994	0.9882	0.9271
68	0.7749	0.5162	0.2749	0.1189	0.0428	118	1.0000	1.0000	0.9996	0.9903	0.9358
69	0.8008	0.5484	0.3005	0.1334	0.0492	119	1.0000	1.0000	0.9997	0.9921	0.9437

	n						n				
c	21	22	23	24	25	c	21	22	23	24	25
45	0.0001	0.0000	0.0000	0.0000	0.0000	95	0.2853	0.1314	0.0510	0.0170	0.0049
46	0.0001	0.0000	0.0000	0.0000	0.0000	96	0.3060	0.1438	0.0569	0.0193	0.0057
47	0.0001	0.0000	0.0000	0.0000	0.0000	97	0.3272	0.1570	0.0633	0.0218	0.0065
48	0.0002	0.0000	0.0000	0.0000	0.0000	98	0.3491	0.1709	0.0702	0.0246	0.0075
49	0.0002	0.0000	0.0000	0.0000	0.0000	99	0.3714	0.1856	0.0777	0.0277	0.0086
50	0.0003	0.0001	0.0000	0.0000	0.0000	100	0.3942	0.2010	0.0858	0.0312	0.0098
51	0.0004	0.0001	0.0000	0.0000	0.0000	101	0.4173	0.2172	0.0944	0.0349	0.0112
52	0.0005	0.0001	0.0000	0.0000	0.0000	102	0.4408	0.2340	0.1037	0.0390	0.0127
53	0.0007	0.0001	0.0000	0.0000	0.0000	103	0.4644	0.2515	0.1136	0.0435	0.0144
54	0.0008	0.0002	0.0000	0.0000	0.0000	104	0.4881	0.2697	0.1241	0.0484	0.0163
55	0.0010	0.0002	0.0000	0.0000	0.0000	105	0.5119	0.2885	0.1353	0.0537	0.0183
56	0.0013	0.0003	0.0001	0.0000	0.0000	106	0.5356	0.3079	0.1472	0.0594	0.0206
57	0.0016	0.0003	0.0001	0.0000	0.0000	107	0.5592	0.3278	0.1597	0.0656	0.0232
58	0.0020	0.0004	0.0001	0.0000	0.0000	108	0.5827	0.3482	0.1729	0.0723	0.0259
59	0.0025	0.0005	0.0001	0.0000	0.0000	109	0.6058	0.3690	0.1867	0.0795	0.0290
60	0.0030	0.0007	0.0001	0.0000	0.0000	110	0.6286	0.3903	0.2011	0.0872	0.0323
61	0.0037	0.0009	0.0002	0.0000	0.0000	111	0.6509	0.4118	0.2162	0.0954	0.0359
62	0.0045	0.0011	0.0002	0.0000	0.0000	112	0.6728	0.4336	0.2320	0.1041	0.0399
63	0.0054	0.0013	0.0003	0.0001	0.0000	113	0.6940	0.4556	0.2483	0.1134	0.0441
64	0.0066	0.0016	0.0003	0.0001	0.0000	114	0.7147	0.4778	0.2652	0.1233	0.0488
65	0.0078	0.0020	0.0004	0.0001	0.0000	115	0.7347	0.5000	0.2827	0.1338	0.0538
66	0.0093	0.0024	0.0005	0.0001	0.0000	116	0.7540	0.5222	0.3006	0.1448	0.0592
67	0.0111	0.0029	0.0007	0.0001	0.0000	117	0.7725	0.5444	0.3191	0.1564	0.0650
68	0.0131	0.0035	0.0008	0.0002	0.0000	118	0.7902	0.5664	0.3380	0.1686	0.0712
69	0.0154	0.0042	0.0010	0.0002	0.0000	119	0.8071	0.5882	0.3573	0.1813	0.0778
70	0.0180	0.0050	0.0012	0.0003	0.0001	120	0.8232	0.6097	0.3770	0.1947	0.0850
71	0.0210	0.0059	0.0015	0.0003	0.0001	121	0.8384	0.6310	0.3970	0.2086	0.0925
72	0.0244	0.0070	0.0018	0.0004	0.0001	122	0.8528	0.6518	0.4173	0.2230	0.1006
73	0.0282	0.0083	0.0021	0.0005	0.0001	123	0.8663	0.6722	0.4378	0.2380	0.1091
74	0.0325	0.0097	0.0025	0.0006	0.0001	124	0.8789	0.6921	0.4584	0.2536	0.1181
75	0.0373	0.0114	0.0030	0.0007	0.0002	125	0.8907	0.7115	0.4792	0.2696	0.1277
76	0.0426	0.0133	0.0036	0.0009	0.0002	126	0.9017	0.7303	0.5000	0.2861	0.1377
77	0.0485	0.0154	0.0043	0.0010	0.0002	127	0.9118	0.7485	0.5208	0.3031	0.1483
78	0.0551	0.0179	0.0050	0.0012	0.0003	128	0.9212	0.7660	0.5416	0.3205	0.1594
79	0.0623	0.0206	0.0059	0.0015	0.0003	129	0.9298	0.7828	0.5622	0.3383	0.1710
80	0.0702	0.0237	0.0069	0.0018	0.0004	130	0.9377	0.7990	0.5827	0.3564	0.1831
81	0.0788	0.0272	0.0081	0.0021	0.0005	131	0.9449	0.8144	0.6030	0.3749	0.1957
82	0.0882	0.0311	0.0094	0.0025	0.0006	132	0.9515	0.8291	0.6230	0.3936	0.2088
83	0.0983	0.0354	0.0109	0.0030	0.0007	133	0.9574	0.8430	0.6427	0.4126	0.2224
84	0.1093	0.0401	0.0126	0.0035	0.0008	134	0.9627	0.8562	0.6620	0.4318	0.2365
85	0.1211	0.0454	0.0146	0.0041	0.0010	135	0.9675	0.8686	0.6809	0.4512	0.2511
86	0.1337	0.0512	0.0167	0.0048	0.0012	136	0.9718	0.8803	0.6994	0.4707	0.2661
87	0.1472	0.0575	0.0192	0.0056	0.0014	137	0.9756	0.8913	0.7173	0.4902	0.2815
88	0.1616	0.0644	0.0219	0.0065	0.0017	138	0.9790	0.9015	0.7348	0.5098	0.2974
89	0.1768	0.0720	0.0249	0.0075	0.0020	139	0.9820	0.9110	0.7517	0.5293	0.3136
90	0.1929	0.0801	0.0283	0.0086	0.0023	140	0.9846	0.9199	0.7680	0.5488	0.3302
91	0.2098	0.0890	0.0320	0.0099	0.0027	141	0.9869	0.9280	0.7838	0.5682	0.3472
92	0.2275	0.0985	0.0361	0.0114	0.0032	142	0.9889	0.9356	0.7989	0.5874	0.3644
93	0.2460	0.1087	0.0406	0.0131	0.0037	143	0.9907	0.9425	0.8133	0.6064	0.3819
94	0.2653	0.1197	0.0456	0.0149	0.0043	144	0.9922	0.9488	0.8271	0.6251	0.3997

APPENDIX C: Tables of Distributions and Critical Values

TABLE C.13
Critical values for the Spearman rank correlation coefficient r_s*

2-tail	0.10	0.05	0.02	0.01
1-tail	0.05	0.025	0.01	0.005
n: 4	1.000			
5	0.900	1.000	1.000	
6	0.829	0.886	0.943	1.000
7	0.714	0.786	0.893	0.929
8	0.643	0.738	0.833	0.881
9	0.600	0.700	0.783	0.833
10	0.564	0.648	0.745	0.794
11	0.536	0.618	0.709	0.755
12	0.503	0.587	0.678	0.727
13	0.484	0.560	0.648	0.703
14	0.464	0.538	0.626	0.679
15	0.446	0.521	0.604	0.654
16	0.429	0.503	0.582	0.635
17	0.414	0.485	0.566	0.615
18	0.401	0.472	0.550	0.600
19	0.391	0.460	0.535	0.584
20	0.380	0.447	0.520	0.570
21	0.370	0.435	0.508	0.556
22	0.361	0.425	0.496	0.544
23	0.353	0.415	0.486	0.532
24	0.344	0.406	0.476	0.521
25	0.337	0.398	0.466	0.511
26	0.331	0.390	0.457	0.501
27	0.324	0.382	0.448	0.491
28	0.317	0.375	0.440	0.483
29	0.312	0.368	0.433	0.475
30	0.306	0.362	0.425	0.467

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TABLE C.14
Critical values for the Kolmogorov-Smirnov test

1-tail / 2-tail	0.1 / 0.2	0.05 / 0.10	0.025 / 0.050	0.01 / 0.02	0.005 / 0.010
n: 1	0.9000	0.9500	0.9750	0.9900	0.9950
2	0.6838	0.7764	0.8419	0.9000	0.9293
3	0.5648	0.6360	0.7076	0.7846	0.8290
4	0.4927	0.5652	0.6239	0.6889	0.7342
5	0.4470	0.5095	0.5633	0.6272	0.6685
6	0.4104	0.4680	0.5193	0.5774	0.6166
7	0.3815	0.4361	0.4834	0.5384	0.5758
8	0.3583	0.4096	0.4543	0.5065	0.5418
9	0.3391	0.3875	0.4300	0.4796	0.5133
10	0.3226	0.3687	0.4092	0.4566	0.4889
11	0.3083	0.3524	0.3912	0.4367	0.4677
12	0.2958	0.3382	0.3754	0.4192	0.4490
13	0.2847	0.3255	0.3614	0.4036	0.4325
14	0.2748	0.3142	0.3489	0.3897	0.4176
15	0.2659	0.3040	0.3376	0.3771	0.4042
16	0.2578	0.2947	0.3273	0.3657	0.3920
17	0.2504	0.2863	0.3180	0.3553	0.3809
18	0.2436	0.2785	0.3094	0.3457	0.3706
19	0.2373	0.2714	0.3014	0.3369	0.3612
20	0.2316	0.2647	0.2941	0.3287	0.3524
21	0.2262	0.2586	0.2872	0.3210	0.3443
22	0.2212	0.2528	0.2809	0.3139	0.3367
23	0.2165	0.2475	0.2749	0.3073	0.3295
24	0.2120	0.2424	0.2693	0.3010	0.3229
25	0.2079	0.2377	0.2640	0.2952	0.3166
26	0.2040	0.2332	0.2591	0.2896	0.3106
27	0.2003	0.2290	0.2544	0.2844	0.3050
28	0.1968	0.2250	0.2499	0.2794	0.2997
29	0.1935	0.2212	0.2457	0.2747	0.2947
30	0.1903	0.2176	0.2417	0.2702	0.2899
31	0.1873	0.2141	0.2379	0.2660	0.2853
32	0.1844	0.2108	0.2342	0.2619	0.2809
33	0.1817	0.2077	0.2308	0.2580	0.2768
34	0.1791	0.2047	0.2274	0.2543	0.2728
35	0.1766	0.2018	0.2242	0.2507	0.2690
36	0.1742	0.1991	0.2212	0.2473	0.2653
37	0.1719	0.1965	0.2183	0.2440	0.2618
38	0.1697	0.1939	0.2154	0.2409	0.2584
39	0.1675	0.1915	0.2127	0.2379	0.2552
40	0.1655	0.1891	0.2101	0.2349	0.2521
41	0.1635	0.1869	0.2076	0.2321	0.2490
42	0.1616	0.1847	0.2052	0.2294	0.2461
43	0.1597	0.1826	0.2028	0.2268	0.2433
44	0.1580	0.1805	0.2006	0.2243	0.2406
45	0.1562	0.1786	0.1984	0.2218	0.2380
46	0.1546	0.1767	0.1963	0.2194	0.2354
47	0.1530	0.1748	0.1942	0.2171	0.2330
48	0.1514	0.1730	0.1922	0.2149	0.2306
49	0.1499	0.1713	0.1903	0.2128	0.2283
50	0.1484	0.1696	0.1884	0.2107	0.2260

1-tail / 2-tail	0.1 / 0.2	0.05 / 0.10	0.025 / 0.050	0.01 / 0.02	0.005 / 0.010
n: 51	0.1470	0.1680	0.1866	0.2086	0.2239
52	0.1456	0.1664	0.1848	0.2067	0.2217
53	0.1442	0.1648	0.1831	0.2048	0.2197
54	0.1429	0.1633	0.1814	0.2029	0.2177
55	0.1416	0.1619	0.1798	0.2011	0.2157
56	0.1404	0.1604	0.1782	0.1993	0.2138
57	0.1392	0.1591	0.1767	0.1976	0.2120
58	0.1380	0.1577	0.1752	0.1959	0.2102
59	0.1369	0.1564	0.1737	0.1943	0.2084
60	0.1357	0.1551	0.1723	0.1927	0.2067
61	0.1346	0.1539	0.1709	0.1911	0.2051
62	0.1336	0.1526	0.1696	0.1896	0.2034
63	0.1325	0.1514	0.1682	0.1881	0.2018
64	0.1315	0.1503	0.1669	0.1867	0.2003
65	0.1305	0.1491	0.1657	0.1853	0.1988
66	0.1295	0.1480	0.1644	0.1839	0.1973
67	0.1286	0.1469	0.1632	0.1825	0.1958
68	0.1277	0.1459	0.1620	0.1812	0.1944
69	0.1267	0.1448	0.1609	0.1799	0.1930
70	0.1259	0.1438	0.1597	0.1786	0.1917
71	0.1250	0.1428	0.1586	0.1774	0.1903
72	0.1241	0.1418	0.1576	0.1762	0.1890
73	0.1233	0.1409	0.1565	0.1750	0.1878
74	0.1225	0.1399	0.1554	0.1738	0.1865
75	0.1217	0.1390	0.1544	0.1727	0.1853
76	0.1209	0.1381	0.1534	0.1716	0.1841
77	0.1201	0.1372	0.1524	0.1705	0.1829
78	0.1193	0.1364	0.1515	0.1694	0.1817
79	0.1186	0.1355	0.1505	0.1683	0.1806
80	0.1179	0.1347	0.1496	0.1673	0.1795
81	0.1172	0.1339	0.1487	0.1663	0.1784
82	0.1165	0.1330	0.1478	0.1653	0.1773
83	0.1158	0.1323	0.1469	0.1643	0.1763
84	0.1151	0.1315	0.1460	0.1633	0.1752
85	0.1144	0.1307	0.1452	0.1624	0.1742
86	0.1138	0.1300	0.1444	0.1614	0.1732
87	0.1131	0.1292	0.1435	0.1605	0.1722
88	0.1125	0.1285	0.1427	0.1596	0.1713
89	0.1119	0.1278	0.1419	0.1587	0.1703
90	0.1112	0.1271	0.1412	0.1579	0.1694
91	0.1106	0.1264	0.1404	0.1570	0.1685
92	0.1100	0.1257	0.1396	0.1562	0.1676
93	0.1095	0.1251	0.1389	0.1553	0.1667
94	0.1089	0.1244	0.1382	0.1545	0.1658
95	0.1083	0.1238	0.1375	0.1537	0.1649
96	0.1078	0.1231	0.1368	0.1529	0.1641
97	0.1072	0.1225	0.1361	0.1521	0.1632
98	0.1067	0.1219	0.1354	0.1514	0.1624
99	0.1062	0.1213	0.1347	0.1506	0.1616
100	0.1056	0.1207	0.1340	0.1499	0.1608
$n > 100$	$\frac{1.0730}{\sqrt{n}}$	$\frac{1.2239}{\sqrt{n}}$	$\frac{1.3581}{\sqrt{n}}$	$\frac{1.5174}{\sqrt{n}}$	$\frac{1.6276}{\sqrt{n}}$

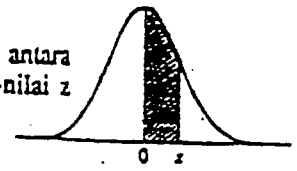
Sifir Nilai-Nilai Genting Untuk t

df	Aras keertian untuk ujian satu hujung					
	.10	.05	.025	.01	.005	.0005
	Aras keertian untuk ujian dua hujung					
	.20	.10	.05	.02	.01	.001
1	3.078	6.314	12.706	31.821	63.657	636.619
2	1.886	2.920	4.303	6.965	9.925	31.598
3	1.638	2.353	3.182	4.541	5.841	12.941
4	1.533	2.132	2.776	3.747	4.604	8.610
5	1.476	2.015	2.571	3.365	4.032	6.859
6	1.440	1.943	2.447	3.143	3.707	5.959
7	1.415	1.895	2.365	2.998	3.499	5.405
8	1.397	1.860	2.306	2.896	3.355	5.041
9	1.383	1.833	2.262	2.821	3.250	4.781
10	1.372	1.812	2.228	2.764	3.169	4.587
11	1.363	1.796	2.201	2.718	3.106	4.437
12	1.356	1.782	2.179	2.681	3.055	4.318
13	1.350	1.771	2.160	2.650	3.012	4.221
14	1.345	1.761	2.145	2.624	2.977	4.140
15	1.341	1.753	2.131	2.602	2.947	4.073
16	1.337	1.746	2.120	2.583	2.921	4.015
17	1.333	1.740	2.110	2.567	2.898	3.965
18	1.330	1.734	2.101	2.552	2.878	3.922
19	1.328	1.729	2.093	2.539	2.861	3.883
20	1.325	1.725	2.086	2.528	2.845	3.850
21	1.323	1.721	2.080	2.518	2.831	3.819
22	1.321	1.717	2.074	2.508	2.819	3.792
23	1.319	1.714	2.069	2.500	2.807	3.767
24	1.318	1.711	2.064	2.492	2.797	3.745
25	1.316	1.708	2.060	2.485	2.787	3.725
26	1.315	1.706	2.056	2.479	2.779	3.707
27	1.314	1.703	2.052	2.473	2.771	3.690
28	1.313	1.701	2.048	2.467	2.763	3.674
29	1.311	1.699	2.045	2.462	2.756	3.659
30	1.310	1.697	2.042	2.457	2.750	3.646
40	1.303	1.684	2.021	2.423	2.704	3.551
60	1.296	1.671	2.000	2.390	2.660	3.460
120	1.289	1.658	1.980	2.358	2.617	3.373
∞	1.282	1.645	1.960	2.326	2.576	3.291

* Table B is abridged from Table III of Fisher and Yates: *Statistical tables for biological, agricultural, and medical research*, published by Oliver and Boyd Ltd., Edinburgh, by permission of the authors and publishers.

Jadual **Sifir Keluasan Di Bawah Lengkung Normal Piawai**

Nilai di dalam sifir ialah kadaran di bawah lengkung di antara $z = 0$ dan sesuatu nilai z positif. Keluasan bagi nilai-nilai z negatif boleh didapatkan dengan simetri.



Tempat perpuluhan kedua untuk z

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
0.7	.2580	.2611	.2642	.2673	.2703	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990

From Paul G. Hoel, *Elementary Statistics*, 3rd ed., © 1971, John Wiley and Sons, Inc., New York, p. 287.

Luas Di Bawah Lengkung Normal Piawai

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.3000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641
0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1036	0.1038	0.1020	0.1003	0.0985
1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0187	0.0183
2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
2.2	0.0139	0.0136	0.0132	0.0129	0.0126	0.0122	0.0119	0.0116	0.0113	0.0110
2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
2.4	0.0082	0.0080	0.0078	0.0076	0.0073	0.0071	0.0070	0.0068	0.0066	0.0064
2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
2.6	0.0047	0.0045	0.0044	0.0043	0.0042	0.0040	0.0039	0.0038	0.0037	0.0036
2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
3.0	0.0014	0.0013	0.0013	0.0012	0.0012	0.0011	0.0021	0.0011	0.0010	0.0010

Bagi $z < 0$, gunakan hubungan $Q(z) = 1 - Q(-z) = P(-z)$,

Jika $\mu \sim N(0,1)$

(a) Kebarangkalian $(\mu > 2.1) = Q(2.1) = 0.0179$

(b) Kebarangkalian $(0 < \mu < 2.1) = Q(0) - Q(2.1) = 0.5000 - 0.0179 = 0.4821$

(c) Kebarangkalian $(|\mu| > 2.1) = 2Q(2.1) = 0.0358$

(d) Kebarangkalian $(|\mu| < 2.1) = 1 - 2Q(2.1) = 0.9642$

(e) Kebarangkalian $(\mu > 2.15) = Q(2.15) = 0.0158$

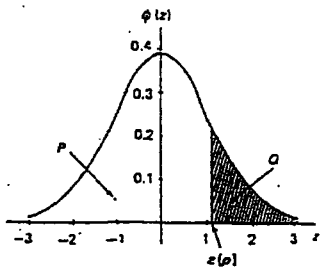
(f) Kebarangkalian $(\mu > 2.152) = Q(2.152) = 0.0158 - 0.0001 = 0.0157$

(g) Kebarangkalian $(\mu > 3.467) = Q(3.467) = 0.00027 - 0.00001 = 0.00026$

Bagi $z < 0$, gunakan hubungan $\Phi(z) = \Phi(-z)$

Fungsi yang disifirkan ditakrif sebagai

$$\Phi(z) = \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}z^2} \qquad \int_{-\infty}^{z(p)} \Phi(u)du = P \qquad Q(z) = \int_{z}^{\infty} \Phi(u)du$$



Proportions of Area Under the Standard Normal Curve

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.3000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641
0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1036	0.1038	0.1020	0.1003	0.0985
1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0187	0.0183
2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
2.2	0.0139	0.0136	0.0132	0.0129	0.0126	0.0122	0.0119	0.0116	0.0113	0.0110
2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
2.4	0.0082	0.0080	0.0078	0.0076	0.0073	0.0071	0.0070	0.0068	0.0066	0.0064
2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
2.6	0.0047	0.0045	0.0044	0.0043	0.0042	0.0040	0.0039	0.0038	0.0037	0.0036
2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
3.0	0.0014	0.0013	0.0013	0.0012	0.0012	0.0011	0.0021	0.0011	0.0010	0.0010

For $z < 0$, use $Q(z) = 1 - Q(-z) = P(-z)$,

If $\mu \sim N(0,1)$

(a) Probability $(\mu > 2.1) = Q(2.1) = 0.0179$

(b) Probability $(0 < \mu < 2.1) = Q(0) - Q(2.1) = 0.5000 - 0.0179 = 0.4821$

(c) Probability $(|\mu| > 2.1) = 2Q(2.1) = 0.0358$

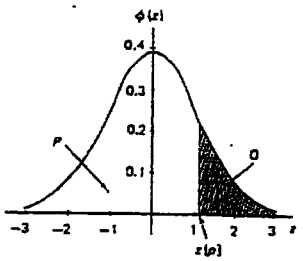
(d) Probability $(|\mu| < 2.1) = 1 - 2Q(2.1) = 0.9642$

(e) Probability $(\mu > 2.15) = Q(2.15) = 0.0158$

(f) Probability $(\mu > 2.152) = Q(2.152) = 0.0158 - 0.0001 = 0.0157$

(g) Probability $(\mu > 3.467) = Q(3.467) = 0.00027 - 0.00001 = 0.00026$

For $z < 0$, use $\Phi(z) = \Phi(-z)$



Function $\Phi(z) = \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}z^2}$ $\int_{-\infty}^{z(p)} \Phi(u)du = P$ $Q(z) = \int_{z}^{\infty} \Phi(u)du$

5% Cetakan Biasan - **Baris Atas.**
1% Cetakan Gelap - **Baris Bawah.**

* Nilai-nilai Genting Untuk Taburan F Bagi Aras Keertian 5% (Cetakan Biasan) Dan 1% (Cetakan Gelap)

Darjah Kebebasan Untuk Pembawah (df_1)	Darjah Kebebasan Untuk Penyebut (df_2)																					
	1	2	3	4	5	6	7	8	9	10	11	12	14	16	20	24	30	40	50	75	100	200	500	∞
1	161 4052	200 4999	216 5403	225 5625	230 5764	234 5859	237 5928	239 5981	241 6022	242 6056	243 6082	244 6106	245 6142	246 6169	248 6208	249 6234	250 6258	251 6286	252 6302	253 6323	253 6334	254 6352	254 6361	254 6366
2	18.51 98.49	19.00 99.01	19.16 99.17	19.25 99.25	19.30 99.30	19.33 99.34	19.36 99.34	19.37 99.36	19.38 99.38	19.39 99.40	19.40 99.41	19.41 99.42	19.42 99.43	19.43 99.44	19.44 99.45	19.45 99.45	19.46 99.47	19.47 99.48	19.47 99.48	19.48 99.49	19.49 99.49	19.49 99.49	19.50 99.50	19.50 99.50
3	10.13 34.12	9.55 30.31	9.28 29.46	9.12 28.71	9.01 28.24	8.88 27.67	8.88 27.67	8.84 27.49	8.81 27.34	8.78 27.23	8.76 27.13	8.74 27.05	8.71 26.92	8.69 26.83	8.66 26.69	8.64 26.60	8.62 26.50	8.60 26.41	8.58 26.30	8.57 26.27	8.56 26.23	8.54 26.18	8.54 26.14	8.53 26.12
4	7.71 21.20	6.94 18.00	6.59 16.69	6.39 15.93	6.26 15.52	6.16 15.21	6.09 14.98	6.04 14.80	6.00 14.66	5.96 14.54	5.93 14.45	5.91 14.77	5.87 14.24	5.84 14.15	5.80 14.02	5.77 13.93	5.74 13.83	5.71 13.74	5.70 13.69	5.68 13.61	5.66 13.57	5.65 13.52	5.64 13.48	5.63 13.46
5	6.61 16.26	5.79 13.87	5.41 12.06	5.19 11.30	5.05 10.97	4.95 10.67	4.88 10.45	4.82 10.27	4.78 10.15	4.74 10.05	4.70 9.96	4.68 9.89	4.64 9.77	4.60 9.68	4.56 9.55	4.53 9.47	4.50 9.38	4.46 9.29	4.44 9.24	4.42 9.17	4.40 9.13	4.38 9.07	4.37 9.04	4.36 9.02
6	5.99 13.74	5.14 10.92	4.76 9.78	4.53 9.15	4.39 8.75	4.28 8.47	4.21 8.26	4.15 8.10	4.10 7.98	4.06 7.87	4.03 7.79	4.00 7.72	3.96 7.60	3.92 7.52	3.87 7.39	3.84 7.31	3.81 7.23	3.77 7.14	3.75 7.09	3.72 7.02	3.71 6.99	3.69 6.94	3.68 6.90	3.67 6.88
7	5.59 12.75	4.74 9.55	4.35 8.45	4.12 7.85	3.97 7.46	3.87 7.19	3.79 7.00	3.73 6.84	3.68 6.71	3.63 6.62	3.60 6.54	3.57 6.47	3.52 6.35	3.49 6.27	3.44 6.15	3.41 6.07	3.38 5.98	3.34 5.90	3.32 5.85	3.29 5.78	3.28 5.75	3.25 5.70	3.24 5.67	3.23 5.65
8	5.32 11.26	4.46 8.65	4.07 7.59	3.81 7.01	3.69 6.63	3.58 6.37	3.50 6.19	3.44 6.03	3.39 5.91	3.34 5.82	3.31 5.74	3.28 5.67	3.23 5.56	3.20 5.48	3.15 5.36	3.12 5.28	3.08 5.20	3.05 5.11	3.03 5.06	3.00 5.00	2.98 4.96	2.96 4.91	2.94 4.88	2.93 4.86
9	5.12 10.56	4.26 8.02	3.86 6.99	3.63 6.42	3.48 6.06	3.37 5.80	3.29 5.62	3.23 5.47	3.18 5.35	3.13 5.26	3.10 5.18	3.07 5.11	3.02 5.00	2.98 4.92	2.93 4.80	2.90 4.73	2.86 4.64	2.82 4.56	2.80 4.51	2.77 4.45	2.76 4.41	2.73 4.36	2.72 4.33	2.71 4.31
10	4.96 10.04	4.10 7.56	3.71 6.55	3.48 5.99	3.33 5.64	3.22 5.21	3.14 5.21	3.07 5.06	3.02 4.95	2.97 4.85	2.94 4.78	2.91 4.71	2.86 4.60	2.82 4.52	2.77 4.41	2.74 4.33	2.70 4.25	2.67 4.17	2.64 4.12	2.61 4.05	2.59 4.01	2.56 3.96	2.56 3.93	2.51 3.91
11	4.84 9.65	3.98 7.20	3.59 6.22	3.36 5.67	3.20 5.32	3.09 5.07	3.01 4.88	2.95 4.74	2.90 4.63	2.86 4.54	2.82 4.46	2.79 4.40	2.74 4.29	2.70 4.21	2.65 4.10	2.61 4.02	2.57 3.94	2.53 3.86	2.50 3.80	2.47 3.74	2.45 3.70	2.42 3.66	2.41 3.62	2.42 3.62
12	4.75 9.33	3.88 6.93	3.49 5.95	3.26 5.41	3.11 5.06	3.00 4.82	2.92 4.65	2.85 4.50	2.80 4.39	2.76 4.30	2.72 4.22	2.69 4.16	2.64 4.05	2.60 3.98	2.54 3.86	2.50 3.78	2.46 3.70	2.42 3.61	2.40 3.56	2.38 3.49	2.35 3.46	2.32 3.41	2.31 3.38	2.32 3.36
13	4.67 9.07	3.80 6.70	3.41 5.74	3.18 5.20	3.02 4.86	2.92 4.62	2.84 4.44	2.77 4.30	2.72 4.19	2.67 4.10	2.63 4.02	2.60 3.96	2.55 3.85	2.51 3.78	2.46 3.67	2.42 3.59	2.38 3.51	2.34 3.42	2.32 3.37	2.28 3.30	2.26 3.27	2.24 3.21	2.22 3.18	2.21 3.15
14	4.60 8.86	3.74 6.53	3.34 5.56	3.11 5.03	2.96 4.69	2.85 4.46	2.77 4.28	2.70 4.14	2.65 4.03	2.60 3.94	2.56 3.86	2.53 3.80	2.48 3.70	2.44 3.62	2.39 3.51	2.35 3.43	2.31 3.34	2.27 3.26	2.24 3.21	2.21 3.14	2.19 3.11	2.16 3.06	2.14 3.02	2.13 3.02
15	4.54 8.68	3.68 6.36	3.29 5.42	3.06 4.89	2.90 4.56	2.79 4.32	2.70 4.14	2.64 4.00	2.59 3.89	2.55 3.80	2.51 3.73	2.48 3.67	2.43 3.56	2.39 3.48	2.33 3.36	2.29 3.29	2.25 3.20	2.21 3.12	2.18 3.07	2.15 3.00	2.12 2.97	2.10 2.92	2.08 2.89	2.07 2.87
16	4.49 8.53	3.63 6.23	3.24 5.29	3.01 4.77	2.85 4.44	2.74 4.20	2.66 4.03	2.59 3.89	2.54 3.78	2.49 3.69	2.45 3.61	2.42 3.55	2.37 3.45	2.33 3.37	2.28 3.25	2.24 3.18	2.20 3.10	2.16 3.01	2.13 2.96	2.09 2.89	2.07 2.86	2.04 2.80	2.02 2.77	2.01 2.73
17	4.45 8.40	3.59 6.11	3.20 5.18	2.96 4.67	2.81 4.34	2.70 4.10	2.62 3.93	2.55 3.79	2.50 3.68	2.45 3.59	2.41 3.52	2.38 3.45	2.33 3.35	2.29 3.27	2.23 3.16	2.19 3.08	2.15 3.00	2.11 2.92	2.08 2.86	2.04 2.79	2.02 2.76	1.99 2.70	1.97 2.67	1.96 2.66
18	4.41 8.28	3.55 6.01	3.16 5.09	2.93 4.58	2.77 4.25	2.66 4.01	2.58 3.85	2.51 3.71	2.46 3.60	2.41 3.51	2.37 3.44	2.34 3.37	2.29 3.27	2.25 3.19	2.19 3.07	2.15 3.00	2.11 2.91	2.07 2.83	2.04 2.78	2.00 2.71	1.98 2.68	1.95 2.62	1.93 2.59	1.92 2.58
19	4.38 8.18	3.52 5.93	3.13 5.01	2.90 4.50	2.74 4.17	2.63 3.94	2.55 3.77	2.48 3.63	2.43 3.52	2.38 3.43	2.34 3.36	2.31 3.30	2.26 3.19	2.21 3.12	2.15 3.00	2.11 2.92	2.07 2.84	2.02 2.76	2.00 2.70	1.96 2.63	1.94 2.60	1.91 2.54	1.90 2.51	1.89 2.49
20	4.35 8.10	3.49 5.85	3.10 4.94	2.87 4.43	2.71 4.10	2.60 3.87	2.52 3.71	2.45 3.56	2.40 3.45	2.35 3.37	2.31 3.30	2.28 3.23	2.23 3.13	2.18 3.05	2.12 2.94	2.08 2.86	2.04 2.77	1.99 2.69	1.96 2.63	1.92 2.56	1.90 2.53	1.87 2.47	1.85 2.44	1.84 2.42
21	4.32 8.02	3.47 5.78	3.07 4.87	2.84 4.37	2.68 4.04	2.57 3.81	2.49 3.65	2.42 3.51	2.37 3.40	2.32 3.31	2.28 3.24	2.25 3.17	2.20 3.07	2.15 2.99	2.09 2.88	2.05 2.80	2.00 2.72	1.96 2.63	1.93 2.58	1.88 2.51	1.87 2.47	1.84 2.42	1.82 2.38	1.81 2.36
22	4.30 7.94	3.44 5.72	3.05 4.82	2.82 4.31	2.66 3.99	2.55 3.76	2.47 3.59	2.40 3.45	2.35 3.35	2.30 3.26	2.26 3.18	2.23 3.12	2.18 3.02	2.13 2.94	2.07 2.83	2.03 2.75	1.98 2.67	1.93 2.58	1.91 2.53	1.87 2.46	1.84 2.42	1.81 2.37	1.80 2.33	1.73 2.31
23	4.28 7.88	3.42 5.66	3.03 4.76	2.80 4.26	2.64 3.94	2.53 3.71	2.45 3.54	2.38 3.41	2.32 3.30	2.28 3.21	2.24 3.14	2.20 3.07	2.14 2.97	2.10 2.89	2.04 2.78	2.00 2.70	1.96 2.62	1.91 2.53	1.88 2.48	1.84 2.41	1.82 2.37	1.79 2.32	1.77 2.28	1.76 2.26

* Sambungan

Darjah Kebebasan Untuk Pembawah (df$_2$)	Darjah Kebebasan Untuk Pengaras (df$_1$)																						
	1	2	3	4	5	6	7	8	9	10	11	12	14	16	20	24	30	40	50	75	100	200	500	∞
24	4.26 7.82	3.40 5.61	3.01 4.72	2.78 4.22	2.62 3.90	2.51 3.67	2.43 3.50	2.36 3.36	2.30 3.25	2.25 3.17	2.22 3.09	2.18 3.03	2.13 2.93	2.09 2.85	2.02 2.74	1.98 2.66	1.94 2.58	1.89 2.49	1.86 2.44	1.82 2.36	1.80 2.33	1.76 2.27	1.74 2.23	1.71 2.21
25	4.24 7.77	3.38 5.57	2.99 4.68	2.76 4.18	2.60 3.86	2.49 3.63	2.41 3.46	2.34 3.32	2.28 3.21	2.24 3.13	2.20 3.05	2.16 2.99	2.11 2.89	2.06 2.81	2.00 2.70	1.96 2.62	1.92 2.54	1.87 2.45	1.84 2.40	1.80 2.32	1.77 2.29	1.74 2.23	1.72 2.19	1.70 2.17
26	4.77 7.72	3.37 5.53	2.89 4.64	2.74 4.14	2.59 3.82	2.47 3.59	2.39 3.42	2.32 3.29	2.27 3.17	2.22 3.09	2.18 3.02	2.15 2.96	2.10 2.86	2.05 2.77	1.99 2.66	1.95 2.58	1.90 2.50	1.85 2.41	1.78 2.28	1.78 2.28	1.76 2.25	1.72 2.19	1.70 2.15	1.69 2.11
27	4.21 7.68	3.35 5.49	2.96 4.60	2.73 4.11	2.57 3.79	2.46 3.56	2.37 3.39	2.30 3.26	2.25 3.14	2.20 3.06	2.16 2.98	2.13 2.93	2.08 2.83	2.03 2.74	1.97 2.63	1.93 2.55	1.88 2.47	1.84 2.38	1.76 2.25	1.76 2.25	1.74 2.21	1.71 2.16	1.69 2.12	1.67 2.10
28	4.20 7.64	3.34 5.45	2.95 4.57	2.71 4.07	2.56 3.76	2.44 3.53	2.36 3.36	2.29 3.23	2.24 3.11	2.19 3.03	2.15 2.95	2.12 2.90	2.06 2.80	2.02 2.71	1.96 2.60	1.91 2.52	1.87 2.44	1.81 2.35	1.75 2.22	1.75 2.22	1.72 2.18	1.69 2.13	1.67 2.09	1.65 2.06
29	4.18 7.60	3.33 5.52	2.93 4.54	2.70 4.04	2.54 3.73	2.43 3.50	2.35 3.33	2.28 3.20	2.22 3.08	2.18 3.00	2.14 2.92	2.10 2.87	2.05 2.77	2.00 2.68	1.94 2.57	1.90 2.49	1.85 2.41	1.80 2.32	1.73 2.19	1.73 2.19	1.71 2.15	1.68 2.10	1.65 2.06	1.64 2.03
30	4.17 7.56	3.32 5.39	2.92 4.51	2.69 4.02	2.53 3.70	2.42 3.47	2.34 3.30	2.27 3.17	2.21 3.06	2.16 2.98	2.12 2.90	2.09 2.84	2.04 2.74	1.99 2.66	1.93 2.55	1.89 2.47	1.84 2.38	1.79 2.29	1.72 2.16	1.72 2.16	1.69 2.13	1.66 2.07	1.64 2.03	1.62 2.01
32	4.15 7.50	3.30 5.34	2.90 4.46	2.67 3.97	2.51 3.66	2.40 3.42	2.32 3.25	2.25 3.12	2.19 3.01	2.14 2.94	2.10 2.86	2.07 2.80	2.02 2.70	1.97 2.62	1.91 2.51	1.86 2.42	1.82 2.34	1.76 2.25	1.69 2.12	1.69 2.12	1.67 2.08	1.64 2.02	1.61 1.98	1.59 1.96
34	4.13 7.44	3.28 5.29	2.88 4.42	2.65 3.93	2.49 3.61	2.38 3.38	2.30 3.21	2.23 3.08	2.17 2.97	2.12 2.88	2.08 2.82	2.05 2.76	2.00 2.66	1.95 2.58	1.89 2.47	1.84 2.38	1.80 2.30	1.74 2.21	1.67 2.08	1.67 2.08	1.64 2.04	1.61 1.98	1.59 1.94	1.57 1.91
36	4.11 7.39	3.26 5.25	2.86 4.38	2.63 3.89	2.48 3.58	2.36 3.35	2.28 3.18	2.21 3.04	2.15 2.94	2.10 2.86	2.06 2.78	2.03 2.72	1.98 2.62	1.93 2.54	1.87 2.43	1.82 2.35	1.78 2.26	1.72 2.17	1.69 2.12	1.65 2.04	1.63 2.00	1.59 1.94	1.56 1.90	1.55 1.87
38	4.10 7.35	3.25 5.21	2.85 4.34	2.62 3.86	2.46 3.54	2.35 3.32	2.26 3.15	2.19 3.02	2.14 2.91	2.09 2.82	2.05 2.75	2.02 2.69	1.96 2.59	1.92 2.51	1.85 2.40	1.80 2.32	1.76 2.22	1.71 2.14	1.67 2.08	1.63 2.00	1.60 1.97	1.57 1.90	1.54 1.86	1.53 1.84
40	4.08 7.31	3.23 5.18	2.84 4.31	2.61 3.83	2.45 3.51	2.34 3.29	2.25 3.12	2.18 2.99	2.12 2.88	2.07 2.80	2.04 2.73	2.00 2.66	1.95 2.56	1.90 2.49	1.84 2.37	1.79 2.29	1.74 2.20	1.69 2.11	1.66 2.05	1.61 1.97	1.59 1.94	1.55 1.88	1.53 1.84	1.51 1.81
42	4.07 7.27	3.22 5.15	2.83 4.29	2.59 3.80	2.44 3.49	2.32 3.26	2.24 3.10	2.17 2.96	2.11 2.86	2.06 2.77	2.02 2.70	1.99 2.64	1.94 2.54	1.89 2.46	1.82 2.35	1.78 2.26	1.73 2.17	1.68 2.06	1.64 2.02	1.60 1.94	1.57 1.91	1.54 1.85	1.51 1.80	1.49 1.78
44	4.06 7.24	3.21 5.12	2.82 4.26	2.58 3.78	2.43 3.46	2.31 3.24	2.23 3.07	2.16 2.94	2.10 2.84	2.06 2.75	2.01 2.68	1.98 2.62	1.92 2.52	1.88 2.44	1.81 2.32	1.76 2.24	1.72 2.15	1.66 2.06	1.63 2.00	1.58 1.92	1.56 1.86	1.52 1.82	1.50 1.78	1.48 1.75
46	4.05 7.21	3.20 5.10	2.81 4.24	2.57 3.76	2.42 3.44	2.30 3.22	2.22 3.05	2.14 2.92	2.09 2.82	2.04 2.73	2.00 2.64	1.97 2.60	1.91 2.50	1.87 2.42	1.80 2.30	1.75 2.22	1.71 2.13	1.65 2.04	1.62 1.98	1.57 1.90	1.54 1.86	1.51 1.80	1.48 1.78	1.46 1.72
48	4.04 7.19	3.19 5.08	2.80 4.22	2.56 3.74	2.41 3.42	2.30 3.20	2.21 3.04	2.14 2.90	2.08 2.80	2.03 2.71	1.99 2.64	1.96 2.58	1.90 2.48	1.86 2.40	1.79 2.28	1.74 2.20	1.70 2.11	1.64 2.02	1.61 1.96	1.56 1.88	1.53 1.84	1.50 1.78	1.47 1.73	1.45 1.70
50	4.03 7.17	3.18 5.06	2.79 4.20	2.56 3.72	2.40 3.41	2.29 3.18	2.20 3.02	2.13 2.88	2.07 2.78	2.02 2.70	1.98 2.62	1.95 2.56	1.90 2.46	1.85 2.39	1.78 2.26	1.74 2.18	1.69 2.10	1.63 2.00	1.60 1.94	1.55 1.86	1.52 1.82	1.48 1.76	1.46 1.71	1.43 1.63
55	4.02 7.12	3.17 5.01	2.78 4.16	2.54 3.68	2.38 3.37	2.27 3.15	2.18 2.98	2.11 2.85	2.05 2.75	2.00 2.66	1.97 2.59	1.93 2.53	1.88 2.43	1.83 2.35	1.76 2.23	1.72 2.15	1.67 2.06	1.61 1.96	1.58 1.90	1.52 1.82	1.50 1.78	1.46 1.71	1.43 1.66	1.41 1.61
60	4.00 7.08	3.15 4.98	2.76 4.13	2.52 3.65	2.37 3.34	2.25 3.12	2.17 2.95	2.10 2.82	2.04 2.72	1.99 2.63	1.95 2.56	1.92 2.50	1.86 2.40	1.81 2.32	1.75 2.20	1.70 2.12	1.65 2.03	1.59 1.93	1.55 1.87	1.50 1.79	1.48 1.74	1.44 1.68	1.41 1.63	1.39 1.60
65	3.99 7.04	3.14 4.95	2.75 4.10	2.51 3.62	2.36 3.31	2.24 3.09	2.15 2.93	2.08 2.79	2.02 2.70	1.98 2.61	1.94 2.54	1.90 2.47	1.85 2.37	1.80 2.30	1.73 2.18	1.68 2.09	1.63 2.00	1.57 1.90	1.54 1.84	1.49 1.76	1.45 1.71	1.42 1.64	1.39 1.60	1.37 1.56
70	3.98 7.01	3.13 4.92	2.74 4.08	2.50 3.60	2.35 3.29	2.32 3.07	2.14 2.91	2.07 2.77	2.01 2.67	1.97 2.59	1.93 2.51	1.89 2.45	1.84 2.35	1.79 2.28	1.72 2.15	1.67 2.07	1.62 1.98	1.56 1.88	1.53 1.82	1.47 1.74	1.45 1.69	1.40 1.63	1.37 1.56	1.35 1.53
80	3.96 6.96	3.11 4.88	2.72 4.04	2.48 3.56	2.33 3.25	2.21 3.04	2.12 2.87	2.05 2.74	1.99 2.64	1.95 2.55	1.91 2.48	1.88 2.41	1.82 2.32	1.77 2.24	1.70 2.11	1.65 2.03	1.60 1.94	1.54 1.84	1.51 1.78	1.45 1.70	1.42 1.65	1.38 1.57	1.35 1.52	1.32 1.49
100	3.94 6.90	3.09 4.82	2.70 3.98	2.46 3.51	2.30 3.20	2.19 2.99	2.10 2.82	2.03 2.69	1.97 2.59	1.93 2.51	1.88 2.43	1.85 2.36	1.79 2.26	1.75 2.19	1.68 2.06	1.63 1.98	1.57 1.89	1.51 1.79	1.48 1.73	1.42 1.64	1.39 1.59	1.34 1.51	1.30 1.45	1.28 1.43
125	3.92 6.84	3.07 4.78	2.68 3.94	2.44 3.47	2.29 3.17	2.17 2.95	2.08 2.79	2.01 2.66	1.95 2.56	1.90 2.47	1.86 2.40	1.83 2.33	1.77 2.23	1.72 2.15	1.65 2.03	1.60 1.94	1.55 1.85	1.49 1.75	1.45 1.68	1.39 1.59	1.36 1.54	1.31 1.46	1.27 1.40	1.25 1.37
150	3.91 6.81	3.06 4.75	2.67 3.91	2.43 3.44	2.27 3.13	2.16 2.92	2.07 2.76	2.00 2.62	1.94 2.53	1.89 2.44	1.85 2.37	1.82 2.30	1.76 2.20	1.71 2.12	1.64 2.00	1.59 1.91	1.54 1.83	1.47 1.72	1.44 1.66	1.37 1.56	1.34 1.51	1.29 1.43	1.25 1.37	1.22 1.33
200	3.89 6.76	3.04 4.71	2.65 3.88	2.41 3.41	2.26 3.11	2.14 2.90	2.05 2.73	1.98 2.60	1.92 2.50	1.87 2.41	1.83 2.34	1.80 2.28	1.74 2.17	1.69 2.09	1.62 1.97	1.57 1.88	1.52 1.79	1.45 1.69	1.42 1.62	1.35 1.53	1.32 1.48	1.28 1.39	1.22 1.33	1.19 1.25
400	3.86 6.70	3.02 4.66	2.62 3.83	2.39 3.36	2.23 3.06	2.12 2.85	2.03 2.69	1.96 2.55	1.90 2.46	1.85 2.37	1.81 2.29	1.78 2.23	1.72 2.12	1.67 2.04	1.60 1.92	1.54 1.84	1.49 1.74	1.42 1.64	1.38 1.57	1.32 1.47	1.28 1.42	1.22 1.32	1.16 1.24	1.13 1.19
1000	3.85 6.66	3.00 4.62	2.61 3.80	2.38 3.34	2.22 3.04	2.10 2.82	2.02 2.66	1.95 2.53	1.89 2.43	1.84 2.34	1.80 2.26	1.76 2.20	1.70 2.09	1.65 2.01	1.58 1.89	1.53 1.81	1.47 1.71	1.41 1.61	1.36 1.54	1.30 1.44	1.26 1.38	1.19 1.28	1.13 1.19	1.08 1.11
∞	3.84 6.64	2.99 4.60	2.60 3.78	2.37 3.32	2.21 3.02	2.09 2.80	2.01 2.64	1.94 2.51	1.88 2.41	1.83 2.32	1.79 2.24	1.75 2.18	1.69 2.07	1.64 1.99	1.57 1.87	1.52 1.79	1.46 1.69	1.40 1.59	1.35 1.52	1.28 1.41	1.24 1.36	1.17 1.25	1.11 1.15	1.00 1.00

* Pengubahsuaian Jadual G daripada Daniel, W.W., Biostatistics A Foundation for Analysis in the health Sciences, 7th ed. 1999, John Wiley & Sons, Inc. new York

Sebahagian Sifir Nilai-nilai Genting Untuk Taburan F

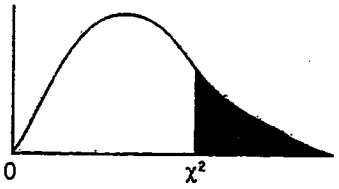
v_1 (darjah kebebasan untuk min kuasa dua pengatas)

v_2(darjah kebebasan untuk min kuasa dua pembawah

	α	1	2	3	4	5	6	7	8	9	10	11
	.75	.111	.302	.413	.481	.524	.561	.586	.606	.621	.635	.645
	.50	.515	.780	.886	.942	.977	1.00	1.02	1.03	1.04	1.05	1.06
	.25	1.62	1.76	1.78	1.79	1.79	1.78	1.78	1.78	1.77	1.77	1.77
	.10	3.78	3.46	3.29	3.18	3.11	3.05	3.01	2.98	2.96	2.94	2.92
6	.05	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06	4.03
	.025	8.81	7.26	6.60	6.23	5.99	5.82	5.70	5.60	5.52	5.46	5.41
	.01	13.7	10.9	9.78	9.15	8.75	8.47	8.26	8.10	7.98	7.87	7.79
	.005	18.6	14.5	12.9	12.0	11.5	11.1	10.8	10.6	10.4	10.3	10.1
	.001	35.5	27.0	23.7	21.9	20.8	20.0	19.5	19.0	18.7	18.4	18.2
	.75	.110	.300	.412	.481	.528	.562	.588	.608	.624	.637	.649
	.50	.506	.767	.871	.926	.960	.983	1.00	1.01	1.02	1.03	1.04
	.25	1.57	1.70	1.72	1.72	1.71	1.71	1.70	1.70	1.69	1.69	1.68
	.10	3.59	3.26	3.07	2.96	2.88	2.83	2.78	2.75	2.72	2.70	2.68
7	.05	5.59	4.74	4.35	4.12	3.97	3.87	3.77	3.73	3.68	3.64	3.60
	.025	8.07	6.54	5.89	5.52	5.29	5.12	4.99	4.89	4.82	4.76	4.71
	.01	12.2	9.55	8.45	7.85	7.46	7.19	6.99	6.84	6.72	6.62	6.54
	.005	16.2	12.4	10.9	10.1	9.52	9.16	8.89	8.68	8.52	8.38	8.27
	.001	29.3	21.7	18.8	17.2	16.2	15.5	15.0	14.6	14.3	14.1	13.9
	.75	.109	.298	.411	.481	.529	.563	.589	.610	.627	.640	.654
	.50	.499	.757	.860	.915	.948	.971	.988	1.00	1.01	1.02	1.03
	.25	1.54	1.66	1.67	1.66	1.66	1.65	1.64	1.64	1.63	1.63	1.63
	.10	3.46	3.11	2.92	2.81	2.73	2.67	2.62	2.59	2.56	2.54	2.52
8	.05	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35	3.31
	.025	7.57	6.06	5.42	5.05	4.82	4.65	4.53	4.43	4.36	4.30	4.25
	.01	11.3	8.65	7.59	7.01	6.63	6.37	6.18	6.03	5.91	5.81	5.73
	.005	14.7	11.0	9.60	8.81	8.30	7.95	7.69	7.50	7.34	7.21	7.10
	.001	25.4	18.5	15.8	14.4	13.5	12.9	12.4	12.0	11.8	11.5	11.3
	.75	.108	.297	.410	.480	.529	.564	.591	.612	.629	.643	.654
	.50	.494	.749	.852	.906	.939	.962	.978	.990	1.00	1.01	1.02
	.25	1.51	1.62	1.63	1.62	1.61	1.60	1.60	1.60	1.59	1.59	1.58
	.10	3.36	3.01	2.81	2.69	2.61	2.55	2.51	2.47	2.44	2.42	2.40
9	.05	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14	3.10
	.025	7.21	5.71	5.08	4.72	4.48	4.32	4.20	4.10	4.03	3.96	3.91
	.01	10.6	8.02	6.99	6.42	6.06	5.80	5.61	5.47	5.35	5.26	5.18
	.005	13.6	10.1	8.72	7.96	7.47	7.13	6.88	6.69	6.54	6.42	6.32
	.001	22.9	16.4	13.9	12.6	11.7	11.1	10.7	10.4	10.1	9.79	9.72
	.75	.107	.296	.409	.480	.529	.565	.592	.613	.631	.645	.657
	.50	.490	.743	.845	.899	.932	.954	.971	.983	.992	1.00	1.01
	.25	1.49	1.60	1.60	1.59	1.59	1.58	1.57	1.56	1.56	1.55	1.54
	.10	3.29	2.92	2.73	2.61	2.52	2.46	2.41	2.38	2.35	2.32	2.30
10	.05	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98	2.94
	.025	6.94	5.46	4.83	4.47	4.24	4.07	3.95	3.85	3.78	3.72	3.67
	.01	10.0	7.56	6.55	5.99	5.64	5.39	5.20	5.06	4.94	4.85	4.77
	.005	12.8	9.43	8.08	7.34	6.87	6.54	6.30	6.12	5.97	5.85	5.75
	.001	21.0	14.9	12.5	11.3	10.5	9.92	9.52	9.20	8.96	8.75	8.59

Pengubahsuaian Jadual A.6 daripada Steel,R.G.D & Torrie, J.H.,Principles and Procedures of Statistics, 1980, McGraw-Hill International Book Co.

Sifir Nilai-Nilai Genting Bagi Taburan χ^2

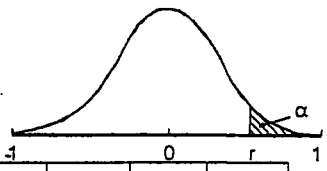


df	α							
	0.995	0.99	0.975	0.95	0.05	0.025	0.01	0.005
1	0.0^4393	0.0^3157	0.0^3982	0.0^2393	3.841	5.024	6.635	7.879
2	0.0100	0.0201	0.0506	0.103	5.991	7.378	9.210	10.597
3	0.0717	0.115	0.216	0.352	7.815	9.348	11.345	25.838
4	0.207	0.297	0.484	0.711	9.488	11.143	13.277	14.860
5	0.412	0.554	0.831	1.145	11.070	12.832	15.086	16.750
6	0.676	0.872	1.237	1.635	12.592	14.449	16.812	18.548
7	0.989	1.239	1.690	2.167	14.067	16.013	18.475	20.278
8	1.344	1.646	2.180	2.733	15.507	17.353	20.090	21.955
9	1.735	2.088	2.700	3.325	16.919	19.023	21.666	23.589
10	2.156	2.558	3.247	3.940	18.307	20.483	23.209	25.188
11	2.603	3.053	3.816	4.575	19.675	21.920	24.725	26.757
12	3.074	3.571	4.404	5.226	21.026	23.337	26.217	28.300
13	3.565	4.107	5.009	5.892	22.326	24.736	27.688	29.819
14	4.075	4.660	5.629	6.571	23.685	26.119	29.141	31.319
15	4.601	5.229	6.262	7.261	24.996	27.488	30.578	32.801
16	5.142	5.812	6.908	7.962	26.296	28.845	32.000	34.267
17	5.697	6.408	7.564	8.672	27.587	30.191	33.409	35.718
18	6.265	7.015	8.231	9.390	28.869	31.526	34.805	37.156
19	6.844	7.633	8.907	10.117	30.144	32.852	36.191	38.582
20	7.434	8.260	9.591	10.851	31.410	34.170	37.566	39.997
21	8.034	8.897	10.283	11.591	32.671	35.479	38.932	41.401
22	8.643	9.542	10.982	12.338	33.924	36.781	40.289	42.796
23	9.260	10.196	11.689	13.091	35.172	38.076	41.638	44.181
24	9.886	10.856	12.401	13.848	36.415	39.364	42.980	45.558
25	10.520	11.524	13.120	14.611	37.652	40.646	44.314	46.928
26	11.160	12.198	13.844	15.379	38.885	41.923	45.642	48.290
27	11.808	12.879	14.573	16.151	40.113	43.194	46.963	49.645
28	12.461	13.565	15.308	16.928	41.337	44.461	48.278	50.993
29	13.121	14.256	16.047	17.708	42.557	45.722	49.588	52.336
30	13.787	14.953	16.791	18.493	43.773	46.979	50.892	53.672

Sumber: Pearson, E.S. Biometrika Tables for Statistics. Vol. I, Biometrika Trustees

Nilai-nilai Genting untuk Pekali Korelasi Pearson, r

Untuk ujian dua hujung, α ialah dua kali nilai aras keertian yang tercatat di pangkal sifir setiap lajur untuk nilai-nilai genting bagi r. Misalnya bagi $\alpha = 0.05$, pilih lajur untuk 0.025.



ν \ α	0.05	0.025	0.010	0.005
5	0.805	0.878	0.934	0.959
6	0.729	0.811	0.882	0.917
7	0.669	0.754	0.833	0.875
8	0.621	0.707	0.789	0.834
9	0.582	0.666	0.750	0.798
10	0.549	0.632	0.716	0.765
11	0.521	0.602	0.685	0.735
12	0.497	0.576	0.658	0.708
13	0.476	0.553	0.634	0.684
14	0.457	0.532	0.612	0.661
15	0.441	0.514	0.592	0.641
16	0.426	0.497	0.574	0.623

ν \ α	0.05	0.025	0.010	0.005
17	0.412	0.482	0.558	0.606
18	0.400	0.468	0.542	0.590
19	0.389	0.456	0.528	0.575
20	0.378	0.444	0.516	0.561
25	0.337	0.396	0.462	0.505
30	0.306	0.361	0.423	0.463
40	0.264	0.312	0.366	0.402
50	0.235	0.279	0.328	0.361
60	0.214	0.254	0.300	0.330
80	0.185	0.220	0.260	0.286
100	0.165	0.196	0.232	0.256

Jadual yang diubahsuai daripada Paul G. Hoel, elementary Statistics, 3ed, 1971, John Wiley and Sons, Inc.