Table A1 Normal Distribution*

Selected values: $w_{0.0001} = -3.7190$ $w_{0.0005} = -3.2905$ $w_{0.025} = -1.9600$ $w_{0.05} = -1.6449$

$w_{0.9999} = 3.7190$ $w_{0.9995} = 3.2905$ $w_{0.975} = 1.9600$ $w_{0.95} = 1.6449$

0.000	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009
	−3.0902	−2.8782	−2.7478	−2.6521	−2.5758	−2.5121	−2.4573	−2.4089	−2.3656
−2.3263	−2.2904	−2.2571	−2.2262	−2.1973	−2.1701	−2.1444	−2.1201	−2.0969	−2.0749
−2.0537	−2.0335	−2.0141	−1.9954	−1.9774	−1.9600	−1.9431	−1.9268	−1.9110	−1.8957
−1.8808	−1.8663	−1.8522	−1.8384	−1.8250	−1.8119	−1.7991	−1.7866	−1.7744	−1.7624
−1.7507	−1.7392	−1.7279	−1.7169	−1.7060	−1.6954	−1.6849	−1.6747	−1.6646	−1.6546
−1.6449	−1.6352	−1.6258	−1.6164	−1.6072	−1.5982	−1.5893	−1.5805	−1.5718	−1.5632
−1.5548	−1.5464	−1.5382	−1.5301	−1.5220	−1.5141	−1.5063	−1.4985	−1.4909	−1.4833
−1.4758	−1.4684	−1.4611	−1.4538	−1.4466	−1.4395	−1.4325	−1.4255	−1.4187	−1.4118
−1.4051	−1.3984	−1.3917	−1.3852	−1.3787	−1.3722	−1.3658	−1.3595	−1.3532	−1.3469
−1.3408	−1.3346	−1.3285	−1.3225	−1.3165	−1.3106	−1.3047	−1.2988	−1.2930	−1.2873
−1.2816	−1.2759	−1.2702	−1.2646	−1.2591	−1.2536	−1.2481	−1.2426	−1.2372	−1.2319
−1.2265	−1.2212	−1.2160	−1.2107	−1.2055	−1.2004	−1.1952	−1.1901	−1.1850	−1.1800
−1.1750	−1.1700	−1.1650	−1.1601	−1.1552	−1.1503	−1.1455	−1.1407	−1.1359	−1.1311
−1.1264	−1.1217	−1.1170	−1.1123	−1.1077	−1.1031	−1.0985	−1.0939	−1.0893	−1.0848
−1.0803	−1.0758	−1.0714	−1.0669	−1.0625	−1.0581	−1.0537	−1.0494	−1.0450	−1.0407
−1.0364	−1.0322	−1.0279	−1.0237	−1.0194	−1.0152	−1.0110	−1.0069	−1.0027	−0.9986
−0.9945	−0.9904	−0.9863	−0.9822	−0.9782	−0.9741	−0.9701	−0.9661	−0.9621	−0.9581
−0.9542	−0.9502	−0.9463	−0.9424	−0.9385	−0.9346	−0.9307	−0.9269	−0.9230	−0.9192
−0.9154	−0.9116	−0.9078	−0.9040	−0.9002	−0.8965	−0.8927	−0.8890	−0.8853	−0.8816
−0.8779	−0.8742	−0.8705	−0.8669	−0.8633	−0.8596	−0.8560	−0.8524	−0.8488	−0.8452
−0.8416	−0.8381	−0.8345	−0.8310	−0.8274	−0.8239	−0.8204	−0.8169	−0.8134	−0.8099
−0.8064	−0.8030	−0.7995	−0.7961	−0.7926	−0.7892	−0.7858	−0.7824	−0.7790	−0.7756
−0.7722	−0.7688	−0.7655	−0.7621	−0.7588	−0.7554	−0.7521	−0.7488	−0.7454	−0.7421
−0.7388	−0.7356	−0.7323	−0.7290	−0.7257	−0.7225	−0.7192	−0.7160	−0.7128	−0.7095
−0.7063	−0.7031	−0.6999	−0.6967	−0.6935	−0.6903	−0.6871	−0.6840	−0.6808	−0.6776

0.000	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009
−0.6745	−0.6713	−0.6682	−0.6651	−0.6620	−0.6588	−0.6557	−0.6526	−0.6495	0.6464
−0.6433	−0.6403	−0.6372	−0.6341	−0.6311	−0.6280	−0.6250	−0.6219	−0.6189	−0.6158
−0.6128	−0.6098	−0.6068	−0.6038	−0.6008	−0.5978	−0.5948	−0.5918	−0.5888	−0.5858
−0.5828	−0.5799	−0.5769	−0.5740	−0.5710	−0.5681	−0.5651	−0.5622	−0.5592	−0.5563
−0.5534	−0.5505	−0.5476	−0.5446	−0.5417	−0.5388	−0.5359	−0.5330	−0.5302	−0.5273
−0.5244	−0.5215	−0.5187	−0.5158	−0.5129	−0.5101	−0.5072	−0.5044	−0.5015	−0.4987
−0.4959	−0.4930	−0.4902	−0.4874	0.48454	−0.4817	−0.4789	−0.4761	−0.4733	−0.4705
−0.4677	−0.4649	−0.4621	−0.4593	−0.4565	−0.4538	−0.4510	−0.4482	−0.4454	−0.4427
−0.4399	−0.4372	−0.4344	−0.4316	−0.4289	−0.4261	−0.4234	−0.4207	−0.4179	−0.4152
−0.4125	−0.4097	−0.4070	−0.4043	−0.4016	−0.3989	−0.3961	−0.3934	−0.3907	−0.3880
−0.3853	−0.3826	−0.3799	−0.3772	−0.3745	−0.3719	−0.3692	−0.3665	−0.3638	−0.3611
−0.3585	−0.3558	−0.3531	−0.3505	−0.3478	−0.3451	−0.3425	−0.3398	−0.3372	−0.3345
−0.3319	−0.3292	−0.3266	−0.3239	−0.3213	−0.3186	−0.3160	−0.3134	−0.3107	−0.3081
−0.3055	−0.3029	−0.3002	−0.2976	−0.2950	−0.2924	−0.2898	−0.2871	−0.2845	−0.2819
−0.2793	−0.2767	−0.2741	−0.2715	−0.2689	−0.2663	−0.2637	−0.2611	−0.2585	−0.2559
−0.2533	−0.2508	−0.2482	−0.2456	−0.2430	−0.2404	−0.2378	−0.2353	−0.2327	−0.2301
−0.2275	−0.2250	−0.2224	−0.2198	−0.2173	−0.2147	−0.2121	−0.2096	−0.2070	−0.2045
−0.2019	−0.1993	−0.1968	−0.1942	−0.1917	−0.1891	−0.1866	−0.1840	−0.1814	−0.1789
−0.1764	−0.1738	−0.1713	−0.1687	−0.1662	−0.1637	−0.1611	−0.1586	−0.1560	−0.1535
−0.1510	−0.1484	−0.1459	−0.1434	−0.1408	−0.1383	−0.1358	−0.1332	−0.1307	−0.1282
−0.1257	−0.1231	−0.1206	−0.1181	−0.1156	−0.1130	−0.1105	−0.1080	−0.1055	−0.1030
−0.1004	−0.0979	−0.0954	−0.0929	−0.0904	−0.0878	−0.0853	−0.0828	−0.0803	−0.0778
−0.0753	−0.0728	−0.0702	−0.0677	−0.0652	−0.0627	−0.0602	−0.0577	−0.0552	−0.0527
−0.0502	−0.0476	−0.0451	−0.0426	−0.0401	−0.0376	−0.0351	−0.0326	−0.0301	−0.0276
−0.0251	−0.0226	−0.0201	−0.0175	−0.0150	−0.0125	−0.0100	−0.0075	−0.0050	−0.0025
0.0000	0.0025	0.0050	0.0075	0.0100	0.0125	0.0150	0.0175	0.0201	0.0226
0.0251	0.0276	0.0301	0.0326	0.0351	0.0376	0.0401	0.0426	0.0451	0.0476
0.0502	0.0527	0.0552	0.0577	0.0602	0.0627	0.0652	0.0677	0.0702	0.0728
0.0753	0.0778	0.0803	0.0828	0.0853	0.0878	0.0904	0.0929	0.0954	0.0979
0.1004	0.1030	0.1055	0.1080	0.1105	0.1130	0.1156	0.1181	0.1206	0.1231

Table A1 (Continued)

0.000	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009
0.1257	0.1282	0.1307	0.1332	0.1358	0.1383	0.1408	0.1434	0.1459	0.1484
0.1510	0.1535	0.1560	0.1586	0.1611	0.1637	0.1662	0.1687	0.1713	0.1738
0.1764	0.1789	0.1815	0.1840	0.1866	0.1891	0.1917	0.1942	0.1968	0.1993
0.2019	0.2045	0.2070	0.2096	0.2121	0.2147	0.2173	0.2198	0.2224	0.2250
0.2275	0.2301	0.2327	0.2353	0.2378	0.2404	0.2430	0.2456	0.2482	0.2508
0.2533	0.2559	0.2585	0.2611	0.2637	0.2663	0.2689	0.2715	0.2741	0.2767
0.2793	0.2819	0.2845	0.2871	0.2898	0.2924	0.2950	0.2976	0.3002	0.3029
0.3055	0.3081	0.3107	0.3134	0.3160	0.3186	0.3213	0.3239	0.3266	0.3292
0.3319	0.3345	0.3372	0.3398	0.3425	0.3451	0.3478	0.3505	0.3531	0.3558
0.3585	0.3611	0.3638	0.3665	0.3692	0.3719	0.3745	0.3772	0.3799	0.3826
0.3853	0.3880	0.3907	0.3934	0.3961	0.3989	0.4016	0.4043	0.4070	0.4097
0.4125	0.4152	0.4179	0.4207	0.4234	0.4261	0.4289	0.4316	0.4344	0.4372
0.4399	0.4427	0.4454	0.4482	0.4510	0.4538	0.4565	0.4593	0.4621	0.4649
0.4677	0.4705	0.4733	0.4761	0.4789	0.4817	0.4845	0.4874	0.4902	0.4930
0.4959	0.4987	0.5015	0.5044	0.5072	0.5101	0.5129	0.5158	0.5187	0.5215
0.5244	0.5273	0.5302	0.5330	0.5359	0.5388	0.5417	0.5446	0.5476	0.5505
0.5534	0.5563	0.5592	0.5622	0.5651	0.5681	0.5710	0.5740	0.5769	0.5799
0.5828	0.5858	0.5888	0.5918	0.5948	0.5978	0.6008	0.6038	0.6068	0.6098
0.6128	0.6158	0.6189	0.6219	0.6250	0.6280	0.6311	0.6341	0.6372	0.6403
0.6433	0.6464	0.6495	0.6526	0.6557	0.6588	0.6620	0.6651	0.6682	0.6713
0.6745	0.6776	0.6808	0.6840	0.6871	0.6903	0.6935	0.6967	0.6999	0.7031
0.7063	0.7095	0.7128	0.7160	0.7192	0.7225	0.7257	0.7290	0.7323	0.7356
0.7388	0.7421	0.7454	0.7488	0.7521	0.7554	0.7588	0.7621	0.7655	0.7688
0.7722	0.7756	0.7790	0.7824	0.7858	0.7892	0.7926	0.7961	0.7995	0.8030
0.8064	0.8099	0.8134	0.8169	0.8204	0.8239	0.8274	0.8310	0.8345	0.8381
0.8416	0.8452	0.8488	0.8524	0.8560	0.8596	0.8633	0.8669	0.8705	0.8742
0.8779	0.8816	0.8853	0.8890	0.8927	0.8965	0.9002	0.9040	0.9078	0.9116
0.9154	0.9192	0.9230	0.9269	0.9307	0.9346	0.9385	0.9424	0.9463	0.9502

0.000	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009
0.9542	0.9581	0.9621	0.9661	0.9701	0.9741	0.9782	0.9822	0.9863	0.9904
0.9945	0.9986	1.0027	1.0069	1.0110	1.0152	1.0194	1.0237	1.0279	1.0322
1.0364	1.0407	1.0450	1.0494	1.0537	1.0581	1.0625	1.0669	1.0714	1.0758
1.0803	1.0848	1.0893	1.0939	1.0985	1.1031	1.1077	1.1123	1.1170	1.1217
1.1264	1.1311	1.1359	1.1407	1.1455	1.1503	1.1552	1.1601	1.1650	1.1700
1.1750	1.1800	1.1850	1.1901	1.1952	1.2004	1.2055	1.2107	1.2160	1.2212
1.2265	1.2319	1.2372	1.2426	1.2481	1.2536	1.2591	1.2646	1.2702	1.2759
1.2816	1.2873	1.2930	1.2988	1.3047	1.3106	1.3165	1.3225	1.3285	1.3346
1.3408	1.3469	1.3532	1.3595	1.3658	1.3722	1.3787	1.3852	1.3917	1.3984
1.4051	1.4118	1.4187	1.4255	1.4325	1.4395	1.4466	1.4538	1.4611	1.4684
1.4758	1.4833	1.4909	1.4985	1.5063	1.5141	1.5220	1.5301	1.5382	1.5464
1.5548	1.5632	1.5718	1.5805	1.5893	1.5982	1.6072	1.6164	1.6258	1.6352
1.6449	1.6546	1.6646	1.6747	1.6849	1.6954	1.7060	1.7169	1.7279	1.7392
1.7507	1.7624	1.7744	1.7866	1.7991	1.8119	1.8250	1.8384	1.8522	1.8663
1.8808	1.8957	1.9110	1.9268	1.9431	1.9600	1.9774	1.9954	2.0141	2.0335
2.0537	2.0749	2.0969	2.1201	2.1444	2.1701	2.1973	2.2262	2.2571	2.2904
2.3263	2.3656	2.4089	2.4573	2.5121	2.5758	2.6521	2.7478	2.8782	3.0902

Adapted from Tables 3 and 4, Pearson and Hartley [1970], with permission from the *Biometrika* Trustees. Entries in this table are quantiles w_p of the standard normal random variable W, selected so $P[W \le w_p] = p$ and $w_{1-p} = -w_p$. Note that the value of p to two decimal places determines which row to use; the third decimal place of p determines which column to use to find w_p.

Table A.3 Chi-Square Distribution[a]

k \ p	.750	.900	.950	.975	.990	.995	.999
1	1.323	2.706	3.841	5.024	6.635	7.879	10.83
2	2.773	4.605	5.991	7.378	9.210	10.60	13.82
3	4.108	6.251	7.815	9.348	11.34	12.84	16.27
4	5.385	7.779	9.488	11.14	13.28	14.86	18.47
5	6.626	9.236	11.07	12.83	15.09	16.75	20.51
6	7.841	10.64	12.59	14.45	16.81	18.55	22.46
7	9.037	12.02	14.07	16.01	18.48	20.28	24.32
8	10.22	13.36	15.51	17.53	20.09	21.96	26.13
9	11.39	14.68	16.92	19.02	21.67	23.59	27.88
10	12.55	15.99	18.31	20.48	23.21	25.19	29.59
11	13.70	17.28	19.68	21.92	24.73	26.76	31.26
12	14.85	18.55	21.03	23.34	26.22	28.30	32.91
13	15.98	19.81	22.36	24.74	27.69	29.82	34.53
14	17.12	21.06	23.68	26.12	29.14	31.32	36.12
15	18.25	22.31	25.00	27.49	30.58	32.80	37.70
16	19.37	23.54	26.30	28.85	32.00	34.27	39.25
17	20.49	24.77	27.59	30.19	33.41	35.72	40.79
18	21.60	25.99	28.87	31.53	34.81	37.16	42.31
19	22.72	27.20	30.14	32.85	36.19	38.58	43.82
20	23.83	28.41	31.41	34.17	37.57	40.00	45.32
21	24.93	29.62	32.67	35.48	38.93	41.40	46.80
22	26.04	30.81	33.92	36.78	40.29	42.80	48.27
23	27.14	32.01	35.17	38.08	41.64	44.18	49.73
24	28.24	33.20	36.42	39.37	42.98	45.56	51.18
25	29.34	34.38	37.65	40.65	44.31	46.93	52.62
26	30.43	35.56	38.89	41.92	45.64	48.29	54.05
27	31.53	36.74	40.11	43.19	46.96	49.64	55.48
28	32.62	37.92	41.34	44.46	48.28	50.99	56.89
29	33.71	39.09	42.56	45.72	49.59	52.34	58.30
30	34.80	40.26	43.77	46.98	50.89	53.67	59.70
40	45.62	51.81	55.76	59.34	63.69	66.77	73.40
50	56.33	63.17	67.50	71.42	76.15	79.49	86.66
60	66.98	74.40	79.08	83.30	88.38	91.95	99.61
70	77.58	85.53	90.53	95.02	100.4	104.2	112.3
80	88.13	96.58	101.9	106.6	112.3	116.3	124.8
90	98.65	107.6	113.1	118.1	124.1	128.3	137.2
100	109.1	118.5	124.3	129.6	135.8	140.2	149.4
x_p	.675	1.282	1.645	1.960	2.326	2.576	3.090

For $k > 100$ use the approximation $w_p = (1/2)(x_p + \sqrt{2k-1})^2$, or the more accurate $w_p = k\left(1 - \frac{2}{9k} + r_p\sqrt{\frac{2}{9k}}\right)^3$, where r_p is the value from the standardized normal distribution shown in the bottom of the table.

SOURCE. Abridged from Table 8, Pearson and Hartley (1970), with permission from the *Biometrika*, Trustees.

[a] The entries in this table are quantiles w_p of a chi-square random variable W with k degrees of freedom, selected so $P(W \le w_p) = p$ and $P(W > w_p) = 1 - p$.

$P = 0.05$ (nine digits)

-0.75

Table A3 Binomial Distribution*

n	y	$p = .05$	.10	.15	.20	.25	.30	.35	.40	.45
1	0	.9500	.9000	.8500	.8000	.7500	.7000	.6500	.6000	.5500
	1	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2	0	.9025	.8100	.7225	.6400	.5625	.4900	.4225	.3600	.3025
	1	.9975	.9900	.9775	.9600	.9375	.9100	.8775	.8400	.7975
	2	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
3	0	.8574	.7290	.6141	.5120	.4219	.3430	.2746	.2160	.1664
	1	.9928	.9720	.9392	.8960	.8438	.7840	.7182	.6480	.5748
	2	.9999	.9990	.9966	.9920	.9844	.9730	.9571	.9360	.9089
	3	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
4	0	.8145	.6561	.5220	.4096	.3164	.2401	.1785	.1296	.0915
	1	.9860	.9477	.8905	.8192	.7383	.6517	.5630	.4752	.3910
	2	.9995	.9963	.9880	.9728	.9492	.9163	.8735	.8208	.7585
	3	1.0000	.9999	.9995	.9984	.9961	.9919	.9850	.9744	.9590
	4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
5	0	.7738	.5905	.4437	.3277	.2373	.1681	.1160	.0778	.0503
	1	.9774	.9185	.8352	.7373	.6328	.5282	.4284	.3370	.2562
	2	.9988	.9914	.9734	.9421	.8965	.8369	.7648	.6826	.5931
	3	1.0000	.9995	.9978	.9933	.9844	.9692	.9460	.9130	.8688
	4	1.0000	1.0000	.9999	.9997	.9990	.9976	.9947	.9898	.9815
	5	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6	0	.7351	.5314	.3771	.2621	.1780	.1176	.0754	.0467	.0277
	1	.9672	.8857	.7765	.6554	.5339	.4202	.3191	.2333	.1636
	2	.9978	.9842	.9527	.9011	.8306	.7443	.6471	.5443	.4415
	3	.9999	.9987	.9941	.9830	.9624	.9295	.8826	.8208	.7447
	4	1.0000	.9999	.9996	.9984	.9954	.9891	.9777	.9590	.9308
	5	1.0000	1.0000	1.0000	.9999	.9998	.9993	.9982	.9959	.9917
	6	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
7	0	.6983	.4783	.3206	.2097	.1335	.0824	.0490	.0280	.0152
	1	.9556	.8503	.7166	.5767	.4449	.3294	.2338	.1586	.1024
	2	.9962	.9743	.9262	.8520	.7564	.6471	.5323	.4199	.3164
	3	.9998	.9973	.9879	.9667	.9294	.8740	.8002	.7102	.6083
	4	1.0000	.9998	.9988	.9953	.9871	.9712	.9444	.9037	.8471
	5	1.0000	1.0000	.9999	.9996	.9987	.9962	.9910	.9812	.9643
	6	1.0000	1.0000	1.0000	1.0000	.9999	.9998	.9994	.9984	.9963
	7	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

* Y has the binomial distribution with parameters n and p. The entries are the values of $P(Y \le y) = \sum_{x=0}^{y} \binom{n}{x} p^x (1-p)^{n-x}$, for p ranging from .05 to .95.

Table A7 Quantiles of the Mann–Whitney Test Statistic[a]

p	$m=2$	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
.001	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
.005	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4
.01	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	5	5
.025	3	3	3	3	3	3	4	4	4	5	5	5	5	5	5	6	6	6	6
.05	3	3	3	4	4	4	5	5	5	5	6	6	7	7	7	7	8	8	8
.10	3	4	4	5	5	5	6	6	7	7	8	8	8	9	9	10	10	11	11
.001	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	7	7	7	7
.005	6	6	6	6	6	6	6	7	7	7	8	8	8	9	9	9	9	10	10
.01	6	6	6	6	6	7	7	8	8	8	9	9	9	10	10	11	11	11	12
.025	6	6	6	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15
.05	6	7	7	8	9	9	10	11	11	12	12	13	14	14	15	16	16	17	18
.10	7	8	8	9	10	11	12	12	13	14	15	16	17	17	18	19	20	21	22
.001	10	10	10	10	10	10	10	10	11	11	11	12	12	12	13	13	14	14	14
.005	10	10	10	10	11	11	12	12	13	13	14	14	15	16	16	17	17	18	19
.01	10	10	10	11	12	12	13	14	14	15	16	16	17	18	18	19	20	20	21
.025	10	10	11	12	13	14	15	15	16	17	18	19	20	21	22	22	23	24	25
.05	10	11	12	13	14	15	16	17	18	19	20	21	22	23	25	26	27	28	29
.10	11	12	14	15	16	17	18	20	21	22	23	24	26	27	28	29	31	32	33
.001	15	15	15	15	15	15	16	17	17	18	18	19	19	20	21	21	22	23	23
.005	15	15	15	16	17	17	18	19	20	21	22	23	23	24	25	26	27	28	29
.01	15	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
.025	15	16	17	18	19	21	22	23	24	25	27	28	29	30	31	33	34	35	36
.05	16	17	18	20	21	22	24	25	27	28	29	31	32	34	35	36	38	39	41
.10	17	18	20	21	23	24	26	28	29	31	33	34	36	38	39	41	43	44	46
.01	21	21	21	21	21	21	23	24	25	26	26	27	28	29	30	31	32	33	34
.05	21	21	22	23	24	25	26	27	28	29	31	32	33	34	35	37	38	39	40
.1	21	21	23	24	25	26	28	29	30	31	33	34	35	37	38	40	41	42	44
.25	21	23	24	25	27	28	30	32	33	35	36	38	39	41	43	44	46	47	49
.5	22	24	25	27	29	30	32	34	36	38	39	41	43	45	47	48	50	52	54
1.0	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	56	58	60
.01	28	28	28	28	29	30	31	32	34	35	36	37	38	39	40	42	43	44	45
.05	28	28	29	30	32	33	35	36	38	39	41	42	44	45	47	48	50	51	53
.1	28	29	30	32	33	35	36	38	40	41	43	45	46	48	50	52	53	55	57
.25	28	30	32	34	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63
.5	29	31	33	35	37	40	42	44	46	48	50	53	55	57	59	62	64	66	68
1.0	30	33	35	37	40	42	45	47	50	52	55	57	60	62	65	67	70	72	75
.01	36	36	36	37	38	39	41	42	43	45	46	48	49	51	52	54	55	57	58
.05	36	36	38	39	41	43	44	46	48	50	52	54	55	57	59	61	63	65	67
.1	36	37	39	41	43	44	46	48	50	52	54	56	59	61	63	65	67	69	71
.25	37	39	41	43	45	47	50	52	54	56	59	61	63	66	68	71	73	75	78
.5	38	40	42	45	47	50	52	55	57	60	63	65	68	70	73	76	78	81	84
1.0	39	42	44	47	50	53	56	59	61	64	67	70	73	76	79	82	85	88	91
.01	45	45	45	47	48	49	51	53	54	56	58	60	61	63	65	67	69	71	72
.05	45	46	47	49	51	53	55	57	59	62	64	66	68	70	73	75	77	79	82
.1	45	47	49	51	53	55	57	60	62	64	67	69	72	74	77	79	82	84	86
.25	46	48	50	53	56	58	61	63	66	69	72	74	77	80	83	85	88	91	94
.5	47	50	52	55	58	61	64	67	70	73	76	79	82	85	88	91	94	97	100
1.0	48	51	55	58	61	64	68	71	74	77	81	84	87	91	94	98	101	104	108
.01	55	55	56	57	59	61	62	64	66	68	70	73	75	77	79	81	83	85	88
.05	55	56	58	60	62	65	67	69	72	74	77	80	82	85	87	90	93	95	98
.1	55	57	59	62	64	67	69	72	75	78	80	83	86	89	92	94	97	100	103
.25	56	59	61	64	67	70	73	76	79	82	85	89	92	95	98	101	104	108	111
.5	57	60	63	67	70	73	76	80	83	87	90	93	97	100	104	107	111	114	118
1.0	59	62	66	69	73	77	80	84	88	92	95	99	103	107	110	114	118	122	126

Table A7 Quantiles of the Mann–Whitney Test Statistic*

p	$m=2$	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
.001	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
.005	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4
.01	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	5
.025	3	3	3	3	3	3	4	4	4	5	5	5	5	5	5	6	6	6	6
.05	3	3	3	4	4	4	5	5	5	5	6	6	7	7	7	7	8	8	8
.10	3	4	4	5	5	5	6	6	7	7	8	8	8	9	9	10	10	11	11
.001	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	7	7	7	7
.005	6	6	6	6	6	6	6	7	7	7	8	8	8	9	9	9	9	10	10
.01	6	6	6	6	6	7	7	8	8	8	9	9	9	10	10	11	11	11	12
.025	6	6	6	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15
.05	6	7	7	8	9	9	10	11	11	12	12	13	14	14	15	16	16	17	18
.10	7	8	8	9	10	11	12	12	13	14	15	16	17	17	18	19	20	21	22
.001	10	10	10	10	10	10	10	10	11	11	11	12	12	12	13	13	14	14	14
.005	10	10	10	10	11	11	12	12	13	13	14	14	15	16	16	17	17	18	19
.01	10	10	10	11	12	12	13	14	14	15	16	16	17	18	18	19	20	20	21
.025	10	10	11	12	13	14	15	15	16	17	18	19	20	21	22	22	23	24	25
.05	10	11	12	13	14	15	16	17	18	19	20	21	22	23	25	26	27	28	29
.10	11	12	14	15	16	17	18	20	21	22	23	24	26	27	28	29	31	32	33
.001	15	15	15	15	15	15	16	17	17	18	18	19	19	20	21	21	22	23	23
.005	15	15	15	16	17	17	18	19	20	21	22	23	23	24	25	26	27	28	29
.01	15	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
.025	15	16	17	18	19	21	22	23	24	25	27	28	29	30	31	33	34	35	36
.05	16	17	18	20	21	22	24	25	27	28	29	31	32	34	35	36	38	39	41
.10	17	18	20	21	23	24	26	28	29	31	33	34	36	38	39	41	43	44	46

.01	21	21	21	21	21	21	23	24	25	26	26	27	28	29	30	31	32	33	34
.05	21	21	22	23	24	25	26	27	28	29	31	32	33	34	35	37	38	39	40
	21	21	23	24	25	26	28	29	30	31	33	34	35	37	38	40	41	42	44
.5	21	23	24	25	27	28	30	32	33	35	36	38	39	41	43	44	46	47	49
	22	24	25	27	29	30	32	34	36	38	39	41	43	45	47	48	50	52	54
	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	56	58	60
.01	28	28	28	28	29	30	31	32	34	35	36	37	38	39	40	42	43	44	45
.05	28	28	29	30	32	33	35	36	38	39	41	42	44	45	47	48	50	51	53
	28	29	30	32	33	35	36	38	40	41	43	45	46	48	50	52	53	55	57
.5	28	30	32	34	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63
	29	31	33	35	37	40	42	44	46	48	50	53	55	57	59	62	64	66	68
	30	33	35	37	40	42	45	47	50	52	55	57	60	62	65	67	70	72	75
	36	36	36	37	38	39	41	42	43	45	46	48	49	51	52	54	55	57	58
	36	36	38	39	41	43	44	46	48	50	52	54	55	57	59	61	63	65	67
	36	37	39	41	43	44	46	48	50	52	54	56	59	61	63	65	67	69	71
	37	39	41	43	45	47	50	52	54	56	59	61	63	66	68	71	73	75	78
	38	40	42	45	47	50	52	55	57	60	63	65	68	70	73	76	78	81	84
	39	42	44	47	50	53	56	59	61	64	67	70	73	76	79	82	85	88	91
	45	45	45	47	48	49	51	53	54	56	58	60	61	63	65	67	69	71	72
	45	46	47	49	51	53	55	57	59	62	64	66	68	70	73	75	77	79	82
	45	47	49	51	53	55	57	60	62	64	67	69	72	74	77	79	82	84	86
	46	48	50	53	56	58	61	63	66	69	72	74	77	80	83	85	88	91	94
	47	50	52	55	58	61	64	67	70	73	76	79	82	85	88	91	94	97	100
	48	51	55	58	61	64	68	71	74	77	81	84	87	91	94	98	101	104	108
	55	55	56	57	59	61	62	64	66	68	70	73	75	77	79	81	83	85	88
	55	56	58	60	62	65	67	69	72	74	77	80	82	85	87	90	93	95	98
.95	55	57	59	62	64	67	69	72	75	78	80	83	86	89	92	94	97	100	103
	56	59	61	64	67	70	73	76	79	82	85	89	92	95	98	101	104	108	111
	57	60	63	67	70	73	76	80	83	87	90	93	97	100	104	107	111	114	118
	59	62	66	69	73	77	80	84	88	92	95	99	103	107	110	114	118	122	126

Table A7 (Continued)

p	$m=2$	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
.001	66	66	67	69	71	73	75	77	79	82	84	87	89	91	94	96	99	101	1
.005	66	67	69	72	74	77	80	83	85	88	91	94	97	100	103	106	109	112	1
.01	66	68	71	74	76	79	82	85	89	92	95	98	101	104	108	111	114	117	1
.025	67	70	73	76	80	83	86	90	93	97	100	104	107	111	114	118	122	125	1
.05	68	72	75	79	83	86	90	94	98	101	105	109	113	117	121	124	128	132	1
.10	70	74	78	82	86	90	94	98	103	107	111	115	119	124	128	132	136	140	1
.001	78	78	79	81	83	86	88	91	93	96	98	102	104	106	110	113	116	118	1
.005	78	80	82	85	88	91	94	97	100	103	106	110	113	116	120	123	126	130	1
.01	78	81	84	87	90	93	96	100	103	107	110	114	117	121	125	128	132	135	1
.025	80	83	86	90	93	97	101	105	108	112	116	120	124	128	132	136	140	144	1
.05	81	84	88	92	96	100	105	109	111	117	121	126	130	134	139	143	147	151	1
.10	83	87	91	96	100	105	109	114	118	123	128	132	137	142	146	151	156	160	1
.001	91	91	93	95	97	100	103	106	109	112	115	118	121	124	127	130	134	137	1
.005	91	93	95	99	102	105	109	112	116	119	123	126	130	134	137	141	145	149	1
.01	92	94	97	101	104	108	112	115	119	123	127	131	135	139	143	147	151	155	1
.025	93	96	100	104	108	112	116	120	125	129	133	137	142	146	151	155	159	164	1
.05	94	98	102	107	111	116	120	125	129	134	139	143	148	153	157	162	167	172	1
.10	96	101	105	110	115	120	125	130	135	140	145	150	155	160	166	171	176	181	1
.001	105	105	107	109	112	115	118	121	125	128	131	135	138	142	145	149	152	156	1
.005	105	107	110	113	117	121	124	128	132	136	140	144	148	152	156	160	164	169	1
.01	106	108	112	116	119	123	128	132	136	140	144	149	153	157	162	166	171	175	1
.025	107	111	115	119	123	128	132	137	142	146	151	156	161	165	170	175	180	184	1
.05	109	113	117	122	127	132	137	142	147	152	157	162	167	172	177	183	188	193	1
.10	110	116	121	126	131	137	142	147	153	158	164	169	175	180	186	191	197	203	2
.001	120	120	122	125	128	133	135	138	142	145	149	153	157	161	164	168	172	176	1
.005	120	123	126	129	133	137	141	145	150	154	158	163	167	172	176	181	185	190	1
.01	121	124	128	132	136	140	145	149	154	158	163	168	172	177	182	187	191	196	2
.025	122	126	131	135	140	145	150	155	160	165	170	175	180	185	191	196	201	206	2
.05	124	128	133	139	144	149	154	160	165	171	176	182	187	193	198	204	209	215	2
.10	126	131	137	143	148	154	160	166	172	178	184	189	195	201	207	213	219	225	2
.001	136	136	139	142	145	148	152	156	160	164	168	172	176	180	185	189	193	197	2
.005	136	139	142	146	150	155	159	164	168	173	178	182	187	192	197	202	207	211	2
.01	137	140	144	149	153	158	163	168	173	178	183	188	193	198	203	208	213	219	2
.025	138	143	148	152	158	163	168	174	179	184	190	196	201	207	212	218	223	229	2
.05	140	145	151	156	162	167	173	179	185	191	197	202	208	214	220	226	232	238	2
.10	142	148	154	160	166	173	179	185	191	198	204	211	217	223	230	236	243	249	2
.001	153	154	156	159	163	167	171	175	179	183	188	192	197	201	206	211	215	220	2
.005	153	156	160	164	169	173	178	183	188	193	198	203	208	214	219	224	229	235	2
.01	154	158	162	167	172	177	182	187	192	198	203	209	214	220	225	231	236	242	2
.025	156	160	165	171	176	182	188	193	199	205	211	217	223	229	235	241	247	253	2
.05	157	163	169	174	180	187	193	199	205	211	218	224	231	237	243	250	256	263	2
.10	160	166	172	179	185	192	199	206	212	219	226	233	239	246	253	260	267	274	2
.001	171	172	175	178	182	186	190	195	199	204	209	214	218	223	228	233	238	243	2
.005	171	174	178	183	188	193	198	203	209	214	219	225	230	236	242	247	253	259	2
.01	172	176	181	186	191	196	202	208	213	219	225	231	237	242	248	254	260	266	2
.025	174	179	184	190	196	202	208	214	220	227	233	239	246	252	258	265	271	278	2
.05	176	181	188	194	200	207	213	220	227	233	240	247	254	260	267	274	281	288	2
.10	178	185	192	199	206	213	220	227	234	241	249	256	263	270	278	285	292	300	3
.001	190	191	194	198	202	206	211	216	220	225	231	236	241	246	251	257	262	268	2
.005	191	194	198	203	208	213	219	224	230	236	242	248	254	260	265	272	278	284	2
.01	192	195	200	206	211	217	223	229	235	241	247	254	260	266	273	279	285	292	2
.025	193	198	204	210	216	223	229	236	243	249	256	263	269	276	283	290	297	304	3
.05	195	201	208	214	221	228	235	242	249	256	263	271	278	285	292	300	307	314	3
.10	198	205	212	219	227	234	242	249	257	264	272	280	288	295	303	311	319	326	3

Table A7 (CONTINUED)

p	$m=2$	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	2
.001	210	211	214	218	223	227	232	237	243	248	253	259	265	270	276	281	287	293	2
.005	211	214	219	224	229	235	241	247	253	259	265	271	278	284	290	297	303	310	3
.01	212	216	221	227	233	239	245	251	258	264	271	278	284	291	298	304	311	318	3
.025	213	219	225	231	238	245	251	259	266	273	280	287	294	301	309	316	323	330	3
.05	215	222	229	236	243	250	258	265	273	280	288	295	303	311	318	326	334	341	3
.10	218	226	233	241	249	257	265	273	281	289	297	305	313	321	330	338	346	354	3

r n or m greater than 20, the pth quantile w_p of the Mann-Whitney test statistic may be approximated by

$$w_p = n(N+1)/2 + x_p\sqrt{nm(N+1)/12}$$

e x_p is the pth quantile of a standard normal random variable, obtained from Table A1, and where $N = m + n$

he entries in this table are quantiles w_p of the Mann-Whitney test statistic T, given by Equation 5.1.1, for selected s of p. Note that $P[T \le w_p] \le p$. Upper quantiles may be found from the equation

$$w_p = n(n+m+1) - w_{1-p}$$

tical regions correspond to values of T less than (or greater than) but not equal to the appropriate quantile

Table A8 Quantiles of the Kruskal-Wallis Test Statistic for Small Sample Sizes[a]

Sample Sizes	$w_{0.90}$	$w_{0.95}$	$w_{0.99}$
2, 2, 2	3.7143	4.5714	4.5714
3, 2, 1	3.8571	4.2857	4.2857
3, 2, 2	4.4643	4.5000	5.3571
3, 3, 1	4.0000	4.5714	5.1429
3, 3, 2	4.2500	5.1389	6.2500
3, 3, 3	4.6000	5.0667	6.4889
4, 2, 1	4.0179	4.8214	4.8214
4, 2, 2	4.1667	5.1250	6.0000
4, 3, 1	3.8889	5.0000	5.8333
4, 3, 2	4.4444	5.4000	6.3000
4, 3, 3	4.7000	5.7273	6.7091
4, 4, 1	4.0667	4.8667	6.1667
4, 4, 2	4.4455	5.2364	6.8727
4, 4, 3	4.773	5.5758	7.1364
4, 4, 4	4.5000	5.6538	7.5385
5, 2, 1	4.0500	4.4500	5.2500
5, 2, 2	4.2933	5.0400	6.1333
5, 3, 1	3.8400	4.8711	6.4000
5, 3, 2	4.4946	5.1055	6.8218
5, 3, 3	4.4121	5.5152	6.9818
5, 4, 1	3.9600	4.8600	6.8400
5, 4, 2	4.5182	5.2682	7.1182
5, 4, 3	4.5231	5.6308	7.3949
5, 4, 4	4.6187	5.6176	7.7440
5, 5, 1	4.0364	4.9091	6.8364
5, 5, 2	4.5077	5.2462	7.2692
5, 5, 3	4.5363	5.6264	7.5429
5, 5, 4	4.5200	5.6429	7.7914
5, 5, 5	4.5000	5.6600	7.9800

SOURCE: Adapted from Iman, Quade, and Alexander (1975), with permission from the American Mathematical Society.

[a] The null hypothesis may be rejected at the level α if the Kruskal-Wallis test statistic, given by Equation 5.2.5, exceeds the $1-\alpha$ quantile given in the table.

Table A9 Quantiles of the Squared Ranks Test Statistic[a]

n	p	m = 3	4	5	6	7	8	9	10
	.005	14	14	14	14	14	14	21	21
	.01	14	14	14	14	21	21	26	26
	.025	14	14	21	26	29	30	35	41
	.05	21	21	26	30	38	42	49	54
3	.10	26	29	35	42	50	59	69	77
	.90	65	90	117	149	182	221	260	305
	.95	70	101	129	161	197	238	285	333
	.975	77	110	138	170	213	257	308	362
	.99	77	110	149	194	230	285	329	394
	.995	77	110	149	194	245	302	346	413
	.005	30	30	30	39	39	46	50	54
	.01	30	30	39	46	50	51	62	66
	.025	30	39	50	54	63	71	78	90
	.05	39	50	57	66	78	90	102	114
4	.10	50	62	71	85	99	114	130	149
	.90	111	142	182	222	270	321	375	435
	.95	119	154	197	246	294	350	413	476
	.975	126	165	206	255	311	374	439	510
	.99	126	174	219	270	334	401	470	545
	.995	126	174	230	281	351	414	494	567
	.005	55	55	66	75	79	88	99	110
	.01	55	66	75	82	90	103	115	127
	.025	66	79	88	100	114	130	145	162
	.05	75	88	103	120	135	155	175	195
5	.10	87	103	121	142	163	187	212	239
	.90	169	214	264	319	379	445	514	591
	.95	178	228	282	342	410	479	558	639
	.975	183	235	297	363	433	508	592	680
	.99	190	246	310	382	459	543	631	727
	.995	190	255	319	391	478	559	654	754
	.005	91	104	115	124	136	152	167	182
	.01	91	115	124	139	155	175	191	210
	.025	115	130	143	164	184	208	231	255
	.05	124	139	164	187	211	239	268	299
6	.10	136	163	187	215	247	280	315	352
	.90	243	300	364	435	511	592	679	772
	.95	255	319	386	463	545	634	730	831
	.975	259	331	406	486	574	670	771	880
	.99	271	339	424	511	607	706	817	935
	.995	271	346	431	526	624	731	847	970

SOURCE. Adapted from tables generated by R.L. Iman.

[a] The entries in this table are selected quantiles w_p of the squared ranks test statistic T, given by Equation 5.3.3. Note that $P(T < w_p) \leq p$ and $P(T > w_p) \leq 1 - p$. Critical regions correspond to values less than (or greater than) but not including the appropriate quantile.

TABLE A9 (CONTINUED)

n	p	m = 3	4	5	6	7	8	9	10
7	.005	140	155	172	195	212	235	257	280
	.01	155	172	191	212	236	260	287	315
	.025	172	195	217	245	274	305	338	372
	.05	188	212	240	274	308	344	384	425
	.10	203	236	271	308	350	394	440	489
	.90	335	407	487	572	665	764	871	984
	.95	347	428	515	608	707	814	929	1051
	.975	356	443	536	635	741	856	979	1108
	.99	364	456	560	664	779	900	1032	1172
	.995	371	467	571	683	803	929	1067	1212
8	.005	204	236	260	284	311	340	368	401
	.01	221	249	276	309	340	372	408	445
	.025	249	276	311	345	384	425	468	513
	.05	268	300	340	381	426	473	524	576
	.10	285	329	374	423	476	531	590	652
	.90	447	536	632	735	846	965	1091	1224
	.95	464	560	664	776	896	1023	1159	1303
	.975	476	579	689	807	935	1071	1215	1368
	.99	485	599	716	840	980	1124	1277	1442
	.995	492	604	731	863	1005	1156	1319	1489
9	.005	304	325	361	393	429	466	508	549
	.01	321	349	384	423	464	508	553	601
	.025	342	380	423	469	517	570	624	682
	.05	365	406	457	510	567	626	689	755
	.10	390	444	501	561	625	694	766	843
	.90	581	689	803	925	1056	1195	1343	1498
	.95	601	717	840	972	1112	1261	1420	1587
	.975	615	741	870	1009	1158	1317	1485	1662
	.99	624	757	900	1049	1209	1377	1556	1745
	.995	629	769	916	1073	1239	1417	1601	1798
10	.005	406	448	486	526	573	620	672	725
	.01	425	470	513	561	613	667	725	785
	.025	457	505	560	616	677	741	808	879
	.05	486	539	601	665	734	806	883	963
	.10	514	580	649	724	801	885	972	1064
	.90	742	866	1001	1144	1296	1457	1627	1806
	.95	765	901	1045	1197	1360	1533	1715	1907
	.975	778	925	1078	1241	1413	1596	1788	1991
	.99	793	949	1113	1286	1470	1664	1869	2085
	.995	798	961	1130	1314	1505	1708	1921	2145

For n or m greater than 10, the pth quantile w_p of the squared ranks test statistic may be approximated by

$$w_p = \frac{n(N+1)(2N+1)}{6} + x_p \sqrt{\frac{mn(N+1)(2N+1)(8N+11}{180}}$$

where $N = n + m$, and where x_p is the pth quantile of a standard normal random variable, obtained from Table A1.

Table A10 Quantiles of the Spearman Test Statistic[a]

n	$p = .900$	.950	.975	.990	.995	.999
4	.8000	.8000				
5	.7000	.8000	.9000	.9000		
6	.6000	.7714	.8286	.8857	.9429	
7	.5357	.6786	.7450	.8571	.8929	.9643
8	.5000	.6190	.7143	.8095	.8571	.9286
9	.4667	.5833	.6833	.7667	.8167	.9000
10	.4424	.5515	.6364	.7333	.7818	.8667
11	.4182	.5273	.6091	.7000	.7455	.8364
12	.3986	.4965	.5804	.6713	.7273	.8182
13	.3791	.4780	.5549	.6429	.6978	.7912
14	.3626	.4593	.5341	.6220	.6747	.7670
15	.3500	.4429	.5179	.6000	.6536	.7464
16	.3382	.4265	.5000	.5824	.6324	.7265
17	.3260	.4118	.4853	.5637	.6152	.7083
18	.3148	.3994	.4716	.5480	.5975	.6904
19	.3070	.3895	.4579	.5333	.5825	.6737
20	.2977	.3789	.4451	.5203	.5684	.6586
21	.2909	.3688	.4351	.5078	.5545	.6455
22	.2829	.3597	.4241	.4963	.5426	.6318
23	.2767	.3518	.4150	.4852	.5306	.6186
24	.2704	.3435	.4061	.4748	.5200	.6070
25	.2646	.3362	.3977	.4654	.5100	.5962
26	.2588	.3299	.3894	.4564	.5002	.5856
27	.2540	.3236	.3822	.4481	.4915	.5757
28	.2490	.3175	.3749	.4401	.4828	.5660
29	.2443	.3113	.3685	.4320	.4744	.5567
30	.2400	.3059	.3620	.4251	.4665	.5479

For n greater than 30 the approximate quantiles of ρ may be obtained from

$$w_p \approx \frac{x_p}{\sqrt{n-1}}$$

where x_p is the p quantile of a standard normal random variable obtained from Table 1.

SOURCE. Adapted from Glasser and Winter (1961), with corrections, with permission from the *Biometrika* Trustees.

[a] The entries in this table are selected quantiles w_p of the Spearman rank correlation coefficient ρ when used as a test statistic. The lower quantiles may be obtained from the equation

$$w_p = -w_{1-p}$$

The critical region corresponds to values of ρ smaller than (or greater than) but not including the appropriate quantile. Note that the median of ρ is 0.

Table A11 Quantiles of the Hotelling-Pabst Test Statistic[a]

n	$p = .001$	.005	.010	.025	.050	.100	$\frac{1}{6}n(n^2-1)$
4					2	2	20
5			2	2	4	6	40
6		2	4	6	8	14	70
7	2	6	8	14	18	26	112
8	6	12	16	24	32	42	168
9	12	22	28	38	50	64	240
10	22	36	44	60	74	92	330
11	36	56	66	86	104	128	440
12	52	78	94	120	144	172	572
13	76	110	130	162	190	226	728
14	106	148	172	212	246	290	910
15	142	194	224	270	312	364	1120
16	186	250	284	340	390	450	1360
17	238	314	356	420	480	550	1632
18	300	390	438	512	582	664	1938
19	372	476	532	618	696	790	2280
20	454	574	638	738	826	934	2660
21	546	686	758	870	972	1092	3080
22	652	810	892	1020	1134	1270	3542
23	772	950	1042	1184	1312	1464	4048
24	904	1104	1208	1366	1510	1678	4600
25	1050	1274	1390	1566	1726	1912	5200
26	1212	1462	1590	1786	1960	2168	5850
27	1390	1666	1808	2024	2216	2444	6552
28	1586	1890	2046	2284	2494	2744	7308
29	1800	2134	2306	2564	2796	3068	8120
30	2032	2398	2584	2868	3120	3416	8990

For n greater than 30, the quantiles of T may be approximated by

$$w_p \simeq \tfrac{1}{6}n(n^2-1) + x_p \frac{1}{6}\frac{n(n^2-1)}{\sqrt{n-1}}$$

where x_p is the pth quantile of a standard normal random variable given in Table 1.

SOURCE. Adapted from Glasser and Winter (1961), with corrections, with permission from the *Biometrika* Trustees.

[a] The entries in this table are the quantiles w_p of the Hotelling-Pabst test statistic T, defined by Equation 5.4.11, for selected values of p. Note that $P(T \le w_p) = p$. Upper quantiles may be found from the equation

$$w_{1-p} = \tfrac{1}{6}n(n^2-1) - w_p$$

Critical regions correspond to values of T less than (or greater than) but not including the appropriate quantiles. Note that the median of T is given by

$$w_{.50} = \tfrac{1}{6}n(n^2-1)$$

Table A12 Quantiles of the Kendall Test Statistic*

n	$p = .900$	.950	.975	.990	.995
4	4	4	6	6	6
5	6	6	8	8	10
6	7	9	11	11	13
7	9	11	13	15	17
8	10	14	16	18	20
9	12	16	18	22	24
10	15	19	21	25	27
11	17	21	25	29	31
12	18	24	28	34	36
13	22	26	32	38	42
14	23	31	35	41	45
15	27	33	39	47	51
16	28	36	44	50	56
17	32	40	48	56	62
18	35	43	51	61	67
19	37	47	55	65	73
20	40	50	60	70	78
21	42	54	64	76	84
22	45	59	69	81	89
23	49	63	73	87	97
24	52	66	78	92	102
25	56	70	84	98	108
26	59	75	89	105	115
27	61	79	93	111	123
28	66	84	98	116	128
29	68	88	104	124	136
30	73	93	109	129	143
31	75	97	115	135	149
32	80	102	120	142	158
33	84	106	126	150	164
34	87	111	131	155	173
35	91	115	137	163	179
36	94	120	144	170	188
37	98	126	150	176	196
38	103	131	155	183	203
39	107	137	161	191	211
40	110	142	168	198	220

Table A12 (Continued)

n	$p = .900$	.950	.975	.990	.995
41	114	146	174	206	228
42	119	151	181	213	235
43	123	157	187	221	245
44	128	162	194	228	252
45	132	168	200	236	262
46	135	173	207	245	271
47	141	179	213	253	279
48	144	186	220	260	288
49	150	190	228	268	296
50	153	197	233	277	305
51	159	203	241	285	315
52	162	208	248	294	324
53	168	214	256	302	334
54	173	221	263	311	343
55	177	227	269	319	353
56	182	232	276	328	362
57	186	240	284	336	372
58	191	245	291	345	381
59	197	251	299	355	391
60	202	258	306	364	402

For n greater than 60, approximate quantiles of T may be obtained from

$$w_p \simeq x_p \sqrt{\frac{n(n-1)(2n+5)}{18}}$$

where x_p is from the standard normal distribution given by Table A1.

[a] The entries in this table are selected quantiles w_p of the Kendall test statistic T, defined by Equation 5.4.13, for selected values of p. Only upper quantiles are given here, but lower quantiles may be obtained from the relationship

$$w_p = -w_{1-p}$$

Critical regions correspond to values of T greater than (or less than) but not including the appropriate quantile. Note that the median of T is 0.

SOURCE. Adapted from Table 1, Best (1974), with permission from the author.

Table A13 (CONTINUED)

	$w_{0.005}$	$w_{0.01}$	$w_{0.025}$	$w_{0.05}$	$w_{0.10}$	$w_{0.90}$	$w_{0.95}$	$w_{0.975}$	$w_{0.99}$	$w_{0.995}$	$\frac{n(n+1)}{2}$
48	340	363	397	428	463	505	536	563	588		1176
49	357	381	416	447	483	527	559	587	612.5		1225
50	374	398	435	467	504	550	583	611	637.5		1275

For n larger than 50, the pth quantile w_p of the Wilcoxon signed ranks test statistic may be approximated by $w_p \approx \lfloor n(n+1)/4 \rfloor + z_p \sqrt{n(n+1)(2n+1)/24}$, where z_p is the pth quantile of a standard normal random variable, obtained from Table A1.

SOURCE: Adapted from Harter and Owen (1970), with permission from the Institute of Mathematical Statistics.

[a] The entries in this table are quantiles w_p of the Wilcoxon signed ranks test statistic T, given by Equation 5.7.6, for selected values of $p \leq .50$. Quantiles w_p for $p > .50$ may be computed from the equation

$$w_p = n(n+1)/2 - w_{1-p}$$

where $n(n+1)/2$ is given in the right hand column in the table. Note that $P(T \leq w_p) = p$ and $P(T \leq w_p - 1) = p$ if H_0 is true. Critical regions correspond to values of T less than or equal to but not including the appropriate quantile.

Table A13 Quantiles of the Wilcoxon Signed Ranks Test Statistic

	$W_{0.005}$	$W_{0.01}$	$W_{0.025}$	$W_{0.05}$	$W_{0.10}$	$W_{0.20}$	$W_{0.30}$	$W_{0.40}$	$W_{0.50}$	$\frac{n(n+1)}{2}$
$n = 4$	0	0	0	0	1	3	3	4	5	10
5	0	0	0	1	3	4	5	6	7.5	15
6	0	0	1	3	4	6	8	9	10.5	21
7	0	1	3	4	6	9	11	12	14	28
8	1	2	4	6	9	12	14	16	18	36
9	2	4	6	9	11	15	18	20	22.5	45
10	4	6	9	11	15	19	22	25	27.5	55
11	6	8	11	14	18	23	27	30	33	66
12	8	10	14	18	22	28	32	36	39	78
13	10	13	18	22	27	33	38	42	45.5	91
14	13	16	22	26	32	39	44	48	52.5	105
15	16	20	26	31	37	45	51	55	60	120
16	20	24	30	36	43	51	58	63	68	136
17	24	28	35	42	49	58	65	71	76.5	153
18	28	33	41	48	56	66	73	80	85.5	171
19	33	38	47	54	63	74	82	89	95	190
20	38	44	53	61	70	83	91	98	105	210
21	44	50	59	68	78	91	100	108	115.5	231
22	49	56	67	76	87	100	110	119	126.5	253
23	55	63	74	84	95	110	120	130	138	276
24	62	70	82	92	105	120	131	141	150	300
25	69	77	90	101	114	131	143	153	162.5	325
26	76	85	99	111	125	142	155	165	175.5	351
27	84	94	108	120	135	154	167	178	189	378
28	92	102	117	131	146	166	180	192	203	406
29	101	111	127	141	158	178	193	206	217.5	435
30	110	121	138	152	170	191	207	220	232.5	465
31	119	131	148	164	182	205	221	235	248	496
32	129	141	160	176	195	219	236	250	264	528
33	139	152	171	188	208	233	251	266	280.5	561
34	149	163	183	201	222	248	266	282	297.5	595
35	160	175	196	214	236	263	283	299	315	630
36	172	187	209	228	251	279	299	317	333	666
37	184	199	222	242	266	295	316	335	351.5	703
38	196	212	236	257	282	312	334	353	370.5	741
39	208	225	250	272	298	329	352	372	390	780
40	221	239	265	287	314	347	371	391	410	820
41	235	253	280	303	331	365	390	411	430.5	861
42	248	267	295	320	349	384	409	431	451.5	903
43	263	282	311	337	366	403	429	452	473	946
44	277	297	328	354	385	422	450	473	495	990
45	292	313	344	372	403	442	471	495	517.5	1035
46	308	329	362	390	423	463	492	517	540.5	1081
47	324	346	379	408	442	484	514	540	564	1128

Table A25 The t Distribution[a]

Degrees of Freedom $p =$	.6	.75	.9	.95	.975	.99	.995	.9975	.999	.9995
1	0.325	1.000	3.078	6.314	12.706	31.821	63.657	127.32	318.31	636.62
2	0.289	0.816	1.886	2.920	4.303	6.965	9.925	14.089	22.327	31.598
3	0.277	0.765	1.638	2.353	3.182	4.541	5.841	7.453	10.214	12.924
4	0.271	0.741	1.533	2.132	2.776	3.747	4.604	5.598	7.173	8.610
5	0.267	0.727	1.476	2.015	2.571	3.365	4.032	4.773	5.893	6.869
6	0.265	0.718	1.440	1.943	2.447	3.143	3.707	4.317	5.208	5.959
7	0.263	0.711	1.415	1.895	2.365	2.998	3.499	4.029	4.785	5.408
8	0.262	0.706	1.397	1.860	2.306	2.896	3.355	3.833	4.501	5.041
9	0.261	0.703	1.383	1.833	2.262	2.821	3.250	3.690	4.297	4.781
10	0.260	0.700	1.372	1.812	2.228	2.764	3.169	3.581	4.144	4.587
11	0.260	0.697	1.363	1.796	2.201	2.718	3.106	3.497	4.025	4.437
12	0.259	0.695	1.356	1.782	2.179	2.681	3.055	3.428	3.930	4.318
13	0.259	0.694	1.350	1.771	2.160	2.650	3.012	3.372	3.852	4.221
14	0.258	0.692	1.345	1.761	2.145	2.624	2.977	3.326	3.787	4.140
15	0.258	0.691	1.341	1.753	2.131	2.602	2.947	3.286	3.733	4.073
16	0.258	0.690	1.337	1.746	2.120	2.583	2.921	3.252	3.686	4.015
17	0.257	0.689	1.333	1.740	2.110	2.567	2.898	3.222	3.646	3.965
18	0.257	0.688	1.330	1.734	2.101	2.552	2.878	3.197	3.610	
19	0.257	0.688	1.328	1.729	2.093	2.539	2.861	3.174	3.579	3.883
20	0.257	0.687	1.325	1.725	2.086	2.528	2.845	3.153	3.552	3.850
21	0.257	0.686	1.323	1.721	2.080	2.518	2.831	3.135	3.527	3.819
22	0.256	0.686	1.321	1.717	2.074	2.508	2.819	3.119	3.505	3.792
23	0.256	0.685	1.319	1.714	2.069	2.500	2.807	3.104	3.485	3.767
24	0.256	0.685	1.318	1.711	2.064	2.492	2.797	3.091	3.467	3.745
25	0.256	0.684	1.316	1.708	2.060	2.485	2.787	3.078	3.450	3.725
26	0.256	0.684	1.315	1.706	2.056	2.479	2.779	3.067	3.435	3.707
27	0.256	0.684	1.314	1.703	2.052	2.473	2.771	3.057	3.421	3.690
28	0.256	0.683	1.313	1.701	2.048	2.467	2.763	3.047	3.408	3.674
29	0.256	0.683	1.311	1.699	2.045	2.462	2.756	3.038	3.396	3.659
30	0.256	0.683	1.310	1.697	2.042	2.457	2.750	3.030	3.385	3.646
40	0.255	0.681	1.303	1.684	2.021	2.423	2.704	2.971	3.307	3.551
60	0.254	0.679	1.296	1.671	2.000	2.390	2.660	2.915	3.232	3.460
120	0.254	0.677	1.289	1.658	1.980	2.358	2.617	2.860	3.160	3.373
∞	0.253	0.674	1.282	1.645	1.960	2.326	2.576	2.807	3.090	3.291

SOURCE: Reprinted from Pearson and Hartley (1970), with permission from the *Biometrika* Trustees.

[a] The entries in this table are quantiles w_p of the t distribution for various degrees of freedom. Quantiles w_p for $p < .5$ may be computed from the equation

$$w_p = -w_{1-p}$$

Note that $w_{0.50} = 0$ for all degrees of freedom.

Table A26 The F Distribution with k_1 and k_2 Degrees of Freedom (0.75 Quantiles)

k_2 \ k_1	1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40	60	120	∞
1	5.83	7.50	8.20	8.58	8.82	8.98	9.10	9.19	9.26	9.32	9.41	9.49	9.58	9.63	9.67	9.71	9.76	9.80	9.85
2	2.57	3.00	3.15	3.23	3.28	3.31	3.34	3.35	3.37	3.38	3.39	3.41	3.43	3.43	3.44	3.45	3.46	3.47	3.48
3	2.02	2.28	2.36	2.39	2.41	2.42	2.43	2.44	2.44	2.44	2.45	2.46	2.46	2.46	2.47	2.47	2.47	2.47	2.47
4	1.81	2.00	2.05	2.06	2.07	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08
5	1.69	1.85	1.88	1.89	1.89	1.89	1.89	1.89	1.89	1.89	1.89	1.89	1.88	1.88	1.88	1.88	1.87	1.87	1.87
6	1.62	1.76	1.78	1.79	1.79	1.78	1.78	1.78	1.77	1.77	1.77	1.76	1.76	1.75	1.75	1.75	1.74	1.74	1.74
7	1.57	1.70	1.72	1.72	1.71	1.71	1.70	1.70	1.69	1.69	1.68	1.68	1.67	1.67	1.66	1.66	1.65	1.65	1.65
8	1.54	1.66	1.67	1.66	1.66	1.65	1.64	1.64	1.63	1.63	1.62	1.62	1.61	1.60	1.60	1.59	1.59	1.58	1.58
9	1.51	1.62	1.63	1.63	1.62	1.61	1.60	1.60	1.59	1.59	1.58	1.57	1.56	1.56	1.55	1.54	1.54	1.53	1.53
10	1.49	1.60	1.60	1.59	1.59	1.58	1.57	1.56	1.56	1.55	1.54	1.53	1.52	1.52	1.51	1.51	1.50	1.49	1.48
11	1.47	1.58	1.58	1.57	1.56	1.55	1.54	1.53	1.53	1.52	1.51	1.50	1.49	1.49	1.48	1.47	1.47	1.46	1.45
12	1.46	1.56	1.56	1.55	1.54	1.53	1.52	1.51	1.51	1.50	1.49	1.48	1.47	1.46	1.45	1.45	1.44	1.43	1.42
13	1.45	1.55	1.55	1.53	1.52	1.51	1.50	1.49	1.49	1.48	1.47	1.46	1.45	1.44	1.43	1.42	1.42	1.41	1.40
14	1.44	1.53	1.53	1.52	1.51	1.50	1.49	1.48	1.47	1.46	1.45	1.44	1.43	1.42	1.41	1.41	1.40	1.39	1.38
15	1.43	1.52	1.52	1.51	1.49	1.48	1.47	1.46	1.46	1.45	1.44	1.43	1.41	1.41	1.40	1.39	1.38	1.37	1.36
16	1.42	1.51	1.51	1.50	1.48	1.47	1.46	1.45	1.44	1.44	1.43	1.41	1.40	1.40	1.39	1.38	1.37	1.36	1.35
17	1.42	1.51	1.50	1.49	1.47	1.46	1.45	1.44	1.43	1.43	1.41	1.40	1.39	1.38	1.37	1.36	1.35	1.34	1.33
18	1.41	1.50	1.49	1.48	1.46	1.45	1.44	1.43	1.42	1.42	1.40	1.39	1.38	1.37	1.36	1.35	1.34	1.33	1.32
19	1.41	1.49	1.49	1.47	1.46	1.44	1.43	1.42	1.41	1.41	1.40	1.39	1.38	1.37	1.36	1.35	1.34	1.33	1.32
20	1.40	1.49	1.48	1.47	1.45	1.44	1.43	1.42	1.41	1.41	1.40	1.39	1.38	1.37	1.36	1.35	1.34	1.33	1.32
21	1.40	1.48	1.48	1.46	1.44	1.43	1.42	1.41	1.41	1.40	1.39	1.38	1.37	1.36	1.35	1.34	1.33	1.32	1.31
22	1.40	1.48	1.47	1.45	1.44	1.43	1.42	1.41	1.40	1.40	1.39	1.38	1.37	1.36	1.35	1.34	1.33	1.32	1.31
23	1.39	1.47	1.47	1.45	1.44	1.42	1.41	1.40	1.40	1.39	1.39	1.38	1.37	1.36	1.35	1.34	1.33	1.32	1.31
24	1.39	1.47	1.46	1.44	1.43	1.42	1.41	1.40	1.39	1.39	1.38	1.37	1.36	1.35	1.34	1.33	1.32	1.31	1.30
25	1.39	1.47	1.46	1.44	1.43	1.41	1.40	1.39	1.39	1.38	1.38	1.37	1.36	1.35	1.34	1.33	1.32	1.31	1.30
26	1.38	1.46	1.45	1.44	1.42	1.41	1.40	1.39	1.39	1.38	1.38	1.37	1.36	1.35	1.34	1.33	1.32	1.31	1.30
27	1.38	1.46	1.45	1.43	1.42	1.41	1.40	1.39	1.39	1.38	1.38	1.37	1.36	1.35	1.34	1.33	1.32	1.31	1.30
28	1.38	1.46	1.45	1.43	1.42	1.40	1.40	1.39	1.38	1.38	1.37	1.36	1.35	1.35	1.33	1.32	1.31	1.30	1.29
29	1.38	1.45	1.45	1.43	1.41	1.40	1.39	1.38	1.38	1.37	1.36	1.36	1.34	1.33	1.33	1.32	1.31	1.30	1.29
30	1.38	1.45	1.44	1.42	1.41	1.40	1.39	1.38	1.37	1.37	1.36	1.35	1.34	1.33	1.32	1.31	1.30	1.29	1.28
40	1.36	1.44	1.42	1.40	1.39	1.38	1.37	1.36	1.36	1.35	1.34	1.33	1.32	1.31	1.30	1.29	1.28	1.27	1.26
60	1.35	1.42	1.41	1.38	1.37	1.36	1.35	1.34	1.33	1.33	1.31	1.30	1.29	1.28	1.27	1.26	1.25	1.24	1.23
120	1.34	1.40	1.39	1.37	1.36	1.35	1.33	1.32	1.31	1.30	1.29	1.27	1.26	1.25	1.24	1.23	1.22	1.21	1.19
∞	1.32	1.39	1.37	1.35	1.34	1.33	1.31	1.30	1.29	1.28	1.26	1.25	1.24	1.23	1.22	1.21	1.19	1.18	1.17

Source: Reprinted from Pearson and Hartley [1966].

Table A26 (Continued) (0.90 Quantiles)

1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40	60	120	∞
39.86	49.50	53.59	55.83	57.24	58.20	58.91	59.44	59.86	60.19	60.71	61.22	61.74	62.00	62.26	62.53	62.79	63.06	63.
8.53	9.00	9.16	9.24	9.29	9.33	9.35	9.37	9.38	9.39	9.41	9.42	9.44	9.45	9.46	9.47	9.47	9.48	9.
5.54	5.46	5.39	5.34	5.31	5.28	5.27	5.25	5.24	5.23	5.22	5.20	5.18	5.18	5.17	5.16	5.15	5.14	5.
4.54	4.32	4.19	4.11	4.05	4.01	3.98	3.95	3.94	3.92	3.90	3.87	3.84	3.83	3.82	3.80	3.79	3.78	3.
4.06	3.78	3.62	3.52	3.45	3.40	3.37	3.34	3.32	3.30	3.27	3.24	3.21	3.19	3.17	3.16	3.14	3.12	3.
3.78	3.46	3.29	3.18	3.11	3.05	3.01	2.98	2.96	2.94	2.90	2.87	2.84	2.82	2.80	2.78	2.76	2.74	2.
3.59	3.26	3.07	2.96	2.88	2.83	2.78	2.75	2.72	2.70	2.67	2.63	2.59	2.58	2.56	2.54	2.51	2.49	2.
3.46	3.11	2.92	2.81	2.73	2.67	2.62	2.59	2.56	2.54	2.50	2.46	2.42	2.40	2.38	2.36	2.34	2.32	2.
3.36	3.01	2.81	2.69	2.61	2.55	2.51	2.47	2.44	2.42	2.38	2.34	2.30	2.28	2.25	2.23	2.21	2.18	2.
3.29	2.92	2.73	2.61	2.52	2.46	2.41	2.38	2.35	2.32	2.28	2.24	2.20	2.18	2.16	2.13	2.11	2.08	2.
3.23	2.86	2.66	2.54	2.45	2.39	2.34	2.30	2.27	2.25	2.21	2.17	2.12	2.10	2.08	2.05	2.03	2.00	1.
3.18	2.81	2.61	2.48	2.39	2.33	2.28	2.24	2.21	2.19	2.15	2.10	2.06	2.04	2.01	1.99	1.96	1.93	1.
3.14	2.76	2.56	2.43	2.35	2.28	2.23	2.20	2.16	2.14	2.10	2.05	2.01	1.98	1.96	1.93	1.90	1.88	1.
3.10	2.73	2.52	2.39	2.31	2.24	2.19	2.15	2.12	2.10	2.05	2.01	1.96	1.94	1.91	1.89	1.86	1.83	1.
3.07	2.70	2.49	2.36	2.27	2.21	2.16	2.12	2.09	2.06	2.02	1.97	1.92	1.90	1.87	1.85	1.82	1.79	1.
3.05	2.67	2.46	2.33	2.24	2.18	2.13	2.09	2.06	2.03	1.99	1.94	1.89	1.87	1.84	1.81	1.78	1.75	1.
3.03	2.64	2.44	2.31	2.22	2.15	2.10	2.06	2.03	2.00	1.96	1.91	1.86	1.84	1.81	1.78	1.75	1.72	1.
3.01	2.62	2.42	2.29	2.20	2.13	2.08	2.04	2.00	1.98	1.93	1.89	1.84	1.81	1.78	1.75	1.72	1.69	1.
2.99	2.61	2.40	2.27	2.18	2.11	2.06	2.02	1.98	1.96	1.91	1.86	1.81	1.79	1.76	1.73	1.70	1.67	1.
2.97	2.59	2.38	2.25	2.16	2.09	2.04	2.00	1.96	1.94	1.89	1.84	1.79	1.77	1.74	1.71	1.68	1.64	1.
2.96	2.57	2.36	2.23	2.14	2.08	2.02	1.98	1.95	1.92	1.87	1.83	1.78	1.75	1.72	1.69	1.66	1.62	1.
2.95	2.56	2.35	2.22	2.13	2.06	2.01	1.97	1.93	1.90	1.86	1.81	1.76	1.73	1.70	1.67	1.64	1.60	1.
2.94	2.55	2.34	2.21	2.11	2.05	1.99	1.95	1.92	1.89	1.84	1.80	1.74	1.72	1.69	1.66	1.62	1.59	1.
2.93	2.54	2.33	2.19	2.10	2.04	1.98	1.94	1.91	1.88	1.83	1.78	1.73	1.70	1.67	1.64	1.61	1.57	1.
2.92	2.53	2.32	2.18	2.09	2.02	1.97	1.93	1.89	1.87	1.82	1.77	1.72	1.69	1.66	1.63	1.59	1.56	1.
2.91	2.52	2.31	2.17	2.08	2.01	1.96	1.92	1.88	1.86	1.81	1.76	1.71	1.68	1.65	1.61	1.58	1.54	1.
2.90	2.51	2.30	2.17	2.07	2.00	1.95	1.91	1.87	1.85	1.80	1.75	1.70	1.67	1.64	1.60	1.57	1.53	1.
2.89	2.50	2.29	2.16	2.06	2.00	1.94	1.90	1.87	1.84	1.79	1.74	1.69	1.66	1.63	1.59	1.56	1.52	1.
2.89	2.50	2.28	2.15	2.06	1.99	1.93	1.89	1.86	1.83	1.78	1.73	1.68	1.65	1.62	1.58	1.55	1.51	1.
2.88	2.49	2.28	2.14	2.05	1.98	1.93	1.88	1.85	1.82	1.77	1.72	1.67	1.64	1.61	1.57	1.54	1.50	1.
2.84	2.44	2.23	2.09	2.00	1.93	1.87	1.83	1.79	1.76	1.71	1.66	1.61	1.57	1.54	1.51	1.47	1.42	1.
2.79	2.39	2.18	2.04	1.95	1.87	1.82	1.77	1.74	1.71	1.66	1.60	1.54	1.51	1.48	1.44	1.40	1.35	1.
2.75	2.35	2.13	1.99	1.90	1.82	1.77	1.72	1.68	1.65	1.60	1.55	1.48	1.45	1.41	1.37	1.32	1.26	1.
2.71	2.30	2.08	1.94	1.85	1.77	1.72	1.67	1.63	1.60	1.55	1.49	1.42	1.38	1.34	1.30	1.24	1.17	1.

Table A26 (Continued) (0.95 Quantiles)

1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40	60	120	∞
161.4	199.5	215.7	224.6	230.2	234.0	236.8	238.9	240.5	241.9	243.9	245.9	248.0	249.1	250.1	251.1	252.2	253.3	25.
18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38	19.40	19.41	19.43	19.45	19.45	19.46	19.47	19.48	19.49	19.
10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79	8.74	8.70	8.66	8.64	8.62	8.59	8.57	8.55	8.
7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96	5.91	5.86	5.80	5.77	5.75	5.72	5.69	5.66	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	4.56	4.53	4.50	4.46	4.43	4.40	4.
5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06	4.00	3.94	3.87	3.84	3.81	3.77	3.74	3.70	3.
5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64	3.57	3.51	3.44	3.41	3.38	3.34	3.30	3.27	3.
5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35	3.28	3.22	3.15	3.12	3.08	3.04	3.01	2.97	2.
5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14	3.07	3.01	2.94	2.90	2.86	2.83	2.79	2.75	2.
4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98	2.91	2.85	2.77	2.74	2.70	2.66	2.62	2.58	2.
4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.85	2.79	2.72	2.65	2.61	2.57	2.53	2.49	2.45	2.
4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75	2.69	2.62	2.54	2.51	2.47	2.43	2.38	2.34	2.
4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67	2.60	2.53	2.46	2.42	2.38	2.34	2.30	2.25	2.
4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65	2.60	2.53	2.46	2.39	2.35	2.31	2.27	2.22	2.18	2.
4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59	2.54	2.48	2.40	2.33	2.29	2.25	2.20	2.16	2.11	2.
4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49	2.42	2.35	2.28	2.24	2.19	2.15	2.11	2.06	2.
4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.49	2.45	2.38	2.31	2.23	2.19	2.15	2.10	2.06	2.01	1.
4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41	2.34	2.27	2.19	2.15	2.11	2.06	2.02	1.97	1.
4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42	2.38	2.31	2.23	2.16	2.12	2.08	2.03	1.98	1.93	1.
4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39	2.35	2.28	2.20	2.12	2.08	2.04	1.99	1.95	1.90	1.
4.32	3.47	3.07	2.84	2.68	2.57	2.49	2.42	2.37	2.32	2.25	2.18	2.10	2.05	2.01	1.96	1.92	1.87	1.
4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34	2.30	2.23	2.15	2.07	2.03	1.98	1.94	1.89	1.84	1.
4.28	3.42	3.03	2.80	2.64	2.53	2.44	2.37	2.32	2.27	2.20	2.13	2.05	2.01	1.96	1.91	1.86	1.81	1.
4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30	2.25	2.18	2.11	2.03	1.98	1.94	1.89	1.84	1.79	1.
4.24	3.39	2.99	2.76	2.60	2.49	2.40	2.34	2.28	2.24	2.16	2.09	2.01	1.96	1.92	1.87	1.82	1.77	1.
4.23	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27	2.22	2.15	2.07	1.99	1.95	1.90	1.85	1.80	1.75	1.
4.21	3.35	2.96	2.73	2.57	2.46	2.37	2.31	2.25	2.20	2.13	2.06	1.97	1.93	1.88	1.84	1.79	1.73	1.
4.20	3.34	2.95	2.71	2.56	2.45	2.36	2.29	2.24	2.19	2.12	2.04	1.96	1.91	1.87	1.82	1.77	1.71	1.
4.18	3.33	2.93	2.70	2.55	2.43	2.35	2.28	2.22	2.18	2.10	2.03	1.94	1.90	1.85	1.81	1.75	1.70	1.
4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.16	2.09	2.01	1.93	1.89	1.84	1.79	1.74	1.68	1.
4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.08	2.00	1.92	1.84	1.79	1.74	1.69	1.64	1.58	1.
4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04	1.99	1.92	1.84	1.75	1.70	1.65	1.59	1.53	1.47	1.
3.92	3.07	2.68	2.45	2.29	2.17	2.09	2.02	1.96	1.91	1.83	1.75	1.66	1.61	1.55	1.50	1.43	1.35	1.
3.84	3.00	2.60	2.37	2.21	2.10	2.01	1.94	1.88	1.83	1.75	1.67	1.57	1.52	1.46	1.39	1.32	1.22	1.

1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40	60	120	∞
47.8	799.5	864.2	899.6	921.8	937.1	948.2	956.7	963.3	963.3	976.7	984.9	993.1	997.2	1001	1006	1010	1014	1018
38.51	39.00	39.17	39.25	39.30	39.33	39.36	39.37	39.39	39.40	39.41	39.43	39.45	39.46	39.46	39.47	39.48	39.49	39.50
17.44	16.04	15.44	15.10	14.88	14.73	14.62	14.54	14.47	14.42	14.34	14.25	14.17	14.12	14.08	14.04	13.99	13.95	13.90
12.22	10.65	9.98	9.60	9.36	9.20	9.07	8.98	8.90	8.84	8.75	8.66	8.56	8.51	8.46	8.41	8.36	8.31	8.26
10.01	8.43	7.76	7.39	7.15	6.98	6.85	6.76	6.68	6.62	6.52	6.43	6.33	6.28	6.23	6.18	6.12	6.07	6.02
8.81	7.26	6.60	6.23	5.99	5.82	5.70	5.60	5.52	5.46	5.37	5.27	5.17	5.12	5.07	5.01	4.96	4.90	4.85
8.07	6.54	5.89	5.52	5.29	5.12	4.99	4.90	4.82	4.76	4.67	4.57	4.47	4.42	4.36	4.31	4.25	4.20	4.14
7.57	6.06	5.42	5.05	4.82	4.65	4.53	4.43	4.36	4.30	4.20	4.10	4.00	3.95	3.89	3.84	3.78	3.73	3.67
7.21	5.71	5.08	4.72	4.48	4.32	4.20	4.10	4.03	3.96	3.87	3.77	3.67	3.61	3.56	3.51	3.45	3.39	3.33
6.94	5.46	4.83	4.47	4.24	4.07	3.95	3.85	3.78	3.72	3.62	3.52	3.42	3.37	3.31	3.26	3.20	3.14	3.08
6.72	5.26	4.63	4.28	4.04	3.88	3.76	3.66	3.59	3.53	3.43	3.33	3.23	3.17	3.12	3.06	3.00	2.94	2.88
6.55	5.10	4.47	4.12	3.89	3.73	3.61	3.51	3.44	3.37	3.28	3.18	3.07	3.02	2.96	2.91	2.85	2.79	2.72
6.41	4.97	4.35	4.00	3.77	3.60	3.48	3.39	3.31	3.25	3.15	3.05	2.95	2.89	2.84	2.78	2.72	2.66	2.60
6.30	4.86	4.24	3.89	3.66	3.50	3.38	3.29	3.21	3.15	3.05	2.95	2.84	2.79	2.73	2.67	2.61	2.55	2.49
6.20	4.77	4.15	3.80	3.58	3.41	3.29	3.20	3.12	3.06	2.96	2.86	2.76	2.70	2.64	2.59	2.52	2.46	2.40
6.12	4.69	4.08	3.73	3.50	3.34	3.22	3.12	3.05	2.98	2.88	2.78	2.68	2.63	2.57	2.51	2.45	2.38	2.32
6.04	4.62	4.01	3.66	3.44	3.28	3.16	3.06	2.98	2.92	2.82	2.72	2.62	2.56	2.50	2.44	2.38	2.32	2.25
5.98	4.56	3.95	3.61	3.38	3.22	3.10	3.01	2.93	2.87	2.77	2.67	2.56	2.50	2.44	2.38	2.32	2.26	2.19
5.92	4.51	3.90	3.56	3.33	3.17	3.05	2.96	2.88	2.82	2.72	2.62	2.51	2.45	2.39	2.33	2.27	2.20	2.13
5.87	4.46	3.86	3.51	3.29	3.13	3.01	2.91	2.84	2.77	2.68	2.57	2.46	2.41	2.35	2.29	2.22	2.16	2.09
5.83	4.42	3.82	3.48	3.25	3.09	2.97	2.87	2.80	2.73	2.64	2.53	2.42	2.37	2.31	2.25	2.18	2.11	2.04
5.79	4.38	3.78	3.44	3.22	3.05	2.93	2.84	2.76	2.70	2.60	2.50	2.39	2.33	2.27	2.21	2.14	2.08	2.00
5.75	4.35	3.75	3.41	3.18	3.02	2.90	2.81	2.73	2.67	2.57	2.47	2.36	2.30	2.24	2.18	2.11	2.04	1.97
5.72	4.32	3.72	3.38	3.15	2.99	2.87	2.78	2.70	2.64	2.54	2.44	2.33	2.27	2.21	2.15	2.08	2.01	1.94
5.69	4.29	3.69	3.35	3.13	2.97	2.85	2.75	2.68	2.61	2.51	2.41	2.30	2.24	2.18	2.12	2.05	1.98	1.91
5.66	4.27	3.67	3.33	3.10	2.94	2.82	2.73	2.65	2.59	2.49	2.38	2.28	2.22	2.16	2.09	2.03	1.95	1.88
5.63	4.24	3.65	3.31	3.08	2.92	2.80	2.71	2.63	2.57	2.47	2.36	2.25	2.19	2.13	2.07	2.00	1.93	1.85
5.61	4.22	3.63	3.29	3.06	2.90	2.78	2.69	2.61	2.55	2.45	2.34	2.23	2.17	2.11	2.05	1.98	1.91	1.83
5.59	4.20	3.61	3.27	3.04	2.88	2.76	2.67	2.59	2.53	2.43	2.32	2.21	2.15	2.09	2.03	1.96	1.89	1.81
5.57	4.18	3.59	3.25	3.03	2.87	2.75	2.65	2.57	2.51	2.41	2.31	2.20	2.14	2.08	2.01	1.94	1.87	1.79
5.42	4.05	3.46	3.13	2.90	2.74	2.62	2.53	2.45	2.39	2.29	2.18	2.07	2.01	1.94	1.88	1.80	1.72	1.64
5.29	3.93	3.34	3.01	2.79	2.63	2.51	2.41	2.33	2.27	2.17	2.06	1.94	1.88	1.82	1.74	1.67	1.58	1.48
5.15	3.80	3.23	2.89	2.67	2.52	2.39	2.30	2.22	2.16	2.05	1.94	1.82	1.76	1.69	1.61	1.53	1.43	1.31
5.02	3.69	3.12	2.79	2.57	2.41	2.29	2.19	2.11	2.05	1.94	1.83	1.71	1.64	1.57	1.48	1.39	1.27	1.00

Table A26 (Continued) (0.99 Quantiles)

1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40	60	120	∞
4999.5	5403	5625	5764	5859	5928	5981	6022	6056	6106	6157	6209	6235	6261	6287	6313	6339	6366	6366
99.00	99.17	99.25	99.30	99.33	99.36	99.37	99.39	99.40	99.42	99.43	99.45	99.46	99.47	99.47	99.48	99.49	99.50	99.50
30.82	29.46	28.71	28.24	27.91	27.67	27.49	27.35	27.23	27.05	26.87	26.69	26.60	26.50	26.41	26.32	26.22	26.13	26.12
18.00	16.69	15.98	15.52	15.21	14.98	14.80	14.66	14.55	14.37	14.20	14.02	13.93	13.84	13.75	13.65	13.56	13.46	13.46
13.27	12.06	11.39	10.97	10.67	10.46	10.29	10.16	10.05	9.89	9.72	9.55	9.47	9.38	9.29	9.20	9.11	9.02	9.02
10.92	9.78	9.15	8.75	8.47	8.26	8.10	7.98	7.87	7.72	7.56	7.40	7.31	7.23	7.14	7.06	6.97	6.88	6.88
9.55	8.45	7.85	7.46	7.19	6.99	6.84	6.72	6.62	6.47	6.31	6.16	6.07	5.99	5.91	5.82	5.74	5.65	5.65
8.65	7.59	7.01	6.63	6.37	6.18	6.03	5.91	5.81	5.67	5.52	5.36	5.28	5.20	5.12	5.03	4.95	4.86	4.86
8.02	6.99	6.42	6.06	5.80	5.61	5.47	5.35	5.26	5.11	4.96	4.81	4.73	4.65	4.57	4.48	4.40	4.31	4.31
7.56	6.55	5.99	5.64	5.39	5.20	5.06	4.94	4.85	4.71	4.56	4.41	4.33	4.25	4.17	4.08	4.00	3.91	3.91
7.21	6.22	5.67	5.32	5.07	4.89	4.74	4.63	4.54	4.40	4.25	4.10	4.02	3.94	3.86	3.78	3.69	3.60	3.60
6.93	5.95	5.41	5.06	4.82	4.64	4.50	4.39	4.30	4.16	4.01	3.86	3.78	3.70	3.62	3.54	3.45	3.36	3.36
6.70	5.74	5.21	4.86	4.62	4.44	4.30	4.19	4.10	3.96	3.82	3.66	3.59	3.51	3.43	3.34	3.25	3.17	3.17
6.51	5.56	5.04	4.69	4.46	4.28	4.14	4.03	3.94	3.80	3.66	3.51	3.43	3.35	3.27	3.18	3.09	3.00	3.00
6.36	5.42	4.89	4.56	4.32	4.14	4.00	3.89	3.80	3.67	3.52	3.37	3.29	3.21	3.13	3.05	2.96	2.87	2.87
6.23	5.29	4.77	4.44	4.20	4.03	3.89	3.78	3.69	3.55	3.41	3.26	3.18	3.10	3.02	2.93	2.84	2.75	2.75
6.11	5.18	4.67	4.34	4.10	3.93	3.79	3.68	3.59	3.46	3.31	3.16	3.08	3.00	2.92	2.83	2.75	2.65	2.65
6.01	5.09	4.58	4.25	4.01	3.84	3.71	3.60	3.51	3.37	3.23	3.08	3.00	2.92	2.84	2.75	2.66	2.57	2.57
5.93	5.01	4.50	4.17	3.94	3.77	3.63	3.52	3.43	3.30	3.15	3.00	2.92	2.84	2.76	2.67	2.58	2.49	2.49
5.85	4.94	4.43	4.10	3.87	3.70	3.56	3.46	3.37	3.23	3.09	2.94	2.86	2.78	2.69	2.61	2.52	2.42	2.42
5.78	4.87	4.37	4.04	3.81	3.64	3.51	3.40	3.31	3.17	3.03	2.88	2.80	2.72	2.64	2.55	2.46	2.36	2.36
5.72	4.82	4.31	3.99	3.76	3.59	3.45	3.35	3.26	3.12	2.98	2.83	2.75	2.67	2.58	2.50	2.40	2.31	2.31
5.66	4.76	4.26	3.94	3.71	3.54	3.41	3.30	3.21	3.07	2.93	2.78	2.70	2.62	2.54	2.45	2.35	2.26	2.26
5.61	4.72	4.22	3.90	3.67	3.50	3.36	3.26	3.17	3.03	2.89	2.74	2.66	2.58	2.49	2.40	2.31	2.21	2.21
5.57	4.68	4.18	3.85	3.63	3.46	3.32	3.22	3.13	2.99	2.85	2.70	2.62	2.54	2.45	2.36	2.27	2.17	2.17
5.53	4.64	4.14	3.82	3.59	3.42	3.29	3.18	3.09	2.96	2.81	2.66	2.58	2.50	2.42	2.33	2.23	2.13	2.13
5.49	4.60	4.11	3.78	3.56	3.39	3.26	3.15	3.06	2.93	2.78	2.63	2.55	2.47	2.38	2.29	2.20	2.10	2.10
5.45	4.57	4.07	3.75	3.53	3.36	3.23	3.12	3.03	2.90	2.75	2.60	2.52	2.44	2.35	2.25	2.17	2.06	2.06
5.42	4.54	4.04	3.73	3.50	3.33	3.20	3.09	3.00	2.87	2.73	2.57	2.49	2.41	2.33	2.23	2.14	2.03	2.03
5.39	4.51	4.02	3.70	3.47	3.30	3.17	3.07	2.98	2.84	2.70	2.55	2.47	2.39	2.30	2.21	2.11	2.01	2.01
5.18	4.31	3.83	3.51	3.29	3.12	2.99	2.89	2.80	2.66	2.52	2.37	2.29	2.20	2.11	2.02	1.92	1.80	1.80
4.98	4.13	3.65	3.34	3.12	2.95	2.82	2.72	2.63	2.50	2.35	2.20	2.12	2.03	1.94	1.84	1.73	1.60	1.60
4.79	3.95	3.48	3.17	2.96	2.79	2.66	2.56	2.47	2.34	2.19	2.03	1.95	1.86	1.76	1.66	1.53	1.38	1.38
4.61	3.78	3.32	3.02	2.80	2.64	2.51	2.41	2.32	2.18	2.04	1.88	1.79	1.70	1.59	1.47	1.32	1.00	1.00