

CRITICAL VALUE TABLES

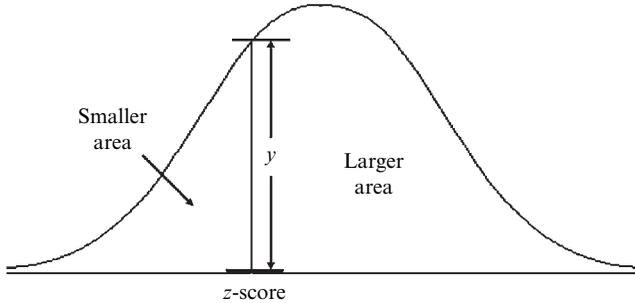


FIGURE B.1

TABLE B.1 The Normal Distribution.

z-score	Smaller area	Larger area	y
0.00	0.5000	0.5000	0.3989
0.01	0.4960	0.5040	0.3989
0.02	0.4920	0.5080	0.3989
0.03	0.4880	0.5120	0.3988
0.04	0.4840	0.5160	0.3986
0.05	0.4801	0.5199	0.3984
0.06	0.4761	0.5239	0.3982
0.07	0.4721	0.5279	0.3980
0.08	0.4681	0.5319	0.3977
0.09	0.4641	0.5359	0.3973
0.10	0.4602	0.5398	0.3970
0.11	0.4562	0.5438	0.3965
0.12	0.4522	0.5478	0.3961
0.13	0.4483	0.5517	0.3956
0.14	0.4443	0.5557	0.3951
0.15	0.4404	0.5596	0.3945

(Continued)

TABLE B.1 (Continued)

z-score	Smaller area	Larger area	y
0.16	0.4364	0.5636	0.3939
0.17	0.4325	0.5675	0.3932
0.18	0.4286	0.5714	0.3925
0.19	0.4247	0.5753	0.3918
0.20	0.4207	0.5793	0.3910
0.21	0.4168	0.5832	0.3902
0.22	0.4129	0.5871	0.3894
0.23	0.4090	0.5910	0.3885
0.24	0.4052	0.5948	0.3876
0.25	0.4013	0.5987	0.3867
0.26	0.3974	0.6026	0.3857
0.27	0.3936	0.6064	0.3847
0.28	0.3897	0.6103	0.3836
0.29	0.3859	0.6141	0.3825
0.30	0.3821	0.6179	0.3814
0.31	0.3783	0.6217	0.3802
0.32	0.3745	0.6255	0.3790
0.33	0.3707	0.6293	0.3778
0.34	0.3669	0.6331	0.3765
0.35	0.3632	0.6368	0.3752
0.36	0.3594	0.6406	0.3739
0.37	0.3557	0.6443	0.3725
0.38	0.3520	0.6480	0.3712
0.39	0.3483	0.6517	0.3697
0.40	0.3446	0.6554	0.3683
0.41	0.3409	0.6591	0.3668
0.42	0.3372	0.6628	0.3653
0.43	0.3336	0.6664	0.3637
0.44	0.3300	0.6700	0.3621
0.45	0.3264	0.6736	0.3605
0.46	0.3228	0.6772	0.3589
0.47	0.3192	0.6808	0.3572
0.48	0.3156	0.6844	0.3555
0.49	0.3121	0.6879	0.3538
0.50	0.3085	0.6915	0.3521
0.51	0.3050	0.6950	0.3503
0.52	0.3015	0.6985	0.3485
0.53	0.2981	0.7019	0.3467
0.54	0.2946	0.7054	0.3448
0.55	0.2912	0.7088	0.3429
0.56	0.2877	0.7123	0.3410
0.57	0.2843	0.7157	0.3391
0.58	0.2810	0.7190	0.3372

TABLE B.1 (Continued)

z-score	Smaller area	Larger area	y
0.59	0.2776	0.7224	0.3352
0.60	0.2743	0.7257	0.3332
0.61	0.2709	0.7291	0.3312
0.62	0.2676	0.7324	0.3292
0.63	0.2643	0.7357	0.3271
0.64	0.2611	0.7389	0.3251
0.65	0.2578	0.7422	0.3230
0.66	0.2546	0.7454	0.3209
0.67	0.2514	0.7486	0.3187
0.68	0.2483	0.7517	0.3166
0.69	0.2451	0.7549	0.3144
0.70	0.2420	0.7580	0.3123
0.71	0.2389	0.7611	0.3101
0.72	0.2358	0.7642	0.3079
0.73	0.2327	0.7673	0.3056
0.74	0.2296	0.7704	0.3034
0.75	0.2266	0.7734	0.3011
0.76	0.2236	0.7764	0.2989
0.77	0.2206	0.7794	0.2966
0.78	0.2177	0.7823	0.2943
0.79	0.2148	0.7852	0.2920
0.80	0.2119	0.7881	0.2897
0.81	0.2090	0.7910	0.2874
0.82	0.2061	0.7939	0.2850
0.83	0.2033	0.7967	0.2827
0.84	0.2005	0.7995	0.2803
0.85	0.1977	0.8023	0.2780
0.86	0.1949	0.8051	0.2756
0.87	0.1922	0.8078	0.2732
0.88	0.1894	0.8106	0.2709
0.89	0.1867	0.8133	0.2685
0.90	0.1841	0.8159	0.2661
0.91	0.1814	0.8186	0.2637
0.92	0.1788	0.8212	0.2613
0.93	0.1762	0.8238	0.2589
0.94	0.1736	0.8264	0.2565
0.95	0.1711	0.8289	0.2541
0.96	0.1685	0.8315	0.2516
0.97	0.1660	0.8340	0.2492
0.98	0.1635	0.8365	0.2468
0.99	0.1611	0.8389	0.2444
1.00	0.1587	0.8413	0.2420

(Continued)

TABLE B.1 (Continued)

z-score	Smaller area	Larger area	y
1.01	0.1562	0.8438	0.2396
1.02	0.1539	0.8461	0.2371
1.03	0.1515	0.8485	0.2347
1.04	0.1492	0.8508	0.2323
1.05	0.1469	0.8531	0.2299
1.06	0.1446	0.8554	0.2275
1.07	0.1423	0.8577	0.2251
1.08	0.1401	0.8599	0.2227
1.09	0.1379	0.8621	0.2203
1.10	0.1357	0.8643	0.2179
1.11	0.1335	0.8665	0.2155
1.12	0.1314	0.8686	0.2131
1.13	0.1292	0.8708	0.2107
1.14	0.1271	0.8729	0.2083
1.15	0.1251	0.8749	0.2059
1.16	0.1230	0.8770	0.2036
1.17	0.1210	0.8790	0.2012
1.18	0.1190	0.8810	0.1989
1.19	0.1170	0.8830	0.1965
1.20	0.1151	0.8849	0.1942
1.21	0.1131	0.8869	0.1919
1.22	0.1112	0.8888	0.1895
1.23	0.1093	0.8907	0.1872
1.24	0.1075	0.8925	0.1849
1.25	0.1056	0.8944	0.1826
1.26	0.1038	0.8962	0.1804
1.27	0.1020	0.8980	0.1781
1.28	0.1003	0.8997	0.1758
1.29	0.0985	0.9015	0.1736
1.30	0.0968	0.9032	0.1714
1.31	0.0951	0.9049	0.1691
1.32	0.0934	0.9066	0.1669
1.33	0.0918	0.9082	0.1647
1.34	0.0901	0.9099	0.1626
1.35	0.0885	0.9115	0.1604
1.36	0.0869	0.9131	0.1582
1.37	0.0853	0.9147	0.1561
1.38	0.0838	0.9162	0.1539
1.39	0.0823	0.9177	0.1518
1.40	0.0808	0.9192	0.1497
1.41	0.0793	0.9207	0.1476
1.42	0.0778	0.9222	0.1456
1.43	0.0764	0.9236	0.1435

TABLE B.1 (Continued)

z-score	Smaller area	Larger area	y
1.44	0.0749	0.9251	0.1415
1.45	0.0735	0.9265	0.1394
1.46	0.0721	0.9279	0.1374
1.47	0.0708	0.9292	0.1354
1.48	0.0694	0.9306	0.1334
1.49	0.0681	0.9319	0.1315
1.50	0.0668	0.9332	0.1295
1.51	0.0655	0.9345	0.1276
1.52	0.0643	0.9357	0.1257
1.53	0.0630	0.9370	0.1238
1.54	0.0618	0.9382	0.1219
1.55	0.0606	0.9394	0.1200
1.56	0.0594	0.9406	0.1182
1.57	0.0582	0.9418	0.1163
1.58	0.0571	0.9429	0.1145
1.59	0.0559	0.9441	0.1127
1.60	0.0548	0.9452	0.1109
1.61	0.0537	0.9463	0.1092
1.62	0.0526	0.9474	0.1074
1.63	0.0516	0.9484	0.1057
1.64	0.0505	0.9495	0.1040
1.65	0.0495	0.9505	0.1023
1.66	0.0485	0.9515	0.1006
1.67	0.0475	0.9525	0.0989
1.68	0.0465	0.9535	0.0973
1.69	0.0455	0.9545	0.0957
1.70	0.0446	0.9554	0.0940
1.71	0.0436	0.9564	0.0925
1.72	0.0427	0.9573	0.0909
1.73	0.0418	0.9582	0.0893
1.74	0.0409	0.9591	0.0878
1.75	0.0401	0.9599	0.0863
1.76	0.0392	0.9608	0.0848
1.77	0.0384	0.9616	0.0833
1.78	0.0375	0.9625	0.0818
1.79	0.0367	0.9633	0.0804
1.80	0.0359	0.9641	0.0790
1.81	0.0351	0.9649	0.0775
1.82	0.0344	0.9656	0.0761
1.83	0.0336	0.9664	0.0748
1.84	0.0329	0.9671	0.0734
1.85	0.0322	0.9678	0.0721

(Continued)

TABLE B.1 (Continued)

z-score	Smaller area	Larger area	y
1.86	0.0314	0.9686	0.0707
1.87	0.0307	0.9693	0.0694
1.88	0.0301	0.9699	0.0681
1.89	0.0294	0.9706	0.0669
1.90	0.0287	0.9713	0.0656
1.91	0.0281	0.9719	0.0644
1.92	0.0274	0.9726	0.0632
1.93	0.0268	0.9732	0.0620
1.94	0.0262	0.9738	0.0608
1.95	0.0256	0.9744	0.0596
1.96	0.0250	0.9750	0.0584
1.97	0.0244	0.9756	0.0573
1.98	0.0239	0.9761	0.0562
1.99	0.0233	0.9767	0.0551
2.00	0.0228	0.9772	0.0540
2.01	0.0222	0.9778	0.0529
2.02	0.0217	0.9783	0.0519
2.03	0.0212	0.9788	0.0508
2.04	0.0207	0.9793	0.0498
2.05	0.0202	0.9798	0.0488
2.06	0.0197	0.9803	0.0478
2.07	0.0192	0.9808	0.0468
2.08	0.0188	0.9812	0.0459
2.09	0.0183	0.9817	0.0449
2.10	0.0179	0.9821	0.0440
2.11	0.0174	0.9826	0.0431
2.12	0.0170	0.9830	0.0422
2.13	0.0166	0.9834	0.0413
2.14	0.0162	0.9838	0.0404
2.15	0.0158	0.9842	0.0396
2.16	0.0154	0.9846	0.0387
2.17	0.0150	0.9850	0.0379
2.18	0.0146	0.9854	0.0371
2.19	0.0143	0.9857	0.0363
2.20	0.0139	0.9861	0.0355
2.21	0.0136	0.9864	0.0347
2.22	0.0132	0.9868	0.0339
2.23	0.0129	0.9871	0.0332
2.24	0.0125	0.9875	0.0325
2.25	0.0122	0.9878	0.0317
2.26	0.0119	0.9881	0.0310
2.27	0.0116	0.9884	0.0303
2.28	0.0113	0.9887	0.0297

TABLE B.1 (Continued)

z-score	Smaller area	Larger area	y
2.29	0.0110	0.9890	0.0290
2.30	0.0107	0.9893	0.0283
2.31	0.0104	0.9896	0.0277
2.32	0.0102	0.9898	0.0270
2.33	0.0099	0.9901	0.0264
2.34	0.0096	0.9904	0.0258
2.35	0.0094	0.9906	0.0252
2.36	0.0091	0.9909	0.0246
2.37	0.0089	0.9911	0.0241
2.38	0.0087	0.9913	0.0235
2.39	0.0084	0.9916	0.0229
2.40	0.0082	0.9918	0.0224
2.41	0.0080	0.9920	0.0219
2.42	0.0078	0.9922	0.0213
2.43	0.0075	0.9925	0.0208
2.44	0.0073	0.9927	0.0203
2.45	0.0071	0.9929	0.0198
2.46	0.0069	0.9931	0.0194
2.47	0.0068	0.9932	0.0189
2.48	0.0066	0.9934	0.0184
2.49	0.0064	0.9936	0.0180
2.50	0.0062	0.9938	0.0175
2.51	0.0060	0.9940	0.0171
2.52	0.0059	0.9941	0.0167
2.53	0.0057	0.9943	0.0163
2.54	0.0055	0.9945	0.0158
2.55	0.0054	0.9946	0.0154
2.56	0.0052	0.9948	0.0151
2.57	0.0051	0.9949	0.0147
2.58	0.0049	0.9951	0.0143
2.59	0.0048	0.9952	0.0139
2.60	0.0047	0.9953	0.0136
2.61	0.0045	0.9955	0.0132
2.62	0.0044	0.9956	0.0129
2.63	0.0043	0.9957	0.0126
2.64	0.0041	0.9959	0.0122
2.65	0.0040	0.9960	0.0119
2.66	0.0039	0.9961	0.0116
2.67	0.0038	0.9962	0.0113
2.68	0.0037	0.9963	0.0110
2.69	0.0036	0.9964	0.0107
2.70	0.0035	0.9965	0.0104

(Continued)

TABLE B.1 (Continued)

z-score	Smaller area	Larger area	y
2.71	0.0034	0.9966	0.0101
2.72	0.0033	0.9967	0.0099
2.73	0.0032	0.9968	0.0096
2.74	0.0031	0.9969	0.0093
2.75	0.0030	0.9970	0.0091
2.76	0.0029	0.9971	0.0088
2.77	0.0028	0.9972	0.0086
2.78	0.0027	0.9973	0.0084
2.79	0.0026	0.9974	0.0081
2.80	0.0026	0.9974	0.0079
2.81	0.0025	0.9975	0.0077
2.82	0.0024	0.9976	0.0075
2.83	0.0023	0.9977	0.0073
2.84	0.0023	0.9977	0.0071
2.85	0.0022	0.9978	0.0069
2.86	0.0021	0.9979	0.0067
2.87	0.0021	0.9979	0.0065
2.88	0.0020	0.9980	0.0063
2.89	0.0019	0.9981	0.0061
2.90	0.0019	0.9981	0.0060
2.91	0.0018	0.9982	0.0058
2.92	0.0018	0.9982	0.0056
2.93	0.0017	0.9983	0.0055
2.94	0.0016	0.9984	0.0053
2.95	0.0016	0.9984	0.0051
2.96	0.0015	0.9985	0.0050
2.97	0.0015	0.9985	0.0048
2.98	0.0014	0.9986	0.0047
2.99	0.0014	0.9986	0.0046
3.00	0.0013	0.9987	0.0044
3.10	0.0010	0.9990	0.0033
3.20	0.0007	0.9993	0.0024
3.30	0.0005	0.9995	0.0017
3.50	0.0002	0.9998	0.0009
3.75	0.0001	0.9999	0.0004
4.00	0.0000	1.0000	0.0001

Source: Adapted by the authors from Hastings (1955).

TABLE B.2 The χ^2 Distribution.

<i>df</i>	0.99	0.975	0.95	0.9	0.1	0.05	0.025	0.01
1	0.00	0.00	0.00	0.02	2.71	3.84	5.02	6.63
2	0.02	0.05	0.10	0.21	4.61	5.99	7.38	9.21
3	0.11	0.22	0.35	0.58	6.25	7.81	9.35	11.34
4	0.30	0.48	0.71	1.06	7.78	9.49	11.14	13.28
5	0.55	0.83	1.15	1.61	9.24	11.07	12.83	15.09
6	0.87	1.24	1.64	2.20	10.64	12.59	14.45	16.81
7	1.24	1.69	2.17	2.83	12.02	14.07	16.01	18.48
8	1.65	2.18	2.73	3.49	13.36	15.51	17.53	20.09
9	2.09	2.70	3.33	4.17	14.68	16.92	19.02	21.67
10	2.56	3.25	3.94	4.87	15.99	18.31	20.48	23.21
11	3.05	3.82	4.57	5.58	17.28	19.68	21.92	24.73
12	3.57	4.40	5.23	6.30	18.55	21.03	23.34	26.22
13	4.11	5.01	5.89	7.04	19.81	22.36	24.74	27.69
14	4.66	5.63	6.57	7.79	21.06	23.68	26.12	29.14
15	5.23	6.26	7.26	8.55	22.31	25.00	27.49	30.58
16	5.81	6.91	7.96	9.31	23.54	26.30	28.85	32.00
17	6.41	7.56	8.67	10.09	24.77	27.59	30.19	33.41
18	7.01	8.23	9.39	10.86	25.99	28.87	31.53	34.81
19	7.63	8.91	10.12	11.65	27.20	30.14	32.85	36.19
20	8.26	9.59	10.85	12.44	28.41	31.41	34.17	37.57
21	8.90	10.28	11.59	13.24	29.62	32.67	35.48	38.93
22	9.54	10.98	12.34	14.04	30.81	33.92	36.78	40.29
23	10.20	11.69	13.09	14.85	32.01	35.17	38.08	41.64
24	10.86	12.40	13.85	15.66	33.20	36.42	39.36	42.98
25	11.52	13.12	14.61	16.47	34.38	37.65	40.65	44.31
26	12.20	13.84	15.38	17.29	35.56	38.89	41.92	45.64
27	12.88	14.57	16.15	18.11	36.74	40.11	43.19	46.96
28	13.56	15.31	16.93	18.94	37.92	41.34	44.46	48.28
29	14.26	16.05	17.71	19.77	39.09	42.56	45.72	49.59
30	14.95	16.79	18.49	20.60	40.26	43.77	46.98	50.89

TABLE B.3 Critical Values for the Wilcoxon Signed Rank Test Statistics T .

n	$\alpha_{\text{two-tailed}} \leq 0.10$	$\alpha_{\text{two-tailed}} \leq 0.05$	$\alpha_{\text{two-tailed}} \leq 0.02$	$\alpha_{\text{two-tailed}} \leq 0.01$
	$\alpha_{\text{one-tailed}} \leq 0.05$	$\alpha_{\text{one-tailed}} \leq 0.025$	$\alpha_{\text{one-tailed}} \leq 0.01$	$\alpha_{\text{one-tailed}} \leq 0.005$
5	0			
6	2	0		
7	3	2	0	
8	5	3	1	0
9	8	5	3	1
10	10	8	5	3
11	13	10	7	5
12	17	13	9	7
13	21	17	12	9
14	25	21	15	12
15	30	25	19	15
16	35	29	23	19
17	41	34	27	23
18	47	40	32	27
19	53	46	37	32
20	60	52	43	37
21	67	58	49	42
22	75	65	55	48
23	83	73	62	54
24	91	81	69	61
25	100	89	76	68
26	110	98	84	75
27	119	107	92	83
28	130	116	101	91
29	140	126	110	100
30	151	137	120	109

Source: Adapted from McCornack, R. L. (1965). Extended tables of the Wilcoxon matched pair signed rank statistic. *Journal of the American Statistical Association*, 60, 864–871. Reprinted with permission from *The Journal of the American Statistical Association*. Copyright 1965 by the American Statistical Association. All rights reserved.

TABLE B.4 Critical Values for the Mann-Whitney *U*-Test Statistic.

α	m	n																								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20					
0.10	1																									
	2																									
	3	0	1																							
	4	0	1	3																						
	5	1	2	4	5																					
	6	1	3	5	7	9																				
	7	1	4	6	8	11	13																			
	8	2	5	7	10	13	16	19																		
	9	0	2	5	9	12	15	18	22	25																
	10	0	3	6	10	13	17	21	24	28	32															
	11	0	3	7	11	15	19	23	27	31	36	40														
	12	0	4	8	12	17	21	26	30	35	39	44	49													
	13	0	4	9	13	18	23	28	33	38	43	48	53	58												
	14	0	5	10	15	20	25	31	36	41	47	52	58	63	69											
	15	0	5	10	16	22	27	33	39	45	51	57	63	68	74	80										
	16	0	5	11	17	23	29	36	42	48	54	61	67	74	80	86	93									
	17	0	6	12	18	25	31	38	45	52	58	65	72	79	85	92	99	106								
	18	0	6	13	20	27	34	41	48	55	62	69	77	84	91	98	106	113	120							
	19	1	7	14	21	28	36	43	51	58	66	73	81	89	97	104	112	120	128	135						
	20	1	7	15	22	30	38	46	54	62	70	78	86	94	102	110	119	127	135	143	151					
0.05	1																									
	2																									
	3			0																						
	4			0	1																					
	5	0	1	2	4																					
	6	0	2	3	5	7																				
	7	0	2	4	6	8	11																			
	8	1	3	5	8	10	13	15																		
	9	1	4	6	9	12	15	18	21																	
	10	1	4	7	11	14	17	20	24	27																
	11	1	5	8	12	16	19	23	27	31	34															
	12	2	5	9	13	17	21	26	30	34	38	42														
	13	2	6	10	15	19	24	28	33	37	42	47	51													
	14	3	7	11	16	21	26	31	36	41	46	51	56	61												
	15	3	7	12	18	23	28	33	39	44	50	55	61	66	72											
	16	3	8	14	19	25	30	36	42	48	54	60	65	71	77	83										
	17	3	9	15	20	26	33	39	45	51	57	64	70	77	83	89	96									
	18	4	9	16	22	28	35	41	48	55	61	68	75	82	88	95	102	109								
	19	0	4	10	17	23	30	37	44	51	58	65	72	80	87	94	101	109	116	123						
	20	0	4	11	18	25	32	39	47	54	62	69	77	84	92	100	107	115	123	130	138					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20						

(Continued)

TABLE B.4 (Continued)

α	m	n																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
0.025	1																				
	2																				
	3																				
	4				0																
	5			0	1	2															
	6			1	2	3	5														
	7			1	3	5	6	8													
	8		0	2	4	6	8	10	13												
	9		0	2	4	7	10	12	15	17											
	10		0	3	5	8	11	14	17	20	23										
	11		0	3	6	9	13	16	19	23	26	30									
	12		1	4	7	11	14	18	22	26	29	33	37								
	13		1	4	8	12	16	20	24	28	33	37	41	45							
	14		1	5	9	13	17	22	26	31	36	40	45	50	55						
	15		1	5	10	14	19	24	29	34	39	44	49	54	59	64					
	16		1	6	11	15	21	26	31	37	42	47	53	59	64	70	75				
	17		2	6	11	17	22	28	34	39	45	51	57	63	69	75	81	87			
	18		2	7	12	18	24	30	36	42	48	55	61	67	74	80	86	93	99		
	19		2	7	13	19	25	32	38	45	52	58	65	72	78	85	92	99	106	113	
	20		2	8	14	20	27	34	41	48	55	62	69	76	83	90	98	105	112	119	127
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
0.01	1																				
	2																				
	3																				
	4																				
	5				0	1															
	6				1	2	3														
	7			0	1	3	4	6													
	8			0	2	4	6	7	9												
	9			1	3	5	7	9	11	14											
	10			1	3	6	8	11	13	16	19										
	11			1	4	7	9	12	15	18	22	25									
	12			2	5	8	11	14	17	21	24	28	31								
	13		0	2	5	9	12	16	20	23	27	31	35	39							
	14		0	2	6	10	13	17	22	26	30	34	38	43	47						
	15		0	3	7	11	15	19	24	28	33	37	42	47	51	56					
	16		0	3	7	12	16	21	26	31	36	41	46	51	56	61	66				
	17		0	4	8	13	18	23	28	33	38	44	49	55	60	66	71	77			
	18		0	4	9	14	19	24	30	36	41	47	53	59	65	70	76	82	88		
	19		1	4	9	15	20	26	32	38	44	50	56	63	69	75	82	88	94	101	
	20		1	5	10	16	22	28	34	40	47	53	60	67	73	80	87	93	100	107	114

Source: Adapted from Milton, R. C. (1964). An extended table of critical values for the Mann-Whitney (Wilcoxon) two-sample statistic. *Journal of the American Statistical Association*, 59, 925-934. Reprinted with permission from *The Journal of the American Statistical Association*. Copyright 1964 by the American Statistical Association. All rights reserved.

TABLE B.5 Critical Values for the Friedman Test Statistic F_r .

k	N	$\alpha \leq 0.10$	$\alpha \leq 0.05$	$\alpha \leq 0.025$	$\alpha \leq 0.01$	
3	3	6.000	6.000			
	4	6.000	6.500	8.000	8.000	
	5	5.200	6.400	7.600	8.400	
	6	5.333	7.000	8.333	9.000	
	7	5.429	7.143	7.714	8.857	
	8	5.250	6.250	7.750	9.000	
	9	5.556	6.222	8.000	8.667	
	10	5.000	6.200	7.800	9.600	
	11	4.909	6.545	7.818	9.455	
	12	5.167	6.500	8.000	9.500	
	13	4.769	6.000	7.538	9.385	
	14	5.143	6.143	7.429	9.000	
	15	4.933	6.400	7.600	8.933	
	4	2	6.000	6.000		
		3	6.600	7.400	8.200	9.000
4		6.300	7.800	8.400	9.600	
5		6.360	7.800	8.760	9.960	
6		6.400	7.600	8.800	10.200	
7		6.429	7.800	9.000	10.371	
8		6.300	7.650	9.000	10.500	
9		6.467	7.800	9.133	10.867	
10		6.360	7.800	9.120	10.800	
11		6.382	7.909	9.327	11.073	
12		6.400	7.900	9.200	11.100	
13		6.415	7.985	7.369	11.123	
14		6.343	7.886	9.343	11.143	
15		6.440	8.040	9.400	11.240	
5		2	7.200	7.600	8.000	8.000
	3	7.467	8.533	9.600	10.133	
	4	7.600	8.800	9.800	11.200	
	5	7.680	8.960	10.240	11.680	
	6	7.733	9.067	10.400	11.867	
	7	7.771	9.143	10.514	12.114	
	8	7.800	9.300	10.600	12.300	
	9	7.733	9.244	10.667	12.444	
	10	7.760	9.280	10.720	12.480	
	6	2	8.286	9.143	9.429	9.714
3		8.714	9.857	10.810	11.762	
4		9.000	10.286	11.429	12.714	
5		9.000	10.486	11.743	13.229	
6		9.048	10.571	12.000	13.619	
7		9.122	10.674	12.061	13.857	

(Continued)

TABLE B.5 (Continued)

k	N	$\alpha \leq 0.10$	$\alpha \leq 0.05$	$\alpha \leq 0.025$	$\alpha \leq 0.01$
	8	9.143	10.714	12.214	14.000
	9	9.127	10.778	12.302	14.143
	10	9.143	10.800	12.343	14.229

Source: Adapted from Martin, L., Leblanc, R., & Toan, N. K. (1993). Tables for the Friedman rank test. *The Canadian Journal of Statistics / La Revue Canadienne de Statistique*, 21(1), 39–43. Reprinted with permission from *The Canadian Journal of Statistics*. Copyright 1993 by the Statistical Society of Canada. All rights reserved.

TABLE B.6 The Critical Values for the Kruskal–Wallis H -Test Statistic.

(The Critical Values for the Kruskal–Wallis H -Test Statistic, $k = 3$).

n_1	n_2	n_3	$\alpha \leq 0.10$	$\alpha \leq 0.05$	$\alpha \leq 0.01$
2	2	2	4.571429	–	–
3	1	1	–	–	–
3	2	1	4.285714	–	–
3	2	2	4.464286	4.714286	–
3	3	1	4.571429	5.142857	–
3	3	2	4.555556	5.361111	–
3	3	3	4.622222	5.600000	6.488889
4	2	1	4.500000	–	–
4	2	2	4.458333	5.333333	–
4	3	1	4.055556	5.208333	–
4	3	2	4.511111	5.444444	6.444444
4	3	3	4.700000	5.790909	6.745455
4	4	1	4.166667	4.966667	6.666667
4	4	2	4.554545	5.454545	7.036364
4	4	3	4.545455	5.598485	7.143939
4	4	4	4.653846	5.692308	7.653846
5	2	1	4.200000	5.000000	–
5	2	2	4.373333	5.160000	6.533333
5	3	1	4.017778	4.871111	–
5	3	2	4.650909	5.250909	6.821818
5	3	3	4.533333	5.648485	7.078788
5	4	1	3.987273	4.985455	6.954545
5	4	2	4.540909	5.272727	7.204545
5	4	3	4.548718	5.656410	7.444872
5	4	4	4.668132	5.657143	7.760440
5	5	1	4.109091	5.127273	7.309091
5	5	2	4.623077	5.338462	7.338462
5	5	3	4.545055	5.626374	7.578022
5	5	4	4.522857	5.665714	7.791429
5	5	5	4.560000	5.780000	8.000000

TABLE B.6 (Continued)

(The Critical Values for the Kruskal–Wallis H -Test Statistic, $k = 3$).

n_1	n_2	n_3	$\alpha \leq 0.10$	$\alpha \leq 0.05$	$\alpha \leq 0.01$
6	2	1	4.200000	4.822222	—
6	2	2	4.436364	5.345455	6.654545
6	3	1	3.909091	4.854545	6.581818
6	3	2	4.681818	5.348485	6.969697
6	3	3	4.538462	5.615385	7.192308
6	4	1	4.037879	4.946970	7.083333
6	4	2	4.493590	5.262821	7.339744
6	4	3	4.604396	5.604396	7.467033
6	4	4	4.523810	5.666667	7.795238
6	5	1	4.128205	4.989744	7.182051
6	5	2	4.595604	5.318681	7.375824
6	5	3	4.535238	5.601905	7.590476
6	5	4	4.522500	5.660833	7.935833
6	5	5	4.547059	5.698529	8.027941
6	6	1	4.000000	4.857143	7.065934
6	6	2	4.438095	5.409524	7.466667
6	6	3	4.558333	5.625000	7.725000
6	6	4	4.547794	5.724265	8.000000
6	6	5	4.542484	5.764706	8.118954
6	6	6	4.538012	5.719298	8.222222
7	1	1	4.266667	—	—
7	2	1	4.200000	4.706494	—
7	2	2	4.525974	5.142857	7.000000
7	3	1	4.173160	4.952381	6.649351
7	3	2	4.582418	5.357143	6.838828
7	3	3	4.602826	5.620094	7.227630
7	4	1	4.120879	4.986264	6.986264
7	4	2	4.549451	5.375981	7.304553
7	4	3	4.527211	5.623129	7.498639
7	4	4	4.562500	5.650000	7.814286
7	5	1	4.035165	5.063736	7.060597
7	5	2	4.484898	5.392653	7.449796
7	5	3	4.535238	5.588571	7.697143
7	5	4	4.541597	5.732773	7.931092
7	5	5	4.540056	5.707563	8.100840
7	6	1	4.032653	5.066667	7.254422
7	6	2	4.500000	5.357143	7.490476
7	6	3	4.550420	5.672269	7.756303
7	6	4	4.561625	5.705882	8.016340
7	6	5	4.559733	5.769925	8.156725

(Continued)

TABLE B.6 (Continued)

(The Critical Values for the Kruskal–Wallis H -Test Statistic, $k = 3$).

n_1	n_2	n_3	$\alpha \leq 0.10$	$\alpha \leq 0.05$	$\alpha \leq 0.01$
7	6	6	4.530075	5.730075	8.257143
7	7	1	3.985714	4.985714	7.157143
7	7	2	4.490546	5.398109	7.490546
7	7	3	4.590103	5.676937	7.809524
7	7	4	4.558897	5.765664	8.141604
7	7	5	4.545564	5.745564	8.244812
7	7	6	4.568027	5.792517	8.341497
7	7	7	4.593692	5.818182	8.378479
8	1	1	4.418182	—	—
8	2	1	4.011364	4.909091	—
8	2	2	4.586538	5.355769	6.663462
8	3	1	4.009615	4.881410	6.804487
8	3	2	4.450549	5.315934	6.986264
8	3	3	4.504762	5.616667	7.254762
8	4	1	4.038462	5.043956	6.972527
8	4	2	4.500000	5.392857	7.350000
8	4	3	4.529167	5.622917	7.585417
8	4	4	4.560662	5.779412	7.852941
8	5	1	3.967143	4.868571	7.110000
8	5	2	4.466250	5.415000	7.440000
8	5	3	4.514338	5.614338	7.705515
8	5	4	4.549020	5.717647	7.992157
8	5	5	4.555263	5.769298	8.115789
8	6	1	4.014583	5.014583	7.256250
8	6	2	4.441176	5.404412	7.522059
8	6	3	4.573529	5.678105	7.795752
8	6	4	4.562865	5.742690	8.045322
8	6	5	4.550263	5.750263	8.210263
8	6	6	4.598810	5.770238	8.294048
8	7	1	4.045431	5.041229	7.307773
8	7	2	4.450980	5.403361	7.571429
8	7	3	4.555556	5.698413	7.827068
8	7	4	4.548496	5.759211	8.118045
8	7	5	4.550612	5.777449	8.241939
8	7	6	4.552876	5.781231	8.332715
8	7	7	4.573687	5.795031	8.356296
8	8	1	4.044118	5.039216	7.313725
8	8	2	4.508772	5.407895	7.653509
8	8	3	4.555263	5.734211	7.889474
8	8	4	4.578571	5.742857	8.167857
8	8	5	4.572727	5.761039	8.297403

TABLE B.6 (Continued)

(The Critical Values for the Kruskal–Wallis H -Test Statistic, $k = 3$).

n_1	n_2	n_3	$\alpha \leq 0.10$	$\alpha \leq 0.05$	$\alpha \leq 0.01$
8	8	6	4.572134	5.778656	8.366601
8	8	7	4.570652	5.791149	8.418866
8	8	8	4.595000	5.805000	8.465000
9	1	1	4.545455	—	—
9	2	1	3.905983	4.841880	6.346154
9	2	2	4.483516	5.260073	6.897436
9	3	1	4.073260	4.952381	6.886447
9	3	2	4.492063	5.339683	6.990476
9	3	3	4.633333	5.588889	7.355556
9	4	1	3.971429	5.071429	7.171429
9	4	2	4.488889	5.400000	7.363889
9	4	3	4.514706	5.651961	7.613971
9	4	4	4.576253	5.703704	7.909586
9	5	1	4.055556	5.040000	7.148889
9	5	2	4.464706	5.395588	7.447059
9	5	3	4.587364	5.669717	7.733333
9	5	4	4.531384	5.712671	8.024561
9	5	5	4.557193	5.769825	8.169825
9	6	1	3.933824	5.049020	7.247549
9	6	2	4.481481	5.392157	7.494553
9	6	3	4.541910	5.664717	7.822612
9	6	4	4.545614	5.744737	8.108772
9	6	5	4.573651	5.761905	8.230794
9	6	6	4.554113	5.808081	8.307359
9	7	1	4.011204	5.042017	7.270464
9	7	2	4.480089	5.429128	7.636591
9	7	3	4.535338	5.656140	7.860652
9	7	4	4.547732	5.731406	8.131406
9	7	5	4.565492	5.757988	8.287941
9	7	6	4.570864	5.782985	8.353284
9	7	7	4.583851	5.802622	8.403037
9	8	1	3.986355	4.984893	7.394250
9	8	2	4.491667	5.419737	7.642105
9	8	3	4.568651	5.717460	7.927381
9	8	4	4.559163	5.744228	8.203102
9	8	5	4.551252	5.783465	8.318050
9	8	6	4.560688	5.775362	8.408514
9	8	7	4.563770	5.807579	8.450000
9	8	8	4.582821	5.809744	8.494359
9	9	1	4.007018	4.961404	7.333333

(Continued)

TABLE B.6 (Continued)

(The Critical Values for the Kruskal–Wallis H -Test Statistic, $k = 3$).

n_1	n_2	n_3	$\alpha \leq 0.10$	$\alpha \leq 0.05$	$\alpha \leq 0.01$
9	9	2	4.460317	5.411111	7.692063
9	9	3	4.565657	5.708514	7.959596
9	9	4	4.550066	5.751647	8.202240
9	9	5	4.587440	5.770048	8.370048
9	9	6	4.555556	5.814444	8.427778
9	9	7	4.567326	5.802198	8.468864
9	9	8	4.570750	5.815052	8.514720
9	9	9	4.582011	5.844797	8.564374
10	1	1	4.653846	4.653846	–
10	2	1	4.114286	4.839560	6.428571
10	2	2	4.434286	5.120000	6.537143
10	3	1	3.996190	5.076190	6.851429
10	3	2	4.470000	5.361667	7.041667
10	3	3	4.529412	5.588235	7.360294
10	4	1	4.042500	5.017500	7.105000
10	4	2	4.462500	5.344853	7.356618
10	4	3	4.587582	5.654248	7.616993
10	4	4	4.564912	5.715789	7.907018
10	5	1	3.988235	4.905882	7.107353
10	5	2	4.454902	5.388235	7.513725
10	5	3	4.552047	5.618713	7.752047
10	5	4	4.556842	5.744211	8.047895
10	5	5	4.574286	5.777143	8.162857
10	6	1	3.967320	5.041830	7.316340
10	6	2	4.479532	5.405848	7.588304
10	6	3	4.542105	5.655789	7.882105
10	6	4	4.550476	5.726190	8.142857
10	6	5	4.554978	5.754978	8.267532
10	6	6	4.575494	5.780237	8.338340
10	7	1	3.981454	4.985965	7.252130
10	7	2	4.491880	5.377444	7.641203
10	7	3	4.545034	5.698095	7.901224
10	7	4	4.550278	5.751206	8.172356
10	7	5	4.567250	5.763862	8.295652
10	7	6	4.563043	5.798758	8.376915
10	7	7	4.562286	5.796571	8.419429
10	8	1	3.963947	5.037632	7.358684
10	8	2	4.482857	5.429286	7.720714
10	8	3	4.533983	5.711688	7.977273
10	8	4	4.550988	5.744466	8.206126
10	9	5	4.556522	5.789130	8.344022

TABLE B.6 (Continued)

(The Critical Values for the Kruskal–Wallis H -Test Statistic, $k = 3$).

n_1	n_2	n_3	$\alpha \leq 0.10$	$\alpha \leq 0.05$	$\alpha \leq 0.01$
10	9	6	4.573333	5.793833	8.397833
10	9	7	4.564484	5.810637	8.480967
10	9	8	4.561538	5.829060	8.494017
10	9	1	4.025714	4.988571	7.436508
10	9	2	4.476479	5.446176	7.693795
10	9	3	4.570751	5.700659	7.997628
10	9	4	4.556401	5.757609	8.223430
10	9	5	4.547556	5.792000	8.380222
10	9	6	4.561231	5.813128	8.449436
10	9	7	4.559707	5.817610	8.507475
10	9	8	4.567063	5.833730	8.544489
10	9	9	4.578982	5.830706	8.575698
10	10	1	3.987013	5.054545	7.501299
10	10	2	4.477470	5.449802	7.726482
10	10	3	4.559420	5.687681	8.026087
10	10	4	4.567000	5.776000	8.263000
10	10	5	4.554462	5.793231	8.403692
10	10	6	4.561823	5.796011	8.472934
10	10	7	4.558277	5.820408	8.536508
10	10	8	4.565025	5.837438	8.565887
10	10	9	4.567050	5.837241	8.606130
10	10	10	4.583226	5.855484	8.640000

(The Critical Values for the Kruskal–Wallis H -Test Statistic, $k = 4$).

n_1	n_2	n_3	n_4	$\alpha \leq 0.10$	$\alpha \leq 0.05$	$\alpha \leq 0.01$
2	2	2	1	5.357143	5.678571	–
2	2	2	2	5.666667	6.166667	6.666667
3	2	1	1	4.892857	–	–
3	2	2	1	5.555556	5.833333	–
3	2	2	2	5.644444	6.333333	7.133333
3	3	1	1	5.333333	6.333333	–
3	3	2	1	5.622222	6.244444	7.044444
3	3	2	2	5.745455	6.527273	7.636364
3	3	3	1	5.654545	6.600000	7.400000
3	3	3	2	5.878788	6.727273	8.015152
3	3	3	3	5.974359	6.897436	8.435897
4	2	1	1	5.250000	5.833333	–
4	2	2	1	5.533333	6.133333	7.000000
4	2	2	2	5.754545	6.545455	7.390909
4	3	1	1	5.066667	6.177778	7.066667

(Continued)

TABLE B.6 (Continued)

(The Critical Values for the Kruskal–Wallis H -Test Statistic, $k = 4$.)

n_1	n_2	n_3	n_4	$\alpha \leq 0.10$	$\alpha \leq 0.05$	$\alpha \leq 0.01$
4	3	2	1	5.572727	6.309091	7.454545
4	3	2	2	5.750000	6.621212	7.871212
4	3	3	1	5.666667	6.545455	7.757576
4	3	3	2	5.858974	6.782051	8.320513
4	3	3	3	6.000000	6.967033	8.653846
4	4	1	1	5.181818	5.945455	7.909091
4	4	2	1	5.568182	6.386364	7.909091
4	4	2	2	5.807692	6.730769	8.346154
4	4	3	1	5.660256	6.634615	8.217949
4	4	3	2	5.901099	6.873626	8.620879
4	4	3	3	6.004762	7.038095	8.866667
4	4	4	1	5.653846	6.725275	8.587912
4	4	4	2	5.914286	6.957143	8.871429
4	4	4	3	6.029167	7.129167	9.075000
4	4	4	4	6.088235	7.235294	9.286765
5	1	1	1	5.333333	—	—
5	2	1	1	5.266667	5.960000	—
5	2	2	1	5.541818	6.109091	7.276364
5	2	2	2	5.636364	6.563636	7.772727
5	3	1	1	5.130909	6.003636	7.400000
5	3	2	1	5.518182	6.363636	7.757576
5	3	2	2	5.771795	6.664103	8.202564
5	3	3	1	5.656410	6.641026	8.117949
5	3	3	2	5.865934	6.821978	8.606593
5	3	3	3	6.020952	7.011429	8.840000
5	4	1	1	5.254545	6.040909	7.909091
5	4	2	1	5.580769	6.419231	8.173077
5	4	2	2	5.782418	6.725275	8.472527
5	4	3	1	5.639560	6.681319	8.408791
5	4	3	2	5.901905	6.925714	8.801905
5	4	3	3	6.029167	7.093333	9.029167
5	4	4	1	5.674286	6.760000	8.725714
5	4	4	2	5.947500	6.990000	9.002500
5	4	4	3	6.035294	7.172794	9.220588
5	4	4	4	6.066667	7.262745	9.392157
5	5	1	1	5.153846	6.076923	8.107692
5	5	2	1	5.564835	6.540659	8.327473
5	5	2	2	5.794286	6.777143	8.634286
5	5	3	1	5.662857	6.737143	8.611429
5	5	3	2	5.921667	6.946667	8.946667
5	5	3	3	6.023529	7.117647	9.188235

TABLE B.6 (Continued)

(The Critical Values for the Kruskal–Wallis H -Test Statistic, $k = 4$.)

n_1	n_2	n_3	n_4	$\alpha \leq 0.10$	$\alpha \leq 0.05$	$\alpha \leq 0.01$
5	5	4	1	5.670000	6.782500	8.870000
5	5	4	2	5.944853	7.032353	9.156618
5	5	4	3	6.052288	7.217647	9.356863
5	5	4	4	6.070175	7.291228	9.536842
5	5	5	1	5.682353	6.829412	9.052941
5	5	5	2	5.945098	7.074510	9.286275
5	5	5	3	6.043275	7.250292	9.495906
5	5	5	4	6.082105	7.327895	9.669474
5	5	5	5	6.097143	7.377143	9.800000

Source: Adapted from Meyer, J. P., & Seaman, M. A. (2008, March). A comparison of the exact Kruskal-Wallis distribution to asymptotic approximations for $N \leq 105$. Paper presented at the annual meeting of the American Educational Research Association, New York. Reprinted with permission of the authors.

TABLE B.7 Critical Values for the Spearman Rank-Order Correlation Coefficient r_s .

n	$\alpha_{\text{two-tailed}} \leq 0.10$	$\alpha_{\text{two-tailed}} \leq 0.05$	$\alpha_{\text{two-tailed}} \leq 0.02$	$\alpha_{\text{two-tailed}} \leq 0.01$
	$\alpha_{\text{one-tailed}} \leq 0.05$	$\alpha_{\text{one-tailed}} \leq 0.025$	$\alpha_{\text{one-tailed}} \leq 0.01$	$\alpha_{\text{one-tailed}} \leq 0.005$
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	0.671	0.727
13	0.484	0.560	0.648	0.703
14	0.464	0.538	0.622	0.675
15	0.443	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

(Continued)

TABLE B.7 (Continued)

n	$\alpha_{\text{two-tailed}} \leq 0.10$	$\alpha_{\text{two-tailed}} \leq 0.05$	$\alpha_{\text{two-tailed}} \leq 0.02$	$\alpha_{\text{two-tailed}} \leq 0.01$
	$\alpha_{\text{one-tailed}} \leq 0.05$	$\alpha_{\text{one-tailed}} \leq 0.025$	$\alpha_{\text{one-tailed}} \leq 0.01$	$\alpha_{\text{one-tailed}} \leq 0.005$
24	0.344	0.406	0.476	0.321
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
31	0.301	0.356	0.418	0.459
32	0.296	0.350	0.412	0.452
33	0.291	0.345	0.405	0.446
34	0.287	0.340	0.399	0.439
35	0.283	0.335	0.394	0.433
36	0.279	0.330	0.388	0.427
37	0.275	0.325	0.383	0.421
38	0.271	0.321	0.378	0.415
39	0.267	0.317	0.373	0.410
40	0.264	0.313	0.368	0.405
41	0.261	0.309	0.364	0.400
42	0.257	0.305	0.359	0.395
43	0.254	0.301	0.355	0.391
44	0.251	0.298	0.351	0.386
45	0.248	0.294	0.347	0.382
46	0.246	0.291	0.343	0.378
47	0.243	0.288	0.340	0.374
48	0.240	0.285	0.336	0.370
49	0.238	0.282	0.333	0.366
50	0.235	0.279	0.329	0.363

Source: Adapted from Zar, J. H. (1972). Significance testing of the Spearman rank correlation coefficient. *Journal of the American Statistical Association*, 67, 578–580. Reprinted with permission from The *Journal of the American Statistical Association*. Copyright 1972 by the American Statistical Association. All rights reserved.

TABLE B.8 Critical Values for the Pearson Product-Moment Correlation Coefficient r .

df	$\alpha_{\text{two-tailed}} \leq 0.10$	$\alpha_{\text{two-tailed}} \leq 0.05$	$\alpha_{\text{two-tailed}} \leq 0.025$	$\alpha_{\text{two-tailed}} \leq 0.01$
	$\alpha_{\text{one-tailed}} \leq 0.05$	$\alpha_{\text{one-tailed}} \leq 0.025$	$\alpha_{\text{one-tailed}} \leq 0.0125$	$\alpha_{\text{one-tailed}} \leq 0.005$
1	0.988	0.997	0.999	0.999
2	0.900	0.950	0.975	0.990
3	0.805	0.878	0.924	0.959
4	0.729	0.811	0.868	0.917
5	0.669	0.754	0.817	0.875
6	0.621	0.707	0.771	0.834
7	0.582	0.666	0.732	0.798
8	0.549	0.632	0.697	0.765
9	0.521	0.602	0.667	0.735
10	0.497	0.576	0.640	0.708
11	0.476	0.553	0.616	0.6840
12	0.458	0.532	0.594	0.661
13	0.441	0.514	0.575	0.641
14	0.426	0.497	0.557	0.623
15	0.412	0.482	0.541	0.606
16	0.400	0.468	0.526	0.590
17	0.389	0.456	0.512	0.575
18	0.378	0.444	0.499	0.561
19	0.369	0.433	0.487	0.549
20	0.360	0.423	0.476	0.537
21	0.352	0.413	0.466	0.526
22	0.344	0.404	0.456	0.515
23	0.337	0.396	0.447	0.505
24	0.330	0.388	0.439	0.496
25	0.323	0.381	0.430	0.487
26	0.317	0.374	0.423	0.479
27	0.311	0.367	0.415	0.471
28	0.306	0.361	0.409	0.463
29	0.301	0.355	0.402	0.456
30	0.296	0.349	0.396	0.449
31	0.291	0.344	0.390	0.442
32	0.287	0.339	0.384	0.436
33	0.283	0.334	0.378	0.430
34	0.279	0.329	0.373	0.424
35	0.275	0.325	0.368	0.418
36	0.271	0.320	0.363	0.413
37	0.267	0.316	0.359	0.408
38	0.264	0.312	0.354	0.403
39	0.260	0.308	0.350	0.398
40	0.257	0.304	0.346	0.393
41	0.254	0.301	0.342	0.389

(Continued)

TABLE B.8 (Continued)

<i>df</i>	$\alpha_{\text{two-tailed}} \leq 0.10$	$\alpha_{\text{two-tailed}} \leq 0.05$	$\alpha_{\text{two-tailed}} \leq 0.025$	$\alpha_{\text{two-tailed}} \leq 0.01$
	$\alpha_{\text{one-tailed}} \leq 0.05$	$\alpha_{\text{one-tailed}} \leq 0.025$	$\alpha_{\text{one-tailed}} \leq 0.0125$	$\alpha_{\text{one-tailed}} \leq 0.005$
42	0.251	0.297	0.338	0.384
43	0.248	0.294	0.334	0.380
44	0.246	0.291	0.330	0.376
45	0.243	0.288	0.327	0.372
46	0.240	0.285	0.323	0.368
47	0.238	0.282	0.320	0.365
48	0.235	0.279	0.317	0.361
49	0.233	0.276	0.314	0.358
50	0.231	0.273	0.311	0.354

TABLE B.9 Factorials.

<i>n</i>	<i>n!</i>
1	1
2	2
3	6
4	24
5	120
6	720
7	5040
8	40,320
9	362,880
10	3,628,800
11	39,916,800
12	479,001,600
13	6,227,020,800
14	87,178,291,200
15	1,307,674,368,000
16	20,922,789,888,000
17	355,687,428,096,000
18	6,402,373,705,728,000
19	121,645,100,408,832,000
20	2,432,902,008,176,640,000
21	51,090,942,171,709,440,000
22	1,124,000,727,777,607,680,000
23	25,852,016,738,884,976,640,000
24	620,448,401,733,239,439,360,000
25	15,511,210,043,330,985,984,000,000

TABLE B.10 Critical Values for the Runs Test for Randomness.

One-tailed alternative; $\alpha = 0.05$.

n_1	n_2										
	2	3	4	5	6	7	8	9	10	11	12
2	-	-	-	-	-	-	2	2	2	2	2
3	-	-	-	2	2	2	2	2	3	3	3
4	-	-	2	2	3	3	3	3	3	3	4
5	-	2	2	3	3	3	3	4	4	4	4
6	-	2	3	3	3	4	4	4	5	5	5
7	-	2	3	3	4	4	4	5	5	5	6
8	2	2	3	3	4	4	5	5	6	6	6
9	2	2	3	4	4	5	5	6	6	6	7
10	2	3	3	4	5	5	6	6	6	7	7
11	2	3	3	4	5	5	6	6	7	7	8
12	2	3	4	4	5	6	6	7	7	8	8

One-tailed alternative; $\alpha = 0.025$.

n_1	n_2										
	2	3	4	5	6	7	8	9	10	11	12
2	-	-	-	-	-	-	-	-	-	-	2
3	-	-	-	-	2	2	2	2	2	2	2
4	-	-	-	2	2	2	3	3	3	3	3
5	-	-	2	2	3	3	3	3	3	4	4
6	-	2	2	3	3	3	3	4	4	4	4
7	-	2	2	3	3	3	4	4	5	5	5

(Continued)

TABLE B.10 (Continued)

One-tailed alternative; $\alpha = 0.025$.

n_1	n_2										
	2	3	4	5	6	7	8	9	10	11	12
8	–	2	3	3	3	4	4	5	5	5	6
	–	–	–	11	12	13	14	14	15	15	16
9	–	2	3	3	4	4	5	5	5	6	6
	–	–	–	–	13	14	14	15	16	16	16
10	–	2	3	3	4	5	5	5	6	6	7
	–	–	–	–	13	14	15	16	16	17	17
11	–	2	3	4	4	5	5	6	6	7	7
	–	–	–	–	13	14	15	16	17	17	18
12	2	2	3	4	4	5	6	6	7	7	7
	–	–	–	–	13	14	16	16	17	18	19

Source: Adapted from tables D.5 and D.6 of Janke, S. J., & Tinsley, F. C. (2005). *Introduction to Linear Models and Statistical Inference*. Hoboken, NJ: John Wiley & Sons, Inc. Reprinted with permission of John Wiley & Sons, Inc. Copyright 2005 by John Wiley & Sons, Inc. All rights reserved.