Statistical Tables

APPENDIX

A

Table A-1   Areas Under the Normal Curve (*z*)

Z	AREA BETWEEN 0 AND Z	AREA ABOVE Z	Z	AREA BETWEEN 0 AND Z	AREA ABOVE Z	Z	AREA BETWEEN 0 AND Z	AREA ABOVE Z
0.00	.0000	.5000	0.45	.1736	.3264	0.90	.3159	.1841
0.01	.0040	.4960	0.46	.1772	.3228	0.91	.3186	.1814
0.02	.0080	.4920	0.47	.1808	.3192	0.92	.3212	.1788
0.03	.0120	.4880	0.48	.1844	.3156	0.93	.3238	.1762
0.04	.0160	.4840	0.49	.1879	.3121	0.94	.3264	.1736
0.05	.0199	.4801	0.50	.1915	.3085	0.95	.3289	.1711
0.06	.0239	.4761	0.51	.1950	.3050	0.96	.3315	.1685
0.07	.0279	.4721	0.52	.1985	.3015	0.97	.3340	.1660
0.08	.0319	.4681	0.53	.2019	.2981	0.98	.3365	.1635
0.09	.0359	.4641	0.54	.2054	.2946	0.99	.3389	.1611
0.10	.0398	.4602	0.55	.2088	.2912	1.00	.3413	.1587
0.11	.0438	.4562	0.56	.2123	.2877	1.01	.3138	.1582
0.12	.0478	.4522	0.57	.2157	.2843	1.02	.3461	.1539
0.13	.0517	.4493	0.58	.2190	.2810	1.03	.3485	.1515
0.14	.0557	.4443	0.59	.2224	.2776	1.04	.3508	.1492
0.15	.0596	.4404	0.60	.2257	.2743	1.05	.3531	.1469
0.16	.0636	.4364	0.61	.2291	.2709	1.06	.3554	.1446
0.17	.0675	.4325	0.62	.2324	.2676	1.07	.3577	.4230
0.18	.0714	.4286	0.63	.2357	.3643	1.08	.3599	.1401
0.19	.0753	.4247	0.64	.2389	.2611	1.09	.3621	.1379
0.20	.0793	.4207	0.65	.2422	.2578	1.10	.3643	.1357
0.21	.0832	.4168	0.66	.2454	.2546	1.11	.3665	.1335
0.22	.0871	.4129	0.67	.2486	.2514	1.12	.3686	.1314
0.23	.0910	.4090	0.68	.2517	.2483	1.13	.3708	.1292
0.24	.0948	.4052	0.69	.2549	.2451	1.14	.3729	.1271
0.25	.0987	.4013	0.70	.2580	.2420	1.15	.3749	.1251
0.26	.1026	.3974	0.71	.2611	.2389	1.16	.3770	.1230
0.27	.1064	.3936	0.72	.2642	.2358	1.17	.3790	.1210
0.28	.1103	.8970	0.73	.2673	.2327	1.18	.3810	.1190
0.29	.1141	.3859	0.74	.2704	.2296	1.19	.3830	.1170
0.30	.1179	.3821	0.75	.2734	.2266	1.20	.3849	.1151
0.31	.1217	.3783	0.76	.2764	.2236	1.21	.3869	.1131
0.32	.1255	.3745	0.77	.2794	.2206	1.22	.3888	.1112
0.33	.1293	.7070	0.78	.2823	.2177	1.23	.3907	.1093
0.34	.1331	.3669	0.79	.2852	.2148	1.24	.3925	.1075
0.35	.1398	.3632	0.80	.2881	.2119	1.25	.3944	.1058
0.36	.1406	.3594	0.81	.2910	.2090	1.26	.3962	.1038
0.37	.1443	.3557	0.82	.2939	.2061	1.27	.3980	.1020
0.38	.1480	.3520	0.83	.2967	.2033	1.28	.3997	.1003
0.39	.1517	.3483	0.84	.2995	.2005	1.29	.4015	.0985
0.40	.1554	.3446	0.85	.3023	.1977	1.30	.4032	.0968
0.41	.1591	.3409	0.86	.3051	.1949	1.31	.4049	.0951
0.42	.1628	.3372	0.87	.3078	.4922	1.32	.4066	.0934
0.43	.1664	.3336	0.88	.3106	.1894	1.33	.4820	.0918
0.44	.1700	.3300	0.89	.3133	.1867	1.34	.4099	.0901

Table A-1 Areas Under the Normal Curve (z) (cont'd)

Z	AREA BETWEEN 0 AND Z	AREA ABOVE Z	Z	AREA BETWEEN 0 AND Z	AREA ABOVE Z	Z	AREA BETWEEN 0 AND Z	AREA ABOVE Z
1.35	.4115	.0885	1.80	.4641	.0359	2.25	.4878	.0122
1.36	.4131	.0869	1.81	.4649	.0651	2.26	.4881	.0119
1.37	.4147	.0853	1.82	.4656	.0344	2.27	.4884	.0116
1.38	.4162	.0838	1.83	.4664	.0336	2.28	.4887	.0113
1.39	.4177	.0523	1.84	.4671	.0329	2.29	.4890	.0110
1.40	.4192	.0808	1.85	.4678	.0322	2.30	.4893	.0102
1.41	.4207	.0793	1.86	.4686	.0314	2.31	.4896	.0104
1.42	.4222	.0778	1.87	.4693	.0307	2.32	.4898	.0102
1.43	.4236	.0764	1.88	.4699	.0301	**2.326**	**.4900**	**.0100**
1.44	.4251	.0749	1.89	.4706	.0294	2.33	.4901	.0099
						2.34	.4904	.0096
1.45	.4265	.0735	1.90	.4713	.0287	2.35	.4906	.0094
1.46	.4279	.0721	1.91	.4719	.0281	2.36	.4909	.0091
1.47	.4292	.0708	1.92	.4726	.0274	2.37	.4911	.0089
1.48	.4306	.0694	1.93	.4732	.0268	2.38	.4913	.0087
1.49	.4319	.0681	1.94	.4738	.0262	2.39	.4916	.0084
1.50	.4332	.0668	1.95	.4744	.0256	2.40	.4918	.0082
1.51	.4345	.0655	**1.96**	**.4750**	**.0250**	2.41	.4920	.0080
1.52	.4357	.0643	1.97	.4756	.0244	2.42	.4922	.0078
1.53	.4370	.0630	1.98	.4761	.0390	2.43	.4925	.0075
1.54	.4382	.0618	1.99	.4767	.0233	2.44	.4927	.0073
1.55	.4394	.0606	2.00	.4772	.0228	2.45	.4929	.0071
1.56	.4406	.0594	2.01	.4778	.0222	2.46	.4931	.0069
1.57	.4418	.0892	2.02	.4783	.0217	2.47	.4932	.0068
1.58	.4429	.0571	2.03	.4788	.0212	2.48	.4934	.0066
1.59	.4441	.0559	2.04	.4793	.0207	2.49	.4936	.0064
1.60	.4452	.0548	2.05	.4798	.0202	2.50	.4938	.0062
1.61	.4463	.0537	2.06	.4803	.0197	2.51	.4940	.0060
1.62	.4474	.0526	2.07	.4808	.0192	2.52	.4941	.0059
1.63	.4484	.0516	2.08	.4812	.0188	2.53	.4943	.0057
1.64	.4495	.0505	2.09	.4817	.0183	2.54	.4945	.0055
1.645	**.4500**	**.0500**						
1.65	.4505	.0495	2.10	.4821	.0179	2.55	.4946	.0054
1.66	.4515	.0485	2.11	.4826	.0174	2.56	.4948	.0052
1.67	.4525	.0475	2.12	.4830	.0170	2.57	.4949	.0051
1.68	.4535	.0465	2.13	.4834	.0166	**2.576**	**.4950**	**.0050**
1.69	.4545	.0455	2.14	.4838	.0162	2.58	.4951	.0049
						2.59	.4952	.0048
1.70	.4554	.0446	2.15	.4842	.0158	2.60	.4953	.0047
1.71	.4564	.0436	2.16	.4846	.0154	2.61	.4955	.0045
1.72	.4573	.0427	2.17	.4850	.0120	2.62	.4956	.0044
1.73	.4582	.0418	2.18	.4854	.0146	2.63	.4957	.0043
1.74	.4591	.0409	2.19	.4857	.0143	2.64	.4959	.0041
1.75	.4599	.0401	2.20	.4861	.0139	2.65	.4960	.0040
1.76	.4608	.0392	2.21	.4864	.0136	2.66	.4961	.0039
1.77	.4616	.0384	2.22	.4868	.0132	2.67	.4962	.0038
1.78	.4625	.0375	2.23	.4871	.0129	2.68	.4963	.0037
1.79	.4633	.0367	2.24	.4875	.0125	2.69	.4964	.0036

Continued

Table A-1 Areas Under the Normal Curve (*z*) (cont'd)

Z	AREA BETWEEN 0 AND Z	AREA ABOVE Z	Z	AREA BETWEEN 0 AND Z	AREA ABOVE Z	Z	AREA BETWEEN 0 AND Z	AREA ABOVE Z
2.70	.7965	.0035	2.95	.4984	.0016	3.20	.49931	.00069
2.71	.4966	.0034	2.96	.4985	.0015	3.21	.49934	.00066
2.72	.4967	.0033	2.97	.4985	.0015	3.22	.49936	.00064
2.73	.4968	.0032	2.98	.4986	.0014	3.23	.49938	.00062
2.74	.4969	.0031	2.99	.4986	.0014	3.24	.49940	.00060
2.75	.4970	.0030	3.00	.4987	.0013	3.25	.49942	.00058
2.76	.4971	.0029	3.01	.4987	.0013	3.26	.49944	.00056
2.77	.4972	.0028	3.02	.4987	.0013	3.27	.49946	.00054
2.78	.4973	.0027	3.03	.4988	.0120	3.28	.49948	.00052
2.79	.4974	.0026	3.04	.4998	.0012	3.29	.49950	.00050
2.80	.4974	.0026	3.05	.49886	.00114	3.30	.49951	.00048
2.81	.4975	.0025	3.06	.49889	.00111	3.31	.49953	.00047
2.82	.4976	.0024	3.07	.49893	.00107	3.32	.49955	.00045
2.83	.4977	.0023	3.08	.49896	.00104	3.33	.49957	.00043
2.84	.4977	.0023	3.09	.49900	.00100	3.34	.49958	.00042
2.85	.4978	.0022	3.10	.49903	.00097	3.35	.49960	.00040
2.86	.4979	.0021	3.11	.49906	.00094	3.36	.49961	.00039
2.87	.4979	.0021	3.12	.49910	.00090	3.37	.49962	.00038
2.88	.4980	.0020	3.13	.49913	.00087	3.38	.49964	.00036
2.89	.4981	.0019	3.14	.49916	.00084	3.39	.49965	.00035
2.90	.4981	.0019	3.15	.49918	.00082	3.40	.49966	.00034
2.91	.4982	.0018	3.16	.49921	.00079	3.45	.49972	.00028
2.92	.4982	.0018	3.17	.49924	.00076	3.50	.49977	.00023
2.93	.4983	.0017	3.18	.49926	.00074	3.60	.49984	.00016
2.94	.4984	.0016	3.19	.49929	.00071	3.70	.49989	.00011
						3.80	.49993	.00001
						3.90	.49995	.00005
						4.00	.49997	.00003

Table A-2 Critical Values of *t*

df	α_1	.10	.05	.025	.01	.005	.0005
	α_2	.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	6.955	9.925	31.598
3		1.638	2.353	3.182	4.541	5.841	12.924
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	0.228	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	2.457	2.898	3.922
18		1.330	1.734	2.101	2.552	2.878	3.922
19		1.328	1.729	2.093	2.538	2.845	3.850
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	3.725
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	2.457	2.763	3.674
29		1.311	1.699	2.045	2.462	2.756	3.659
30		1.310	1.694	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

For unpaired *t*-test $df = (n_1 - 1) + (n_2 - 1)$. For paired *t*-test, $df - n - 1$. Test statistic must be greater than or equal to critical value to reject H_0.

Table A-3 Critical Values of F (α = .05)

df_e						df_b					
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**∞**
1	161.40	199.50	215.70	224.60	230.20	234.00	236.80	238.90	240.50	241.90	254.30
2	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38	19.40	19.50
3	10.13	9.55	9.28	9.12	9.01	8.64	8.89	8.85	8.81	8.79	8.53
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96	5.63
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74	4.36
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06	3.67
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64	3.23
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35	2.93
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14	2.71
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98	2.54
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.85	2.40
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.88	2.30
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67	2.21
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65	2.60	2.13
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59	2.54	2.07
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39	2.35	1.84
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.16	1.62
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.08	1.51
60	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04	1.99	1.39
120	3.92	3.07	2.68	2.45	2.29	2.17	2.09	2.02	1.96	1.91	1.25
∞	3.84	3.00	2.60	2.37	2.21	2.10	2.01	1.94	1.88	1.83	1.00

df_b = between groups degrees of freedom for numerator (k -1).

df_e = error (within-groups) degrees of freedom for denominator (N-k).

Test statistic must be greater than or equal to critical value to reject H_0.

Table A-4 Critical Values of the Pearson Correlation, *r*

df	α_1	.05	.025	.01	.005	.0005
df	α_2	.10	.05	.02	.01	.001
1		.988	,997	.9995	.9999	.9999
2		.900	.950	.980	.990	.999
3		.805	.878	.934	.959	.991
4		.729	.811	.882	.917	.974
5		.669	.755	.833	.875	.951
6		.622	.707	.789	.834	.925
7		.582	.668	.750	.798	.898
8		.549	.632	.716	.765	.872
9		.521	.602	.685	.735	.847
10		.497	.576	.658	.708	.823
11		.476	.553	.634	.684	.801
12		.458	.532	.612	.661	.780
13		.441	.514	.592	.641	.760
14		426	.497	.574	.623	.742
15		.412	.482	.558	.606	.725
16		.400	.468	.543	.590	.708
17		.389	.456	.529	.575	.693
18		.378	.444	.516	.561	.679
19		.369	.433	.503	.549	.665
20		.360	.423	.492	.537	.652
25		.323	.381	.445	.487	.597
30		.296	.349	.409	.449	.554
35		.275	.325	.381	.418	.519
40		.257	.304	.358	.393	.490
45		.243	.288	.338	.372	.465
50		.231	.273	.322	.354	.443
60		.211	.250	.295	.325	.408
70		.195	.232	.274	.302	.380
80		.183	.217	.257	.283	.357
90		.173	.205	.242	.267	.338
100		.164	.195	.230	.254	.321

$df = n - 2$. Test statistic must be greater than or equal to critical value to reject H_0.

Table A-5 Critical Values of Chi-Square, χ^2

df	α	.05	.02	.01	.01	.00
1		3.84	5.02	6.64	7.88	10.83
2		5.99	7.38	9.21	10.60	13.82
3		7.82	9.35	11.35	12.84	16.27
4		9.49	11.14	13.28	14.86	18.47
5		11.07	12.83	15.09	16.75	20.52
6		12.59	14.45	16.81	18.55	22.46
7		14.07	16.01	18.48	20.28	24.32
8		15.51	17.53	20.09	21.96	26.13
9		16.92	19.03	21.67	23.59	27.88
10		18.31	20.48	23.21	25.19	29.59
11		19.68	21.92	24.73	26.76	31.26
12		21.03	23.34	26.22	28.30	32.91
13		22.36	24.74	27.69	29.82	34.53
14		23.69	26.12	29.14	31.32	36.12
15		25.00	27.49	30.58	32.80	37.70
16		26.30	28.85	32.00	34.27	39.25
17		27.59	30.19	33.41	35.72	40.79
18		28.87	31.53	34.81	37.16	42.31
19		30.14	32.85	36.19	38.58	43.82
20		31.41	34.17	37.57	40.00	45.32
21		32.67	35.48	38.93	41.40	46.80
22		33.92	36.78	40.29	42.80	48.27
23		35.17	38.06	41,64	44.18	49.73
24		36.42	39.36	42.98	45.56	51.18
25		37.65	40.65	44.31	46.93	52.62
26		38.89	41.92	45.64	48.29	54.05
27		40.11	43.19	46.96	49.65	55.47
28		41.34	44.46	48.28	50.99	56.89
29		42.56	45.72,	49.59	52.34	58.30
30		43.77	46.98	50.89	53.67	59.70
40		55.76	59.34	63.69	66.77	73.40
50		67.51	71.42	76.15	79.49	86.66
60		79.08	83.30	88.38	91.95	99.61
70		90.53	95.02	100.43	104.22	112.32
80		101.88	106.63	112.33	116.32	124.84
90		113.15	118.14	124.12	128.30	137.21
100		124.34	129.56	135.81	140.47	149.45

For one-sample test $df = k$-1. For two-sample test $df = $ (R-1)(C-1). Test statistic must be greater than or equal to critical value to reject H_0.

Table A-6 Table of Random Numbers

89747	45483	44871	40670	90134	74914	89805	31185	67635	20265	45183
69188	04296	45769	99712	46544	48816	07448	53958	90961	19106	10959
09531	04454	75490	38718	88775	13132	35221	27226	45150	03310	11782
71477	21953	31726	87557	58363	49797	07691	06171	87997	29476	87918
53060	77443	08291	97504	03345	09133	90590	43504	11659	70250	74061
54013	35297	21346	92244	36160	03332	98806	40162	76512	54956	50893
35023	74291	52037	75899	01766	25552	68788	39048	97110	10148	28109
96544	30860	77686	56636	55253	71749	28969	05937	22903	47145	92747
87888	57749	38005	21474	17105	35844	31478	82778	33021	13612	46637
28899	26189	27015	65203	72387	54343	91698	48718	14150	77126	04133
47695	36105	92109	04144	96645	27072	30756	78560	27328	98232	52652
91583	38052	04180	57939	33987	12622	00123	36150	26231	80250	89158
80859	32767	76157	42393	73219	35887	51196	89077	42761	23476	24783
42072	13550	09292	10293	86360	89695	78830	32757	50731	26296	04892
67621	85921	38877	00192	24444	20849	42907	86663	94352	48158	74869
09946	14727	03867	94743	40982	64415	51409	87297	82778	05654	52817
82759	56387	42334	57754	10461	99187	61226	84209	06708	08614	63437
28962	72338	99553	64630	72982	05928	26834	23632	98443	47148	75366
39193	46816	54359	84240	05822	01151	53685	24275	96677	20700	43694
99221	49368	17548	25892	55956	19224	12790	50739	74703	08126	35658
85100	60328	22625	65537	66142	20059	59863	29531	72034	33753	49665
57520	79952	21854	87303	61238	97336	09081	32482	30120	43424	83557
70179	51732	70983	65252	95133	61173	14756	42648	61799	89619	69092
59048	74304	54482	04860	74741	20804	59246	82782	89341	56913	36197
21675	49455	83688	22021	02670	17529	71285	08767	18825	64891	66725
98527	05293	25736	60934	09509	70027	63492	76794	99552	12033	26075
95792	51286	68149	11278	69481	25848	82572	78677	60279	99475	48629
23931	17277	37698	43810	17094	41134	81091	93734	52015	07293	94847
95128	22088	11808	24601	59115	80642	09608	35813	36636	39607	83130
20912	22832	44043	18245	25882	80991	75351	31964	86800	17014	35960
67746	46580	73793	44761	42789	09659	44932	75215	44810	48445	19029
71049	77999	74307	02662	59509	81979	79285	61972	83850	27143	14226
28512	15320	76961	19597	27767	38773	67955	87556	26060	62374	66707
12057	51665	75731	93617	13464	02158	85118	07863	68504	68703	15488
68323	47022	90949	62849	04858	99454	72545	26384	14275	96129	32740
53069	29718	50813	03149	93034	01450	85741	72998	84584	48502	04472
41853	75323	21878	35065	55702	56943	32512	61683	25287	24874	23664
76834	61882	87689	61166	06793	15488	21426	01287	87432	95567	40199
59010	29583	10657	07809	38977	46347	15367	53663	46460	13765	68508
41926	71062	09284	61481	73048	27624	14816	44227	51789	35468	84084

Table A-7 Critical Values of the Studentized Range Statistic, q (α=.05)

df_e	r = number of means (HSD) or size of comparison interval (SNK)								
	2	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
5	3.64	4.60	5.22	5.67	6.03	6.33	6.58	6.80	6.99
6	3.46	4.34	4.90	5.30	5.63	5.90	6.12	6.32	6.49
7	3.34	4.16	4.68	5.06	5.36	5.61	5.82	6.00	6.16
8	3.26	4.04	4.53	4.89	5.17	5.40	5.60	5.77	5.92
9	3.20	3.95	4.41	4.76	5.02	5.24	5.43	5.59	5.74
10	3.15	3.88	4.33	4.65	4.91	5.12	5.30	5.46	5.60
11	3.11	3.82	4.26	4.57	4.82	5.03	5.20	5.35	5.49
12	3.08	3.77	4.20	4.51	4.75	4.95	5.12	5.27	5.39
13	3.06	3.73	4.15	4.45	4.69	4.88	5.05	5.19	5.32
14	3.03	3.70	4.11	4.41	4.64	4.83	4.99	5.13	5.25
15	3.01	3.67	4.08	4.37	4.59	4.78	4.94	5.08	5.20
16	3.00	3.65	4.05	4.33	4.56	4.74	4.90	5.03	5.15
17	2.98	3.63	4.02	4.30	4.52	4.70	4.86	4.99	5.11
18	2.97	3.61	4.00	4.28	4.49	4.67	4.82	4.96	5.07
19	2.96	3.59	3.98	4.25	4.47	4.65	4.79	4.92	5.04
20	2.95	3.58	3.96	4.23	4.45	4.62	4.77	4.90	5.01
30	2.89	3.49	3.85	4.10	4.30	4.46	4.60	4.72	4.82
40	2.86	3.44	3.79	4.04	4.23	4.39	4.52	4.63	4.73
60	2.83	3.40	3.74	3.98	4.16	4.31	4.44	4.55	4.65
120	2.80	3.36	3.68	3.92	4.10	4.24	4.36	4.47	4.56
∞	2.77	3.31	3.63	3.86	4.03	4.17	4.29	4.39	4.47

Table A-8 Critical Values of *U* for the Mann-Whitney *U* Test

n_2 (larger sample size)

n_1	α_1	α_2	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
5	0.005	0.01	0	1	1	2	3	4	5	6	7	7	8	9	10	11	12	13
	0.01	0.02	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	0.025	0.05	2	3	5	6	7	8	9	11	12	13	14	15	17	18	19	20
	0.05	0.10	4	5	6	8	9	11	12	13	15	16	18	19	20	22	23	25
6	0.005	0.01	—	2	3	4	5	6	7	9	10	11	12	13	15	16	17	18
	0.01	0.02	—	3	4	6	7	8	9	11	12	13	15	16	18	19	20	22
	0.025	0.05	—	5	6	8	10	11	13	14	16	17	19	21	22	24	25	27
	0.05	0.10	—	7	8	10	12	14	16	17	19	21	23	25	26	28	30	32
7	0.005	0.01	—	—	4	6	7	9	10	12	13	15	16	18	19	21	22	24
	0.01	0.02	—	—	6	7	9	11	12	14	16	17	19	21	23	24	26	28
	0.025	0.05	—	—	8	10	12	14	16	18	20	22	24	26	28	30	32	34
	0.05	0.10	—	—	11	13	15	17	19	21	24	26	28	30	33	35	37	39
8	0.005	0.01	—	—	—	7	9	11	13	15	17	19	20	22	24	26	28	30
	0.01	0.02	—	—	—	9	11	13	15	17	20	22	24	26	28	30	32	34
	0.025	0.05	—	—	—	13	15	17	19	22	24	26	29	31	34	36	38	41
	0.05	0.10	—	—	—	15	18	20	23	26	28	31	33	36	39	41	44	47
9	0.005	0.01	—	—	—	—	11	13	16	18	20	22	24	27	29	31	36	38
	0.01	0.02	—	—	—	—	14	16	18	21	23	26	28	31	33	36	38	40
	0.025	0.05	—	—	—	—	28	20	23	26	28	31	34	37	39	42	45	48
	0.05	0.10	—	—	—	—	21	24	27	30	33	36	39	42	45	48	51	54
10	0.005	0.01	—	—	—	—	—	16	18	21	24	26	29	31	34	37	39	42
	0.01	0.02	—	—	—	—	—	19	22	24	27	30	33	36	38	41	44	47
	0.025	0.05	—	—	—	—	—	23	26	29	33	36	39	42	45	48	52	55
	0.05	0.10	—	—	—	—	—	27	31	34	37	41	44	48	51	55	58	62
11	0.005	0.01	—	—	—	—	—	—	21	24	27	30	33	36	39	42	45	48
	0.01	0.02	—	—	—	—	—	—	25	28	31	34	37	41	44	47	50	53
	0.025	0.05	—	—	—	—	—	—	30	33	37	40	44	47	51	55	58	62
	0.05	0.10	—	—	—	—	—	—	34	38	42	46	50	54	57	61	65	69
12	0.005	0.01	—	—	—	—	—	—	—	27	31	34	37	41	44	47	51	54
	0.01	0.02	—	—	—	—	—	—	—	31	35	38	42	46	49	53	56	60
	0.025	0.05	—	—	—	—	—	—	—	37	41	45	49	53	57	61	65	69
	0.05	0.10	—	—	—	—	—	—	—	42	47	51	55	60	64	68	72	77

The test statistic must be equal to or *less than* the critical value to reject H_0.
When groups are of unequal size, n_1 is the smaller group.
For samples larger than 20, use the z distribution.

Table A-8 Critical Values of U for the Mann-Whitney U Test (continued)

n_1	α_1	α_2	12	13	14	15	16	17	18	19	20
						n_2 (larger sample size)					
13	0.005	0.01	—	34	38	42	45	49	53	57	60
	0.01	0.02	—	39	43	47	51	55	59	63	67
	0.025	0.05	—	45	50	54	59	63	67	72	76
	0.05	0.10	—	51	56	61	65	70	75	80	84
14	0.005	0.01	—	—	42	46	50	54	58	63	67
	0.01	0.02	—	—	47	51	56	60	65	69	73
	0.025	0.05	—	—	55	59	64	69	74	78	83
	0.05	0.10	—	—	61	66	71	77	82	87	92
15	0.005	0.01	—	—	—	51	55	60	64	69	73
	0.01	0.02	—	—	—	56	61	66	70	75	80
	0.025	0.05	—	—	—	64	70	75	80	85	90
	0.05	0.10	—	—	—	72	77	83	88	84	100
16	0.005	0.01	—	—	—	—	60	65	70	74	79
	0.01	0.02	—	—	—	—	66	71	76	82	87
	0.025	0.05	—	—	—	—	75	81	86	92	98
	0.05	0.10	—	—	—	—	83	89	95	101	107
17	0.005	0.01	—	—	—	—	—	70	75	81	86
	0.01	0.02	—	—	—	—	—	77	82	88	93
	0.025	0.05	—	—	—	—	—	87	93	99	105
	0.05	0.10	—	—	—	—	—	96	102	109	115
18	0.005	0.01	—	—	—	—	—	—	81	87	92
	0.01	0.02	—	—	—	—	—	—	88	94	100
	0.025	0.05	—	—	—	—	—	—	99	106	112
	0.05	0.10	—	—	—	—	—	—	109	116	123
19	0.005	0.01	—	—	—	—	—	—	—	93	99
	0.01	0.02	—	—	—	—	—	—	—	101	107
	0.025	0.05	—	—	—	—	—	—	—	113	119
	0.05	0.10	—	—	—	—	—	—	—	123	130
20	0.005	0.01	—	—	—	—	—	—	—	—	105
	0.01	0.02	—	—	—	—	—	—	—	—	114
	0.025	0.05	—	—	—	—	—	—	—	—	127
	0.05	0.10	—	—	—	—	—	—	—	—	138

The test statistic must be equal to or *less than* the critical value to reject H_0.

When groups are of unequal size, n_1 is the smaller group.

For samples larger than 20, use the z distribution.

Table A-9 One-Tailed Probabilities* Associated With Values of x in the Binomial Test

n	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
4	.062	.312	.688	.938													
5	.031	.188	.500	.812	.969												
6	.016	.109	.344	.656	.891	.984											
7	.008	.062	.227	.500	.773	.938	.992										
8	.004	.035	.145	.363	.637	.855	.965	.996									
9	.002	.020	.090	.254	.500	.746	.910	.980	.998								
10	.001	.011	.055	.172	.377	.623	.828	.945	.989	.999							
11	—	.006	.033	.113	.274	.500	.726	.887	.967	.994							
12	—	.003	.019	.073	.194	.387	.613	.806	.927	.981	.997						
13	—	.002	.011	.046	.133	.291	.500	.709	.867	.954	.989	.998					
14	—	.001	.006	.029	.090	.212	.395	.605	.788	.910	.971	.994	.999				
15	—	—	.004	.018	.059	.151	.304	.500	.696	.849	.941	.982	.996				
16	—	—	.002	.011	.038	.105	.227	.402	.598	.773	.895	.962	.989	.998			
17	—	—	.001	.006	.025	.072	.166	.315	.500	.685	.834	.928	.975	.994	.999		
18	—	—	.001	.004	.015	.048	.119	.240	.407	.593	.760	.881	.952	.985	.996	.999	
19	—	—	—	.002	.010	.032	.084	.180	.324	.500	.676	.850	.916	.968	.990	.998	
20	—	—	—	.001	.006	.021	.058	.132	.252	.412	.588	.748	.868	.942	.979	.994	.999
21	—	—	—	.001	.004	.013	.039	.095	.192	.332	.500	.668	.808	.902	.961	.987	.996
22	—	—	—	—	.002	.008	.026	.067	.143	.262	.416	.584	.738	.857	.933	.974	.992
23	—	—	—	—	.001	.005	.017	.047	.105	.202	.339	.500	.661	.798	.895	.953	.983
24	—	—	—	—	.001	.003	.011	.032	.076	.154	.271	.419	.581	.729	.846	.924	.968
25	—	—	—	—	—	.002	.007	.022	.054	.115	.212	.345	.500	.655	.788	.885	.946
26	—	—	—	—	—	.001	.005	.014	.038	.084	.163	.279	.423	.577	.721	.837	.916
27	—	—	—	—	—	.001	.003	.010	.026	.061	.124	.221	.351	.500	.649	.779	.876
28	—	—	—	—	—	—	.002	.006	.018	.044	.092	.172	.286	.425	.575	.714	.828
29	—	—	—	—	—	—	.001	.004	.012	.031	.068	.132	.229	.356	.500	.644	.771
30	—	—	—	—	—	—	.001	.003	.008	.021	.049	.100	.181	.292	.428	.572	.708

* Double values in table for a two-tailed test.

Table A-10 Critical Values of T for the Wilcoxon Signed-Ranks Test				
n	$\alpha_2 = .05$	$\alpha_2 = .01$	$\alpha_1 = .05$	$\alpha_1 = .01$
5	--	--	0	--
6	0	--	2	--
7	2	--	3	0
8	3	0	5	1
9	5	1	8	3
10	8	3	10	5
11	10	5	13	7
12	13	7	17	9
13	17	9	21	12
14	21	12	25	15
15	25	15	30	19
16	29	19	35	23
17	34	23	41	27
18	40	27	47	32
19	46	32	53	37
20	52	37	60	43
21	58	42	67	49
22	65	48	75	55
23	73	54	83	62
24	81	61	91	69
25	89	68	100	76
26	98	75	110	84
27	107	83	119	92
28	116	91	130	101
29	126	100	140	110
30	137	109	151	120

Table A-11 Critical Values of Spearman's Rank Correlation Coefficient, r_s

n	α_2 0.10 / α_1 0.05	0.05 / 0.025	0.02 / 0.01	n	α_2 0.10 / α_1 0.05	0.05 / 0.025	0.02 / 0.01
4	1.000			20	0.380	0.447	0.520
5	0.900	1.000	1.000	30	0.306	0.362	0.425
6	0.829	0.886	0.943	40	0.264	0.313	0.368
7	0.714	0.786	0.893	50	0.235	0.279	0.329
8	0.643	0.738	0.833				
9	0.600	0.700	0.783	60	0.214	0.255	0.300
10	0.564	0.648	0.745	70	0.198	0.235	0.278
				80	0.185	0.220	0.260
11	0.536	0.618	0.709	90	0.174	0.207	0.245
12	0.503	0.587	0.671	100	0.165	0.197	0.233
13	0.484	0.560	0.648				
14	0.464	0.538	0.622				
15	0.443	0.521	0.604				

The calculated value must be *equal to or larger than* the critical value to be significant.

Table 7 Critical Values of Spearman's Rank Correlation Coefficient, r_s

n	α_2 / α_1 0.10 / 0.05	0.05 / 0.025	0.02 / 0.01		n	α_2 / α_1 0.10 / 0.05	0.05 / 0.025	0.02 / 0.01
4	1.000				20	0.380	0.447	0.520
5	0.900	1.000	1.000		30	0.306	0.362	0.425
6	0.829	0.886	0.943		40	0.264	0.313	0.368
7	0.714	0.786	0.893		50	0.235	0.279	0.329
8	0.643	0.738	0.833					
9	0.600	0.700	0.783		60	0.214	0.255	0.300
10	0.564	0.648	0.745		70	0.198	0.235	0.278
					80	0.185	0.220	0.260
11	0.536	0.618	0.709		90	0.174	0.207	0.245
12	0.503	0.587	0.671		100	0.165	0.197	0.233
13	0.484	0.560	0.648					
14	0.464	0.538	0.622					
15	0.443	0.521	0.604					

The calculated value must be *equal to or larger than* the critical value to be significant.