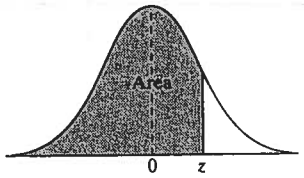

Areas Under the Normal Curve

Table 3

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
−3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
−3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
−3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
−3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
−3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
−2.9	0.0019	0.0018	0.0017	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
−2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
−2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
−2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
−2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
−2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
−2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
−2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
−2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
−2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
−1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
−1.8	0.0359	0.0352	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
−1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
−1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
−1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
−1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0722	0.0708	0.0694	0.0681
−1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
−1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
−1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
−1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
−0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
−0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
−0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
−0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
−0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
−0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
−0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
−0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
−0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
−0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641

TABLE 9 Critical Values of the Chi-Square Distribution

Note: If H_A is directional (for df = 1), column headings should be multiplied by 1/2 when bracketing the *P*-value.

	TAIL PROBABILITY						
df	.20	.10	.05	.02	.01	.001	.0001
1	1.64	2.71	3.84	5.41	6.63	10.83	15.14
2	3.22	4.61	5.99	7.82	9.21	13.82	18.42
3	4.64	6.25	7.81	9.84	11.34	16.27	21.11
4	5.99	7.78	9.49	11.67	13.28	18.47	23.51
5	7.29	9.24	11.07	13.39	15.09	20.51	25.74
6	8.56	10.64	12.59	15.03	16.81	22.46	27.86
7	9.80	12.02	14.07	16.62	18.48	24.32	29.88
8	11.03	13.36	15.51	18.17	20.09	26.12	31.83
9	12.24	14.68	16.92	19.68	21.67	27.88	33.72
10	13.44	15.99	18.31	21.16	23.21	29.59	35.56
11	14.63	17.28	19.68	22.62	24.72	31.26	37.37
12	15.81	18.55	21.03	24.05	26.22	32.91	39.13
13	16.98	19.81	22.36	25.47	27.69	34.53	40.87
14	18.15	21.06	23.68	26.87	29.14	36.12	42.58
15	19.31	22.31	25.00	28.26	30.58	37.70	44.26
16	20.47	23.54	26.30	29.63	32.00	39.25	45.92
17	21.61	24.77	27.59	31.00	33.41	40.79	47.57
18	22.76	25.99	28.87	32.35	34.81	42.31	49.19
19	23.90	27.20	30.14	33.69	36.19	43.82	50.80
20	25.04	28.41	31.41	35.02	37.57	45.31	52.39
21	26.17	29.62	32.67	36.34	38.93	46.80	53.96
22	27.30	30.81	33.92	37.66	40.29	48.27	55.52
23	28.43	32.01	35.17	38.97	41.64	49.73	57.08
24	29.55	33.20	36.42	40.27	42.98	51.18	58.61
25	30.68	34.38	37.65	41.57	44.31	52.62	60.14
26	31.79	35.56	38.89	42.86	45.64	54.05	61.66
27	32.91	36.74	40.11	44.14	46.96	55.48	63.16
28	34.03	37.92	41.34	45.42	48.28	56.89	64.66
29	35.14	39.09	42.56	46.69	49.59	58.30	66.15
30	36.25	40.26	43.77	47.96	50.89	59.70	67.63

the Wilcoxon–Mann–Whitney Statistic

Note: Because the Wilcoxon-Mann-Whitney null distribution is discrete, the actual tail probability corresponding to a given critical value is typically somewhat *less* than the column heading.

		NOMINAL TAIL PROBABILITY						
		Two tails:	.20	.10	.05	.02	.01	.002	.001
n	n'	One tail:	.10	.05	.025	.01	.005	.001	.000
3	2		6						
	3		8	9					
4	2		8						
	3		11	12					
	4		13	15	16				
5	2		9	10					
	3		13	14	15				
	4		16	18	19	20			
	5		20	21	23	24	25		
6	2		11	12					
	3		15	16	17				
	4		19	21	22	23	24		
	5		23	25	27	28	29		
	6		27	29	31	33	34		
7	2		13	14					
	3		17	19	20	21			
	4		22	24	25	27	28		
	5		27	29	30	32	34		
	6		31	34	36	38	39	42	
	7		36	38	41	43	45	48	49
8	2		14	15	16				
	3		19	21	22	24			
	4		25	27	28	30	31		
	5		30	32	34	36	38	40	
	6		35	38	40	42	44	47	4
	7		40	43	46	49	50	54	5
	8		45	49	51	55	57	60	6
9	1		9						
	2		16	17	18				
	3		22	23	25	26	27		
	4		27	30	32	33	35		
	5		33	36	38	40	42	44	4
	6		39	42	44	47	49	52	5
	7		45	48	51	54	56	60	6
	8		50	54	57	61	63	67	6
	9		56	60	64	67	70	74	76
10	1		10						
	2		17	19	20				
	3		24	26	27	29	30		
	4		30	33	35	37	38	40	
	5		37	39	42	44	46	49	50
	6		43	46	49	52	54	57	58
	7		49	53	56	59	61	65	67
	8		56	60	63	67	69	74	75
	9		62	66	70	74	77	82	83
	10		68	73	77	81	84	90	92

TABLE 7 Critical Values of *B* for the Sign Test

Note: Because the sign-test null distribution is discrete, the actual tail prob corresponding to a given critical value is typically somewhat *less* than the c heading.

n_d	NOMINAL TAIL PROBABILITY					
Two tails:	.20	.10	.05	.02	.01	.002
One tail:	.10	.05	.025	.01	.005	.001
1						
2						
3						
4						
5	5	5				
6	6	6	6			
7	7	7	7	7		
8	7	8	8	8	8	
9	8	9	9	9	9	
10	9	10	10	10	10	10
11	10	10	11	11	11	11
12	10	11	12	12	12	12
13	11	12	13	13	13	13
14	12	13	14	14	14	14
15	13	14	15	15	15	15
16	13	15	15	16	16	16
17	14	16	16	17	17	17
18	15	17	17	18	18	18
19	16	17	18	19	19	19
20	17	18	19	20	20	20
21	18	19	20	21	21	21
22	19	20	20	21	22	22
23	20	20	21	22	22	23
24	21	22	23	23	24	24
25	22	23	24	25	25	25
26	23	24	25	26	26	26
27	24	25	26	27	27	27
28	25	26	27	28	28	28
29	26	27	28	29	29	29
30	27	28	29	30	30	30

Critical Values of Student's *t* distribution

Table 4

	UPPER TAIL PROBABILITY									
df	0.20	0.10	0.05	0.04	0.03	0.025	0.02	0.01	0.005	0.00
1	1.376	3.078	6.314	7.916	10.579	12.706	15.895	31.821	63.657	636.6
2	1.061	1.886	2.920	3.320	3.896	4.303	4.849	6.965	9.925	31.5
3	0.978	1.638	2.353	2.605	2.951	3.182	3.482	4.541	5.841	12.9
4	0.941	1.533	2.132	2.333	2.601	2.776	2.999	3.747	4.604	8.6
5	0.920	1.476	2.015	2.191	2.422	2.571	2.757	3.365	4.032	6.8
6	0.906	1.440	1.943	2.104	2.313	2.447	2.612	3.143	3.707	5.9
7	0.896	1.415	1.895	2.046	2.241	2.365	2.517	2.998	3.499	5.4
8	0.889	1.397	1.860	2.004	2.189	2.306	2.449	2.896	3.355	5.0
9	0.883	1.383	1.833	1.973	2.150	2.262	2.398	2.821	3.250	4.7
10	0.879	1.372	1.812	1.948	2.120	2.228	2.359	2.764	3.169	4.5
11	0.876	1.363	1.796	1.928	2.096	2.201	2.328	2.718	3.106	4.4
12	0.873	1.356	1.782	1.912	2.076	2.179	2.303	2.681	3.055	4.3
13	0.870	1.350	1.771	1.899	2.060	2.160	2.282	2.650	3.012	4.2
14	0.868	1.345	1.761	1.888	2.046	2.145	2.264	2.624	2.977	4.1
15	0.866	1.341	1.753	1.878	2.034	2.131	2.249	2.602	2.947	4.0
16	0.865	1.337	1.746	1.869	2.024	2.120	2.235	2.583	2.921	4.0
17	0.863	1.333	1.740	1.862	2.015	2.110	2.224	2.567	2.898	3.9
18	0.862	1.330	1.734	1.855	2.007	2.101	2.214	2.552	2.878	3.9
19	0.861	1.328	1.729	1.850	2.000	2.093	2.205	2.539	2.861	3.8
20	0.860	1.325	1.725	1.844	1.994	2.086	2.197	2.528	2.845	3.8
21	0.859	1.323	1.721	1.840	1.988	2.080	2.189	2.518	2.831	3.8
22	0.858	1.321	1.717	1.835	1.983	2.074	2.183	2.508	2.819	3.7
23	0.858	1.319	1.714	1.832	1.978	2.069	2.177	2.500	2.807	3.7
24	0.857	1.318	1.711	1.828	1.974	2.064	2.172	2.492	2.797	3.7
25	0.856	1.316	1.708	1.825	1.970	2.060	2.167	2.485	2.787	3.7
26	0.856	1.315	1.706	1.822	1.967	2.056	2.162	2.479	2.779	3.7
27	0.855	1.314	1.703	1.819	1.963	2.052	2.158	2.473	2.771	3.6
28	0.855	1.313	1.701	1.817	1.960	2.048	2.154	2.467	2.763	3.6
29	0.854	1.311	1.699	1.814	1.957	2.045	2.150	2.462	2.756	3.6
30	0.854	1.310	1.697	1.812	1.955	2.042	2.147	2.457	2.750	3.6
40	0.851	1.303	1.684	1.796	1.936	2.021	2.123	2.423	2.704	3.5
50	0.849	1.299	1.676	1.787	1.924	2.009	2.109	2.403	2.678	3.4
60	0.848	1.296	1.671	1.781	1.917	2.000	2.099	2.390	2.660	3.4
70	0.847	1.294	1.667	1.776	1.912	1.994	2.093	2.381	2.648	3.4
80	0.846	1.292	1.664	1.773	1.908	1.990	2.088	2.374	2.639	3.4
100	0.845	1.290	1.660	1.769	1.902	1.984	2.081	2.364	2.626	3.3
140	0.844	1.288	1.656	1.763	1.896	1.977	2.073	2.353	2.611	3.3
1000	0.842	1.282	1.646	1.752	1.883	1.962	2.056	2.330	2.581	3.3
∞	0.842	1.282	1.645	1.751	1.881	1.960	2.054	2.326	2.576	3.2
	60%	80%	90%	92%	94%	95%	96%	98%	99%	99.9
	CONFIDENCE LEVEL									

TABLE 10 Critical Values of the *F* Distribution *(continued)*

Numerator df = 2

Denom.	TAIL PROBABILITY						
df	.20	.10	.05	.02	.01	.001	.0001
1	12.00	49.50	200	125^1	500^1	500^3	500^5
2	4.00	9.00	19.00	49.00	99.00	999	100^2
3	2.89	5.46	9.55	18.86	30.82	149	695
4	2.47	4.32	6.94	12.14	18.00	61.25	198
5	2.26	3.78	5.79	9.45	13.27	37.12	97.03
6	2.13	3.46	5.14	8.05	10.92	27.00	61.63
7	2.04	3.26	4.74	7.20	9.55	21.69	45.13
8	1.98	3.11	4.46	6.64	8.65	18.49	36.00
9	1.93	3.01	4.26	6.23	8.02	16.39	30.34
10	1.90	2.92	4.10	5.93	7.56	14.91	26.55
11	1.87	2.86	3.98	5.70	7.21	13.81	23.85
12	1.85	2.81	3.89	5.52	6.93	12.97	21.85
13	1.83	2.76	3.81	5.37	6.70	12.31	20.31
14	1.81	2.73	3.74	5.24	6.51	11.78	19.09
15	1.80	2.70	3.68	5.14	6.36	11.34	18.11
16	1.78	2.67	3.63	5.05	6.23	10.97	17.30
17	1.77	2.64	3.59	4.97	6.11	10.66	16.62
18	1.76	2.62	3.55	4.90	6.01	10.39	16.04
19	1.75	2.61	3.52	4.84	5.93	10.16	15.55
20	1.75	2.59	3.49	4.79	5.85	9.95	15.12
21	1.74	2.57	3.47	4.74	5.78	9.77	14.74
22	1.73	2.56	3.44	4.70	5.72	9.61	14.41
23	1.73	2.55	3.42	4.66	5.66	9.47	14.12
24	1.72	2.54	3.40	4.63	5.61	9.34	13.85
25	1.72	2.53	3.39	4.59	5.57	9.22	13.62
26	1.71	2.52	3.37	4.56	5.53	9.12	13.40
27	1.71	2.51	3.35	4.54	5.49	9.02	13.21
28	1.71	2.50	3.34	4.51	5.45	8.93	13.03
29	1.70	2.50	3.33	4.49	5.42	8.85	12.87
30	1.70	2.49	3.32	4.47	5.39	8.77	12.72