## **Appendix Tables**

**Table A.1** Cumulative Binomial Probabilities

a. n = 5

$$B(x; n, p) = \sum_{y=0}^{x} b(y; n, p)$$

			<i>p</i>													
		0.01	0.05	0.10	0.20	0.25	0.30	0.40	0.50	0.60	0.70	0.75	0.80	0.90	0.95	0.99
	0	.951	.774	.590	.328	.237	.168	.078	.031	.010	.002	.001	.000	.000	.000	.000
	1	.999	.977	.919	.737	.633	.528	.337	.188	.087	.031	.016	.007	.000	.000	.000
x	2	1.000	.999	.991	.942	.896	.837	.683	.500	.317	.163	.104	.058	.009	.001	.000
	3	1.000	1.000	1.000	.993	.984	.969	.913	.812	.663	.472	.367	.263	.081	.023	.001
	4	1.000	1.000	1.000	1.000	.999	.998	.990	.969	.922	.832	.763	.672	.410	.226	.049

b. n = 10

	p														
	0.01	0.05	0.10	0.20	0.25	0.30	0.40	0.50	0.60	0.70	0.75	0.80	0.90	0.95	0.99
0	.904	.599	.349	.107	.056	.028	.006	.001	.000	.000	.000	.000	.000	.000	.000
1	.996	.914	.736	.376	.244	.149	.046	.011	.002	.000	.000	.000	.000	.000	.000
2	1.000	.988	.930	.678	.526	.383	.167	.055	.012	.002	.000	.000	.000	.000	.000
3	1.000	.999	.987	.879	.776	.650	.382	.172	.055	.011	.004	.001	.000	.000	.000
4	1.000	1.000	.998	.967	.922	.850	.633	.377	.166	.047	.020	.006	.000	.000	.000
<i>x</i> 5	1.000	1.000	1.000	.994	.980	.953	.834	.623	.367	.150	.078	.033	.002	.000	.000
6	1.000	1.000	1.000	.999	.996	.989	.945	.828	.618	.350	.224	.121	.013	.001	.000
7	1.000	1.000	1.000	1.000	1.000	.998	.988	.945	.833	.617	.474	.322	.070	.012	.000
8	1.000	1.000	1.000	1.000	1.000	1.000	.998	.989	.954	.851	.756	.624	.264	.086	.004
9	1.000	1.000	1.000	1.000	1.000	1.000	1.000	.999	.994	.972	.944	.893	.651	.401	.096

c. n = 15

	p														
	0.01	0.05	0.10	0.20	0.25	0.30	0.40	0.50	0.60	0.70	0.75	0.80	0.90	0.95	0.99
0	.860	.463	.206	.035	.013	.005	.000	.000	.000	.000	.000	.000	.000	.000	.000
1	.990	.829	.549	.167	.080	.035	.005	.000	.000	.000	.000	.000	.000	.000	.000
2	1.000	.964	.816	.398	.236	.127	.027	.004	.000	.000	.000	.000	.000	.000	.000
3	1.000	.995	.944	.648	.461	.297	.091	.018	.002	.000	.000	.000	.000	.000	.000
4	1.000	.999	.987	.836	.686	.515	.217	.059	.009	.001	.000	.000	.000	.000	.000
5	1.000	1.000	.998	.939	.852	.722	.402	.151	.034	.004	.001	.000	.000	.000	.000
6	1.000	1.000	1.000	.982	.943	.869	.610	.304	.095	.015	.004	.001	.000	.000	.000
<i>x</i> 7	1.000	1.000	1.000	.996	.983	.950	.787	.500	.213	.050	.017	.004	.000	.000	.000
8	1.000	1.000	1.000	.999	.996	.985	.905	.696	.390	.131	.057	.018	.000	.000	.000
9	1.000	1.000	1.000	1.000	.999	.996	.966	.849	.597	.278	.148	.061	.002	.000	.000
10	1.000	1.000	1.000	1.000	1.000	.999	.991	.941	.783	.485	.314	.164	.013	.001	.000
11	1.000	1.000	1.000	1.000	1.000	1.000	.998	.982	.909	.703	.539	.352	.056	.005	.000
12	1.000	1.000	1.000	1.000	1.000	1.000	1.000	.996	.973	.873	.764	.602	.184	.036	.000
13	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	.995	.965	.920	.833	.451	.171	.010
14	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	.995	.987	.965	.794	.537	.140

 Table A.1
 Cumulative Binomial Probabilities (cont.)

d. n = 20

$$B(x; n, p) = \sum_{y=0}^{x} b(y; n, p)$$

									p			p														
		0.01	0.05	0.10	0.20	0.25	0.30	0.40	0.50	0.60	0.70	0.75	0.80	0.90	0.95	0.99										
	0	.818	.358	.122	.012	.003	.001	.000	.000	.000	.000	.000	.000	.000	.000	.000										
	1	.983	.736	.392	.069	.024	.008	.001	.000	.000	.000	.000	.000	.000	.000	.000										
	2	.999	.925	.677	.206	.091	.035	.004	.000	.000	.000	.000	.000	.000	.000	.000										
	3	1.000	.984	.867	.411	.225	.107	.016	.001	.000	.000	.000	.000	.000	.000	.000										
	4	1.000	.997	.957	.630	.415	.238	.051	.006	.000	.000	.000	.000	.000	.000	.000										
	5	1.000	1.000	.989	.804	.617	.416	.126	.021	.002	.000	.000	.000	.000	.000	.000										
	6	1.000	1.000	.998	.913	.786	.608	.250	.058	.006	.000	.000	.000	.000	.000	.000										
	7	1.000	1.000	1.000	.968	.898	.772	.416	.132	.021	.001	.000	.000	.000	.000	.000										
	8	1.000	1.000	1.000	.990	.959	.887	.596	.252	.057	.005	.001	.000	.000	.000	.000										
	9	1.000	1.000	1.000	.997	.986	.952	.755	.412	.128	.017	.004	.001	.000	.000	.000										
X	10	1.000	1.000	1.000	.999	.996	.983	.872	.588	.245	.048	.014	.003	.000	.000	.000										
	11	1.000	1.000	1.000	1.000	.999	.995	.943	.748	.404	.113	.041	.010	.000	.000	.000										
	12	1.000	1.000	1.000	1.000	1.000	.999	.979	.868	.584	.228	.102	.032	.000	.000	.000										
	13	1.000	1.000	1.000	1.000	1.000	1.000	.994	.942	.750	.392	.214	.087	.002	.000	.000										
	14	1.000	1.000	1.000	1.000	1.000	1.000	.998	.979	.874	.584	.383	.196	.011	.000	.000										
	15	1.000	1.000	1.000	1.000	1.000	1.000	1.000	.994	.949	.762	.585	.370	.043	.003	.000										
	16	1.000	1.000	1.000	1.000	1.000	1.000	1.000	.999	.984	.893	.775	.589	.133	.016	.000										
	17	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	.996	.965	.909	.794	.323	.075	.001										
	18	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	.999	.992	.976	.931	.608	.264	.017										
	19	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	.999	.997	.988	.878	.642	.182										

 Table A.1
 Cumulative Binomial Probabilities (cont.)

e. n = 25

$$B(x; n, p) = \sum_{y=0}^{x} b(y; n, p)$$

									p							
		0.01	0.05	0.10	0.20	0.25	0.30	0.40	0.50	0.60	0.70	0.75	0.80	0.90	0.95	0.99
	0	.778	.277	.072	.004	.001	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	1	.974	.642	.271	.027	.007	.002	.000	.000	.000	.000	.000	.000	.000	.000	.000
	2	.998	.873	.537	.098	.032	.009	.000	.000	.000	.000	.000	.000	.000	.000	.000
	3	1.000	.966	.764	.234	.096	.033	.002	.000	.000	.000	.000	.000	.000	.000	.000
	4	1.000	.993	.902	.421	.214	.090	.009	.000	.000	.000	.000	.000	.000	.000	.000
	5	1.000	.999	.967	.617	.378	.193	.029	.002	.000	.000	.000	.000	.000	.000	.000
	6	1.000	1.000	.991	.780	.561	.341	.074	.007	.000	.000	.000	.000	.000	.000	.000
	7	1.000	1.000	.998	.891	.727	.512	.154	.022	.001	.000	.000	.000	.000	.000	.000
	8	1.000	1.000	1.000	.953	.851	.677	.274	.054	.004	.000	.000	.000	.000	.000	.000
	9	1.000	1.000	1.000	.983	.929	.811	.425	.115	.013	.000	.000	.000	.000	.000	.000
	10	1.000	1.000	1.000	.994	.970	.902	.586	.212	.034	.002	.000	.000	.000	.000	.000
	11	1.000	1.000	1.000	.998	.980	.956	.732	.345	.078	.006	.001	.000	.000	.000	.000
x :	12	1.000	1.000	1.000	1.000	.997	.983	.846	.500	.154	.017	.003	.000	.000	.000	.000
	13	1.000	1.000	1.000	1.000	.999	.994	.922	.655	.268	.044	.020	.002	.000	.000	.000
	14	1.000	1.000	1.000	1.000	1.000	.998	.966	.788	.414	.098	.030	.006	.000	.000	.000
	15	1.000	1.000	1.000	1.000	1.000	1.000	.987	.885	.575	.189	.071	.017	.000	.000	.000
	16	1.000	1.000	1.000	1.000	1.000	1.000	.996	.946	.726	.323	.149	.047	.000	.000	.000
	17	1.000	1.000	1.000	1.000	1.000	1.000	.999	.978	.846	.488	.273	.109	.002	.000	.000
	18	1.000	1.000	1.000	1.000	1.000	1.000	1.000	.993	.926	.659	.439	.220	.009	.000	.000
	19	1.000	1.000	1.000	1.000	1.000	1.000	1.000	.998	.971	.807	.622	.383	.033	.001	.000
2	20	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	.991	.910	.786	.579	.098	.007	.000
2	21	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	.998	.967	.904	.766	.236	.034	.000
2	22	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	.991	.968	.902	.463	.127	.002
2	23	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	.998	.993	.973	.729	.358	.026
2	24	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	.999	.996	.928	.723	.222

**Table A.2 Cumulative Poisson Probabilities** 

$$F(x; \lambda) = \sum_{y=0}^{x} \frac{e^{-\lambda} \lambda^{y}}{y!}$$

						j	l				
		.1	.2	.3	.4	.5	.6	.7	.8	.9	1.0
	0	.905	.819	.741	.670	.607	.549	.497	.449	.407	.368
	1	.995	.982	.963	.938	.910	.878	.844	.809	.772	.736
	2	1.000	.999	.996	.992	.986	.977	.966	.953	.937	.920
X	3		1.000	1.000	.999	.998	.997	.994	.991	.987	.981
	4				1.000	1.000	1.000	.999	.999	.998	.996
	5							1.000	1.000	1.000	.999
	6										1.000

 Table A.2
 Cumulative Poisson Probabilities (cont.)

$$F(x; \lambda) = \sum_{y=0}^{x} \frac{e^{-\lambda} \lambda^{y}}{y!}$$

							λ				<i>y</i> -	-0 5
		2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	15.0	20.0
	0	.135	.050	.018	.007	.002	.001	.000	.000	.000	.000	.000
	1	.406	.199	.092	.040	.017	.007	.003	.001	.000	.000	.000
	2	.677	.423	.238	.125	.062	.030	.014	.006	.003	.000	.000
	3	.857	.647	.433	.265	.151	.082	.042	.021	.010	.000	.000
	4	.947	.815	.629	.440	.285	.173	.100	.055	.029	.001	.000
	5	.983	.916	.785	.616	.446	.301	.191	.116	.067	.003	.000
	6	.995	.966	.889	.762	.606	.450	.313	.207	.130	.008	.000
	7	.999	.988	.949	.867	.744	.599	.453	.324	.220	.018	.001
	8	1.000	.996	.979	.932	.847	.729	.593	.456	.333	.037	.002
	9		.999	.992	.968	.916	.830	.717	.587	.458	.070	.005
	10		1.000	.997	.986	.957	.901	.816	.706	.583	.118	.011
	11			.999	.995	.980	.947	.888	.803	.697	.185	.021
	12			1.000	.998	.991	.973	.936	.876	.792	.268	.039
	13				.999	.996	.987	.966	.926	.864	.363	.066
	14				1.000	.999	.994	.983	.959	.917	.466	.105
	15					.999	.998	.992	.978	.951	.568	.157
	16					1.000	.999	.996	.989	.973	.664	.221
	17						1.000	.998	.995	.986	.749	.297
	18							.999	.998	.993	.819	.381
х	19							1.000	.999	.997	.875	.470
	20								1.000	.998	.917	.559
	21									.999	.947	.644
	22									1.000	.967	.721
	23										.981	.787
	24										.989	.843
	25										.994	.888
	26										.997	.922
	27										.998	.948
	28										.999	.966
	29										1.000	.978
	30											.987
	31											.992
	32											.995
	33											.997
	34											.999
	35											.999
	36											1.000
	50											1.000

**Table A.3** Standard Normal Curve Areas

 $\Phi(z) = P(Z \le z)$ 

Standard normal density function
Shaded area = $\Phi(z)$
Sinued and = \$\Psi(z)\$
0 7

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
-3.4	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0002
-3.3	.0005	.0005	.0005	.0004	.0004	.0004	.0004	.0004	.0004	.0003
-3.2	.0007	.0007	.0006	.0006	.0006	.0006	.0006	.0005	.0005	.0005
-3.1	.0010	.0009	.0009	.0009	.0008	.0008	.0008	.0008	.0007	.0007
-3.0	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010
-2.9	.0019	.0018	.0017	.0017	.0016	.0016	.0015	.0015	.0014	.0014
-2.8	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
-2.7	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0028	.0027	.0026
-2.6	.0047	.0045	.0044	.0043	.0041	.0040	.0039	.0038	.0037	.0036
-2.5	.0062	.0060	.0059	.0057	.0055	.0054	.0052	.0051	.0049	.0038
-2.4	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
-2.3	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
-2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
-2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
-2.0	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
-1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
-1.8	.0359	.0352	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
-1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
-1.6	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
-1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
-1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0722	.0708	.0694	.0681
-1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
-1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
-1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
-1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
-0.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
-0.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
-0.7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
-0.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
-0.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
-0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
-0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3482
-0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
-0.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
-0.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641

Table A.3 Standard Normal Curve Areas (cont.)

 $\Phi(z) = P(Z \le z)$ 

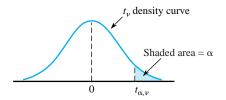
z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
0.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
0.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
0.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
0.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9278	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995
3.3	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998

**Table A.4** The Incomplete Gamma Function

$F(x; \alpha) =$	$\int_{0}^{x} \overline{I}$	$\frac{1}{\Gamma(\alpha)}y^{\alpha}$	$-1e^{-y}dy$
------------------	-----------------------------	--------------------------------------	--------------

$x^{\alpha}$	1	2	3	4	5	6	7	8	9	10
1	.632	.264	.080	.019	.004	.001	.000	.000	.000	.000
2	.865	.594	.323	.143	.053	.017	.005	.001	.000	.000
3	.950	.801	.577	.353	.185	.084	.034	.012	.004	.001
4	.982	.908	.762	.567	.371	.215	.111	.051	.021	.008
5	.993	.960	.875	.735	.560	.384	.238	.133	.068	.032
6	.998	.983	.938	.849	.715	.554	.394	.256	.153	.084
7	.999	.993	.970	.918	.827	.699	.550	.401	.271	.170
8	1.000	.997	.986	.958	.900	.809	.687	.547	.407	.283
9		.999	.994	.979	.945	.884	.793	.676	.544	.413
10		1.000	.997	.990	.971	.933	.870	.780	.667	.542
11			.999	.995	.985	.962	.921	.857	.768	.659
12			1.000	.998	.992	.980	.954	.911	.845	.758
13				.999	.996	.989	.974	.946	.900	.834
14				1.000	.998	.994	.986	.968	.938	.891
15					.999	.997	.992	.982	.963	.930

Table A.5 Critical Values for t Distributions

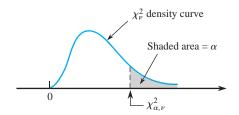


 $\alpha$ .10 .05 .025 .01 .005 .001 .0005  $\nu$ 1 12.706 31.821 3.078 6.314 63.657 318.31 636.62 2 1.886 2.920 4.303 6.965 9.925 22.326 31.598 3 2.353 1.638 3.182 4.541 5.841 10.213 12.924 4 1.533 2.132 2.776 3.747 4.604 7.173 8.610 5 1.476 2.015 2.571 3.365 4.032 5.893 6.869 6 1.440 1.943 2.447 3.707 5.208 5.959 3.143 7 2.365 1.415 1.895 2.998 3.499 4.785 5.408 8 1.397 1.860 2.306 2.896 3.355 4.501 5.041 9 1.383 1.833 2.262 2.821 3.250 4.297 4.781 10 1.372 2.228 3.169 4.144 1.812 2.764 4.587 11 1.363 1.796 2.201 2.718 3.106 4.025 4.437 12 1.782 2.179 3.930 4.318 1.356 2.681 3.055 2.160 13 1.350 1.771 2.650 3.012 3.852 4.221 14 1.345 1.761 2.145 2.624 2.977 3.787 4.140 15 1.341 1.753 2.131 2.602 2.947 3.733 4.073 2.583 2.921 16 1.337 1.746 2.120 3.686 4.015 17 1.333 1.740 2.110 2.567 2.898 3.646 3.965 18 1.330 1.734 2.552 2.878 3.922 2.101 3.610 19 1.328 1.729 2.093 2.539 2.861 3.579 3.883 20 2.086 2.528 1.325 1.725 2.845 3.552 3.850 21 1.323 1.721 2.080 2.518 2.831 3.527 3.819 22 2.074 3.505 3.792 1.321 1.717 2.508 2.819 23 1.319 1.714 2.069 2.500 2.807 3.485 3.767 24 1.318 1.711 2.064 2.492 2.797 3.467 3.745 25 1.316 1.708 2.060 2.485 2.787 3.450 3.725 26 1.706 2.056 2.479 2.779 3.435 1.315 3.707 27 1.314 1.703 2.052 2.473 2.771 3.421 3.690 3.408 28 1.313 1.701 2.048 2.467 2.763 3.674 29 1.311 1.699 2.045 2.462 2.756 3.396 3.659 30 1.310 1.697 2.042 2.457 2.750 3.385 3.646 32 1.309 1.694 2.037 2.449 2.738 3.365 3.622 34 1.307 1.691 2.032 2.441 2.728 3.348 3.601 36 1.306 1.688 2.028 2.434 2.719 3.333 3.582 38 1.304 1.686 2.024 2.429 2.712 3.319 3.566 40 1.303 1.684 2.021 2.423 2.704 3.307 3.551 50 1.299 1.676 2.009 2.403 2.678 3.262 3.496 60 1.296 1.671 2.000 2.390 2.660 3.232 3.460 120 1.289 1.980 2.358 1.658 2.617 3.160 3.373 1.282 1.645 1.960 2.326 2.576 3.090 3.291  $\infty$ 

Table A.6 Tolerance Critical Values for Normal Population Distributions

Volume         PSPA         99%         PSPA         <				Two-sided	Two-sided Intervals					One-sided	One-sided Intervals		
Ambitation Captured         ≥ 95% </th <th>Confidence Leve</th> <th>- To</th> <th>%56</th> <th></th> <th></th> <th>%66</th> <th></th> <th></th> <th>%56</th> <th></th> <th></th> <th>%66</th> <th></th>	Confidence Leve	- To	%56			%66			%56			%66	
2         2.0.01         3.7.674         48.4.30         160.193         188.491         24.2.300         20.2.801         26.2.60         37.094         103.092         13.14.26         18.308         23.096         1.1.827         1.1.828         1.1.827         1.1.827         1.1.828         1.1.	% of Population Capture	ΛI	<b>≥ 95%</b>	%66 ⋜	%06 ⋜	× 65%	%66 ⋜	%06 ⋜	<i>&gt;</i> 95%	%66 ⋜	%06 ⋜	<b>≥ 95</b> %	%66 ⋜
3         8.380         9.916         12.8G1         18.930         22.401         29.055         6.156         10.553         13.995         17.370           4         5.369         6.370         8.299         11.80         12.840         13.905         17.370         17.87         17.87         27.84         17.87         27.84         17.87         27.84         17.87         27.84         27.84         27.84         27.84         27.87         3.400         4.401         5.389         4.713         5.406         3.708         5.004         4.411         5.408         9.88         3.13         4.411         5.406         5.89         3.718         4.718         2.766         3.708         5.004         4.411         5.408         5.008         3.809         4.411         5.408         5.808         3.809         4.411         5.408         5.809         3.709         4.411         5.409         3.800         3.8	2	32.019	37.674	48.430	160.193	188.491	242.300	20.581	26.260	37.094	103.029	131.426	185.617
4         5.369         6.370         8.939         9.398         II.150         I.427         4.162         5.144         7.042         7.380         9.083           4         5.275         6.370         6.634         6.612         7.885         10.200         3.407         4.203         5.741         5.330         9.083           4         3.369         4.007         5.248         4.613         5.488         7.187         2.756         3.400         4.642         3.890         4.728           9         2.897         3.732         4.891         4.147         4.836         6.468         2.882         3.187         4.784         3.001         3.789         4.728         3.001         3.789         4.728         3.001         3.497         4.203         5.740         4.549         5.400         4.642         3.889         4.728         5.248         3.781         4.893         2.040         4.642         3.899         3.781         4.993         2.071         3.891         3.494         4.288         3.493         3.493         3.781         4.993         2.071         3.491         4.288         3.493         4.288         3.493         4.288         3.493         3.493         4	e e	8.380	9.916	12.861	18.930	22.401	29.055	6.156	7.656	10.553	13.995	17.370	23.896
5         4.275         5.079         6.634         6.612         7.855         10.260         3.407         4.203         5.741         5.362         6.578           8         3.136         4.414         5.775         6.634         6.612         7.855         10.260         4.441         5.362         4.491         5.448         8.301         3.006         4.441         5.446         4.837         6.488         3.018         3.006         4.441         5.406         4.411         5.406         4.414         3.821         4.858         5.896         2.456         3.00         4.441         5.406         4.414         3.841         4.858         3.187         4.433         3.841         4.858         2.945         3.876         2.456         3.040         4.414         3.946         4.488         2.945         3.876         2.878         2.945         3.876         2.946         2.878         2.947         3.741         3.441         3.948         3.948         3.246         4.873         2.910         2.876         3.874         3.741         3.448         3.948         3.948         3.248         3.874         4.493         2.946         2.848         3.948         3.948         3.949         3.828 <th>4</th> <th>5.369</th> <th>6.370</th> <th>8.299</th> <th>9.398</th> <th>11.150</th> <th>14.527</th> <th>4.162</th> <th>5.144</th> <th>7.042</th> <th>7.380</th> <th>9.083</th> <th>12.387</th>	4	5.369	6.370	8.299	9.398	11.150	14.527	4.162	5.144	7.042	7.380	9.083	12.387
6         3712         4.414         5.775         5.337         6.345         8.301         3.006         3.708         5.062         4.411         5.408           8         3.356         4.007         5.248         4.613         5.488         7.187         2.756         3.400         4.642         3.889         4.738           9         2.967         3.532         4.631         3.822         4.550         5.966         2.454         3.031         4.143         3.249         4.738           11         2.833         3.337         4.433         3.822         4.265         2.944         3.031         4.143         3.249         4.788           12         2.837         3.252         4.850         2.275         2.818         3.497         4.888         3.738         2.949         3.349         2.744         3.081         4.143         3.241         4.88         3.741         4.88         3.741         4.88         3.742         4.88         2.752         2.849         3.752         2.849         2.752         2.816         3.741         4.89         2.752         2.811         3.741         4.89         3.741         4.89         3.245         2.849         3.732	u)	4.275	5.079	6.634	6.612	7.855	10.260	3.407	4.203	5.741	5.362	6.578	8.939
7         3.369         4.007         5.248         4.187         2.186         3.400         4.642         3.859         4.728           8         3.136         3.136         3.372         4.81         4.147         4.936         6.468         2.828         3.187         4.134         3.497         4.728           10         2.839         3.372         4.831         3.822         4.263         5.382         2.911         3.381         3.413         3.413         3.413         3.413         3.413         3.413         3.413         3.413         3.413         3.413         3.413         3.413         3.413         3.413         3.413         3.413         3.413         3.413         3.413         3.243         4.045         5.308         2.155         2.811         3.049         3.734         3.404         2.355         2.814         3.734         4.044         3.130         3.734         4.045         5.308         2.174         3.629         3.734         3.404         4.837         2.816         2.824         3.734         4.044         3.130         3.734         4.044         3.130         3.734         4.605         2.820         2.816         3.241         3.823         3.849	9	3.712	4.414	5.775	5.337	6.345	8.301	3.006	3.708	5.062	4.411	5.406	7.335
8         3.136         3.732         4.891         4.147         4.936         6.468         2.582         3.187         4.343         3.497         4.285           10         2.894         3.532         4.661         3.822         2.584         3.031         4.143         3.491         4.285           11         2.834         3.352         4.661         3.820         2.894         3.556         2.451         3.031         3.491         3.492           12         2.834         3.259         4.277         3.870         4.045         5.896         2.275         2.815         3.892         2.898         3.556           13         2.887         3.279         4.045         5.896         2.275         2.817         3.414         3.490         3.754           14         4.284         2.675         2.276         2.276         2.276         2.883         3.734         4.049         2.735         2.671         3.737         3.490         3.724         4.492         2.079         2.674         3.744         2.492         3.280         2.272         2.893         3.744         2.492         3.280         2.272         2.811         3.744         2.492         2.210		3.369	4.007	5.248	4.613	5.488	7.187	2.756	3.400	4.642	3.859	4.728	6.412
9         2.967         3.532         4.631         3.822         4.550         5.966         2.454         3.031         4.143         3.241         3.972           10         2.889         3.379         4.433         3.882         4.265         5.594         2.355         2.911         3.981         3.048         3.738           12         2.887         3.259         4.265         5.594         2.355         2.911         3.981         3.048         3.738           13         2.887         3.180         4.044         3.130         3.727         4.893         2.155         2.611         3.698         3.734         2.949         3.736         2.949         3.736         2.949         2.356         2.941         3.988         3.741         4.893         2.156         3.670         2.793         3.747         4.893         2.156         3.670         2.793         3.747         4.893         2.156         3.746         3.793         3.747         4.893         2.156         3.744         3.702         4.492         2.049         2.703         3.747         4.493         2.002         2.448         3.744         3.745         4.393         2.002         2.449         3.747 <th< th=""><th>\$</th><th>ω.</th><th>3.732</th><th>4.891</th><th>4.147</th><th>4.936</th><th>6.468</th><th>2.582</th><th>3.187</th><th>4.354</th><th>3.497</th><th>4.285</th><th>5.812</th></th<>	\$	ω.	3.732	4.891	4.147	4.936	6.468	2.582	3.187	4.354	3.497	4.285	5.812
10         2.839         3.379         4.433         3.582         4.265         5.594         2.355         2.911         3.981         3.048         3.738           11         2.737         3.259         4.277         3.597         4.045         5.398         2.275         2.815         3.882         2.883         3.586           12         2.587         3.081         4.041         3.350         3.803         4.045         3.939         2.175         2.715         3.882         2.883         3.526         3.727         3.893         3.290         3.884         4.737         2.109         2.015         3.883         3.294         3.727         4.893         2.165         3.580         2.947         3.737         4.109         2.015         3.580         2.893         3.784         2.945         3.507         4.605         2.068         3.566         3.500         2.893         3.444         2.405         3.703         3.100         3.723         3.440         2.944         3.930         3.294         3.444         3.930         3.284         3.494         3.294         3.444         3.406         3.106         3.723         3.444         2.405         3.294         3.344         2.405	20	7	3.532	4.631	3.822	4.550	5.966	2.454	3.031	4.143	3.241	3.972	5.389
11         2.737         3.259         4.277         3.397         4.045         5.308         2.275         2.815         3.850         3.556           13         2.655         3.162         4.150         3.250         3.870         5.079         2.210         2.736         3.747         2.777         3.410           14         2.529         3.012         3.954         3.279         3.870         2.010         2.736         3.747         2.777         3.410           15         2.283         3.012         3.954         3.878         2.945         3.870         4.605         2.068         2.566         3.529         2.777         3.410           16         2.437         2.903         3.874         4.492         2.033         2.248         3.464         2.490         3.028           18         2.366         2.878         3.743         4.492         2.033         2.248         3.444         2.493         3.294         4.307         1.994         2.294         3.407         3.028         3.349         4.307         1.949         2.023         2.248         3.444         2.492         3.294         3.284         3.331         2.448         3.444         2.492	16	7	3.379	4.433	3.582	4.265	5.594	2.355	2.911	3.981	3.048	3.738	5.074
1.6         2.655         3.162         4.150         3.250         3.870         5.079         2.210         2.736         3.747         2.777         3.410           1.3         2.587         3.081         4.044         3.130         3.727         4.893         2.155         2.611         3.659         2.677         3.240           1.4         2.589         3.012         3.878         3.494         3.508         4.737         2.018         2.561         3.582         2.523         3.189           1.6         2.430         2.984         3.574         4.492         2.083         2.524         3.464         2.460         2.502           1.7         2.400         2.883         3.754         4.393         2.002         2.486         3.414         2.405         2.963           1.8         2.366         2.773         3.221         4.492         2.032         2.444         2.449         2.446         2.460         2.963           2.4         2.400         2.873         3.247         4.307         1.944         2.443         3.444         2.449         2.449         2.449         2.449         2.449         2.449         2.449         2.449         2.449	11	7	3.259	4.277	3.397	4.045	5.308	2.275	2.815	3.852	2.898	3.556	4.829
13         2.587         3.081         4.044         3.130         3.727         4.893         2.155         2.671         3.659         2.677         3.290           14         2.529         3.012         3.955         3.029         3.688         4.737         2.109         2.615         3.585         2.593         3.189           16         2.480         2.943         3.029         3.688         4.737         2.109         2.615         3.585         2.593         3.189           17         2.400         2.858         3.734         2.808         3.421         4.605         2.048         2.444         2.405         3.284         2.405         3.264         2.405         3.188           2.30         2.386         2.703         3.221         4.307         1.974         2.453         3.370         2.357         2.903           2.30         2.310         2.703         3.221         4.230         1.944         2.450         3.373         2.344         2.450         3.373         2.344         2.450         3.284         2.450         3.287         2.450         3.321         2.242         3.341         2.453         3.331         2.344         2.453         3.341 <th>12</th> <th>7</th> <th>3.162</th> <th>4.150</th> <th>3.250</th> <th>3.870</th> <th>5.079</th> <th>2.210</th> <th>2.736</th> <th>3.747</th> <th>2.777</th> <th>3.410</th> <th>4.633</th>	12	7	3.162	4.150	3.250	3.870	5.079	2.210	2.736	3.747	2.777	3.410	4.633
14         2.529         3.012         3.955         3.029         3.608         4.737         2.109         2.615         3.585         2.593         3.189           15         2.480         2.954         3.878         2.945         3.507         4.605         2.068         2.566         3.520         2.522         3.102           17         2.400         2.888         3.744         2.492         2.033         2.945         3.464         2.460         3.028           18         2.340         2.888         3.744         2.493         2.002         2.486         3.440         2.490         2.294         3.204         3.004         2.295         3.102         3.028         3.201         4.493         3.340         2.295         3.102         3.028         3.201         2.493         2.002         2.443         3.406         2.493         3.204         2.493         3.204         2.493         3.204         2.493         3.204         2.493         3.204         2.493         3.204         2.493         3.204         2.403         3.204         2.403         2.205         2.203         3.108         3.204         3.204         3.204         3.204         3.204         3.204 <th< th=""><th>13</th><th>7</th><th>3.081</th><th>4.044</th><th>3.130</th><th>3.727</th><th>4.893</th><th>2.155</th><th>2.671</th><th>3.659</th><th>2.677</th><th>3.290</th><th>4.472</th></th<>	13	7	3.081	4.044	3.130	3.727	4.893	2.155	2.671	3.659	2.677	3.290	4.472
15         2.480         2.954         3.878         2.945         3.507         4.605         2.068         2.566         3.520         2.522         3.102           16         2.437         2.903         3.812         2.872         3.421         4.492         2.033         2.524         3.464         2.406         3.028           17         2.400         2.858         3.734         4.393         2.002         2.486         3.414         2.405         3.028           18         2.366         2.819         3.702         2.753         3.279         4.307         1.974         2.433         3.714         2.405         3.028           29         2.366         2.819         3.702         2.753         3.279         4.101         1.926         2.396         3.279         2.902         3.379         2.379         2.302         2.379         2.302         2.379         2.379         2.379         2.379         3.292         3.279         3.292         3.279         3.292         3.292         3.279         2.302         3.284         4.101         1.926         2.936         3.292         3.292         3.279         2.302         3.292         3.292         3.292         3.292<	14	2	3.012	3.955	3.029	3.608	4.737	2.109	2.615	3.585	2.593	3.189	4.337
16         2.437         2.903         3.812         2.872         3.421         4.492         2.033         2.524         3.464         2.460         3.028           17         2.400         2.888         3.754         2.808         3.345         4.393         2.002         2.486         3.414         2.405         2.963           18         2.366         2.819         3.702         2.753         3.279         4.307         1.974         2.453         3.370         2.357         2.905           20         2.310         2.752         3.615         2.703         3.221         4.307         1.974         2.453         3.331         2.314         2.805           25         2.208         2.649         3.763         2.743         4.161         1.926         2.326         2.804           35         2.090         2.490         3.272         2.484         3.611         1.777         2.202         3.164         2.808           40         2.052         2.445         3.213         2.244         2.644         3.611         1.777         2.202         3.244         3.611         1.777         2.202         2.941         2.936           40         2.05	15	7	2.954	3.878	2.945	3.507	4.605	2.068	2.566	3.520	2.522	3.102	4.222
17         2.400         2.858         3.754         2.808         3.345         4.393         2.002         2.486         3.414         2.405         2.963           18         2.366         2.819         3.702         2.753         3.279         4.307         1.974         2.453         3.370         2.965           20         2.336         2.819         3.702         2.753         3.279         4.307         1.974         2.453         3.370         2.395         2.373         2.394         2.853         3.371         2.384         2.894         3.457         2.943         2.379         3.451         1.974         2.453         3.371         2.374         2.894         3.451         2.379         3.451         1.974         2.453         3.371         2.894         3.218         2.994         3.295         3.294         2.992         3.294         2.092         3.294         2.093         2.379         3.444         1.669         2.092         2.941         1.902         2.343           40         2.052         2.445         3.213         2.444         1.669         2.092         2.941         1.902         2.943         1.304           40         2.052         2.247<	16	7	2.903	3.812	2.872	3.421	4.492	2.033	2.524	3.464	2.460	3.028	4.123
2.366         2.819         3.702         2.753         3.279         4.307         1.974         2.453         3.370         2.357         2.905           2.337         2.784         3.656         2.703         3.221         4.230         1.949         2.423         3.331         2.314         2.854           2.310         2.752         3.615         2.659         3.168         4.161         1.926         2.396         3.295         2.276         2.808           2.208         2.631         3.457         2.494         2.972         3.904         1.838         2.292         3.158         2.129         2.896           2.140         2.549         3.350         2.385         2.841         3.733         1.777         2.220         3.158         2.197         2.904         1.838         2.292         3.158         2.199         2.533         2.944         2.972         3.944         1.697         2.197         2.941         1.777         2.220         3.046         1.838         2.197         2.941         1.777         2.220         3.046         2.952         2.197         2.941         1.949         2.922         3.184         2.833         1.841         2.934         1.949		2	2.858	3.754	2.808	3.345	4.393	2.002	2.486	3.414	2.405	2.963	4.037
2.337         2.784         3.656         2.703         3.221         4.230         1.949         2.423         3.331         2.314         2.854           2.310         2.752         3.615         2.659         3.168         4.161         1.926         2.396         3.295         2.276         2.808           2.208         2.631         3.457         2.494         2.972         3.904         1.838         2.292         3.158         2.129         2.808           2.140         2.549         3.350         2.385         2.841         3.733         1.777         2.220         3.064         2.030         2.518           2.090         2.490         3.272         2.306         2.748         3.611         1.732         2.167         2.995         1.957         2.430           2.092         2.445         3.213         2.247         2.677         3.444         1.669         2.092         2.898         1.857         2.30           2.001         2.248         2.671         3.444         1.669         2.092         2.898         1.857         2.21           1.996         2.379         3.126         2.172         3.285         1.646         2.065         2.893<	18	2	2.819	3.702	2.753	3.279	4.307	1.974	2.453	3.370	2.357	2.905	3.960
2.310         2.752         3.615         2.659         3.168         4.161         1.926         2.396         3.295         2.276         2.808           2.208         2.631         3.457         2.494         2.972         3.904         1.838         2.292         3.158         2.129         2.633           2.140         2.549         3.350         2.385         2.841         3.733         1.777         2.220         3.064         2.030         2.516           2.090         2.490         3.272         2.386         2.748         3.611         1.732         2.167         2.995         1.957         2.430           2.092         2.445         3.213         2.247         2.677         3.518         1.697         2.196         2.995         1.957         2.430           2.021         2.448         3.161         1.732         2.167         2.998         1.857         2.312           2.021         2.448         3.161         1.699         2.092         2.893         1.874         2.062         2.893         1.874         2.062         2.893         1.874         2.062         2.893         1.874         2.062         2.893         1.144         2.062	19	7	2.784	3.656	2.703	3.221	4.230	1.949	2.423	3.331	2.314	2.854	3.892
2.2082.6313.4572.4942.9723.9041.8382.2223.1582.1292.6332.1402.5493.3502.3852.8413.7331.7772.2203.0642.0302.5162.0902.4903.2722.3062.7483.6111.7322.1672.9951.9572.3642.0522.4453.2132.2472.6773.5181.6692.0922.8981.8572.3642.0212.4083.1262.1022.5763.2831.6462.0652.8931.8212.2691.9582.3333.0662.1032.5063.2931.6092.0222.8071.7642.2021.9592.2993.0212.0602.4543.2251.5811.9902.7651.7632.1631.9702.2722.9862.0262.4143.1731.5591.9442.7061.6612.0821.8742.2332.9341.9772.3823.1961.5271.9442.7061.6431.9231.7802.1132.8891.8702.5111.9561.9711.8681.7802.1132.8801.4171.8802.5221.4761.8911.7642.1062.7671.6451.6451.6451.6451.6451.645	20	7	2.752	3.615	2.659	3.168	4.161	1.926	2.396	3.295	2.276	2.808	3.832
2.140         2.549         3.350         2.385         2.841         3.733         1.777         2.220         3.064         2.030         2.516           2.090         2.490         3.272         2.366         2.748         3.611         1.732         2.167         2.995         1.957         2.430           2.052         2.445         3.213         2.247         2.677         3.518         1.699         2.995         1.957         2.430           2.021         2.448         3.165         2.200         2.621         3.444         1.669         2.092         2.898         1.857         2.312           1.956         2.379         3.126         2.162         3.293         1.646         2.065         2.803         1.821         2.209           1.958         2.333         3.066         2.103         2.566         3.293         1.609         2.022         2.807         1.764         2.202           1.958         2.232         2.060         2.444         3.173         1.559         1.965         2.733         1.641         2.022           1.960         2.234         2.325         1.581         1.990         2.765         1.764         2.022 <t< th=""><th>25</th><th>7</th><th>2.631</th><th>3.457</th><th>2.494</th><th>2.972</th><th>3.904</th><th>1.838</th><th>2.292</th><th>3.158</th><th>2.129</th><th>2.633</th><th>3.601</th></t<>	25	7	2.631	3.457	2.494	2.972	3.904	1.838	2.292	3.158	2.129	2.633	3.601
2.090         2.490         3.272         2.306         2.748         3.611         1.732         2.167         2.995         1.957         2.430           2.052         2.445         3.213         2.247         2.677         3.518         1.697         2.126         2.941         1.902         2.364           2.021         2.448         3.165         2.200         2.621         3.444         1.669         2.092         2.898         1.857         2.312           1.966         2.379         3.126         2.162         2.576         3.285         1.646         2.065         2.807         1.821         2.269           1.958         2.333         3.066         2.103         2.506         3.293         1.609         2.022         2.807         1.764         2.202           1.959         2.229         3.021         2.060         2.444         3.173         1.559         1.900         2.765         1.772         2.163           1.977         2.224         3.25         1.581         1.990         2.765         1.764         2.022           1.889         2.217         2.342         3.130         1.542         1.944         2.706         1.641         1.94<	30	7	2.549	3.350	2.385	2.841	3.733	1.777	2.220	3.064	2.030	2.516	3.447
2.052         2.445         3.213         2.247         2.677         3.518         1.697         2.126         2.941         1.902         2.364           2.021         2.408         3.165         2.200         2.621         3.444         1.669         2.092         2.898         1.857         2.312           1.966         2.379         3.126         2.162         2.576         3.385         1.646         2.065         2.803         1.821         2.269           1.958         2.333         3.066         2.103         2.506         3.293         1.609         2.022         2.807         1.764         2.205           1.979         2.229         3.021         2.060         2.454         3.225         1.581         1.990         2.765         1.772         2.163           1.977         2.222         2.414         3.173         1.559         1.965         2.733         1.688         2.114           1.889         2.221         2.986         2.026         2.341         3.173         1.542         1.944         2.706         1.661         2.082           1.889         2.137         2.355         3.096         1.527         1.944         2.706         1.64	35	7	2.490	3.272	2.306	2.748	3.611	1.732	2.167	2.995	1.957	2.430	3.334
2.021         2.408         3.165         2.200         2.621         3.444         1.669         2.092         2.898         1.857         2.312           1.996         2.379         3.126         2.162         2.576         3.385         1.646         2.065         2.807         1.821         2.269           1.958         2.333         3.066         2.103         2.506         3.293         1.609         2.022         2.807         1.764         2.202           1.929         2.229         3.021         2.060         2.454         3.225         1.581         1.990         2.765         1.772         2.153           1.889         2.227         2.986         2.026         2.414         3.173         1.559         1.965         2.733         1.688         2.114           1.889         2.251         2.986         2.026         2.414         3.173         1.549         2.056         1.611         2.082           1.889         2.251         2.986         1.977         2.355         3.996         1.527         1.944         2.706         1.639         2.056           1.825         2.143         2.889         1.977         2.382         2.921         1.45	46	7	2.445	3.213	2.247	2.677	3.518	1.697	2.126	2.941	1.902	2.364	3.249
1.996         2.379         3.126         2.162         2.576         3.385         1.646         2.065         2.863         1.821         2.269           1.958         2.333         3.066         2.103         2.506         3.293         1.609         2.022         2.807         1.764         2.202           1.929         2.299         3.021         2.060         2.454         3.225         1.581         1.990         2.765         1.772         2.153           1.907         2.272         2.986         2.026         2.414         3.173         1.559         1.965         2.733         1.688         2.114           1.889         2.271         2.986         2.026         2.414         3.173         1.559         1.944         2.706         1.661         2.082           1.889         2.271         2.382         3.096         1.527         1.944         2.036         1.639         2.056           1.825         2.175         2.859         1.907         2.222         2.921         1.450         1.837         2.542         1.956         1.924           1.767         2.126         1.889         2.141         2.880         1.431         1.815         2.54	45	7	2.408	3.165	2.200	2.621	3.444	1.669	2.092	2.898	1.857	2.312	3.180
1.958         2.333         3.066         2.103         2.506         3.293         1.609         2.022         2.807         1.764         2.202           1.929         2.299         3.021         2.060         2.454         3.225         1.581         1.990         2.765         1.722         2.153           1.907         2.272         2.986         2.026         2.414         3.173         1.559         1.965         2.733         1.688         2.114           1.889         2.251         2.986         2.026         2.414         3.173         1.559         1.945         2.765         1.611         2.082           1.889         2.251         2.986         1.977         2.385         3.096         1.527         1.944         2.706         1.611         2.082           1.825         2.175         2.934         1.977         2.385         1.478         1.870         2.611         1.639         2.056           1.798         2.143         2.816         1.865         2.222         2.921         1.450         1.815         2.542         1.961         1.815         2.842         1.966         1.837         2.542         1.496         1.891           1.76	99	1	2.379	3.126	2.162	2.576	3.385	1.646	2.065	2.863	1.821	2.269	3.125
1.929         2.299         3.021         2.060         2.454         3.225         1.581         1.990         2.765         1.772         2.153           1.907         2.272         2.986         2.026         2.414         3.173         1.559         1.965         2.733         1.688         2.114           1.889         2.251         2.986         2.026         2.414         3.173         1.559         1.965         2.733         1.688         2.114           1.889         2.251         2.382         3.130         1.542         1.944         2.706         1.661         2.082           1.874         2.233         2.934         1.977         2.355         3.096         1.527         1.927         2.684         1.639         2.056           1.825         2.175         2.859         1.905         2.270         2.983         1.478         1.870         2.511         1.566         1.971           1.780         2.113         2.880         1.431         1.815         2.542         1.496         1.891           1.767         2.106         2.767         1.820         2.870         1.416         1.868           1.645         1.960         2.576 <th>99</th> <th></th> <th>2.333</th> <th>3.066</th> <th>2.103</th> <th>2.506</th> <th>3.293</th> <th>1.609</th> <th>2.022</th> <th>2.807</th> <th>1.764</th> <th>2.202</th> <th>3.038</th>	99		2.333	3.066	2.103	2.506	3.293	1.609	2.022	2.807	1.764	2.202	3.038
1.907         2.272         2.986         2.026         2.414         3.173         1.559         1.965         2.733         1.688         2.114           1.889         2.251         2.958         1.999         2.382         3.130         1.542         1.944         2.706         1.661         2.082           1.874         2.233         2.934         1.977         2.355         3.096         1.527         1.927         2.684         1.639         2.056           1.825         2.175         2.859         1.905         2.270         2.983         1.478         1.870         2.611         1.566         1.971           1.798         2.143         2.816         1.865         2.222         2.921         1.450         1.837         2.570         1.524         1.923           1.780         2.113         2.788         1.839         2.191         2.880         1.431         1.815         2.542         1.496         1.891           1.767         2.106         2.767         1.820         2.876         1.417         1.800         2.522         1.476         1.868           1.767         2.106         2.767         1.645         1.645         2.326         1.47	92		2.299	3.021	2.060	2.454	3.225	1.581	1.990	2.765	1.722	2.153	2.974
1.889         2.251         2.958         1.999         2.382         3.130         1.542         1.944         2.706         1.661         2.082           1.874         2.233         2.934         1.977         2.355         3.096         1.527         1.927         2.684         1.639         2.056           1.825         2.175         2.859         1.905         2.270         2.983         1.478         1.870         2.611         1.566         1.971           1.798         2.143         1.865         2.222         2.921         1.450         1.837         2.570         1.524         1.923           1.780         2.121         2.788         1.839         2.191         2.880         1.431         1.815         2.542         1.496         1.891           1.767         2.106         2.767         1.820         2.147         1.800         2.522         1.417         1.800         2.522         1.476         1.891           1.767         2.106         2.767         1.645         2.850         1.417         1.800         2.522         1.476         1.868           1.645         1.960         2.576         1.645         2.326         1.645         2.32	98	1	2.272	2.986	2.026	2.414	3.173	1.559	1.965	2.733	1.688	2.114	2.924
1.874         2.233         2.934         1.977         2.355         3.096         1.527         1.927         2.684         1.639         2.056           1.825         2.175         2.859         1.905         2.270         2.983         1.478         1.870         2.611         1.566         1.971           1.798         2.143         2.816         1.865         2.222         2.921         1.450         1.837         2.570         1.524         1.923           1.780         2.121         2.788         1.839         2.191         2.880         1.431         1.815         2.542         1.496         1.891           1.767         2.106         2.767         1.820         2.147         1.800         2.522         1.476         1.868           1.645         1.960         2.576         1.645         2.326         1.645         2.326         1.645         2.326         1.645	96		2.251	2.958	1.999	2.382	3.130	1.542	1.944	2.706	1.661	2.082	2.883
1.825         2.175         2.859         1.905         2.270         2.983         1.478         1.870         2.611         1.566         1.971           1.798         2.143         2.816         1.865         2.222         2.921         1.450         1.837         2.570         1.524         1.923           1.780         2.121         2.788         1.839         2.191         2.880         1.431         1.815         2.542         1.496         1.891           1.767         2.106         2.767         1.820         2.169         2.850         1.417         1.800         2.522         1.476         1.868           1.645         1.960         2.576         1.645	100		2.233	2.934	1.977	2.355	3.096	1.527	1.927	2.684	1.639	2.056	2.850
1.798         2.143         2.816         1.865         2.222         2.921         1.450         1.837         2.570         1.524         1.923           1.780         2.121         2.788         1.839         2.191         2.880         1.431         1.815         2.542         1.496         1.891           1.767         2.106         2.767         1.820         2.169         2.850         1.417         1.800         2.522         1.476         1.868           1.645         1.960         2.576         1.645         1.645         2.326         1.282         1.645         1.645         1.645	150	1	2.175	2.859	1.905	2.270	2.983	1.478	1.870	2.611	1.566	1.971	2.741
1.780         2.121         2.788         1.839         2.191         2.880         1.431         1.815         2.542         1.496         1.891           1.767         2.106         2.767         1.820         2.169         2.850         1.417         1.800         2.522         1.476         1.868           1.645         1.960         2.576         1.645         1.645         2.326         1.282         1.645         1.645         1.645	200		2.143	2.816	1.865	2.222	2.921	1.450	1.837	2.570	1.524	1.923	2.679
1.767         2.106         2.767         1.820         2.169         2.850         1.417         1.800         2.522         1.476         1.868           1.645         1.960         2.576         1.960         2.576         1.282         1.645         2.326         1.282         1.645	250		2.121	2.788	1.839	2.191	2.880	1.431	1.815	2.542	1.496	1.891	2.638
1.645 1.960 2.576 1.645 1.960 2.576 1.282 1.645 2.326 1.282 1.645	300		2.106	2.767	1.820	2.169	2.850	1.417	1.800	2.522	1.476	1.868	2.608
	8		1.960	2.576	1.645	1.960	2.576	1.282	1.645	2.326	1.282	1.645	2.326

**Table A.7** Critical Values for Chi-Squared Distributions



					α					
ν	.995	.99	.975	.95	.90	.10	.05	.025	.01	.005
1	0.000	0.000	0.001	0.004	0.016	2.706	3.843	5.025	6.637	7.882
2	0.010	0.020	0.051	0.103	0.211	4.605	5.992	7.378	9.210	10.597
3	0.072	0.115	0.216	0.352	0.584	6.251	7.815	9.348	11.344	12.837
4	0.207	0.297	0.484	0.711	1.064	7.779	9.488	11.143	13.277	14.860
5	0.412	0.554	0.831	1.145	1.610	9.236	11.070	12.832	15.085	16.748
6	0.676	0.872	1.237	1.635	2.204	10.645	12.592	14.440	16.812	18.548
7	0.989	1.239	1.690	2.167	2.833	12.017	14.067	16.012	18.474	20.276
8	1.344	1.646	2.180	2.733	3.490	13.362	15.507	17.534	20.090	21.954
9	1.735	2.088	2.700	3.325	4.168	14.684	16.919	19.022	21.665	23.587
10	2.156	2.558	3.247	3.940	4.865	15.987	18.307	20.483	23.209	25.188
11	2.603	3.053	3.816	4.575	5.578	17.275	19.675	21.920	24.724	26.755
12	3.074	3.571	4.404	5.226	6.304	18.549	21.026	23.337	26.217	28.300
13	3.565	4.107	5.009	5.892	7.041	19.812	22.362	24.735	27.687	29.817
14	4.075	4.660	5.629	6.571	7.790	21.064	23.685	26.119	29.141	31.319
15	4.600	5.229	6.262	7.261	8.547	22.307	24.996	27.488	30.577	32.799
16	5.142	5.812	6.908	7.962	9.312	23.542	26.296	28.845	32.000	34.267
17	5.697	6.407	7.564	8.682	10.085	24.769	27.587	30.190	33.408	35.716
18	6.265	7.015	8.231	9.390	10.865	25.989	28.869	31.526	34.805	37.156
19	6.843	7.632	8.906	10.117	11.651	27.203	30.143	32.852	36.190	38.580
20	7.434	8.260	9.591	10.851	12.443	28.412	31.410	34.170	37.566	39.997
21	8.033	8.897	10.283	11.591	13.240	29.615	32.670	35.478	38.930	41.399
22	8.643	9.542	10.982	12.338	14.042	30.813	33.924	36.781	40.289	42.796
23	9.260	10.195	11.688	13.090	14.848	32.007	35.172	38.075	41.637	44.179
24	9.886	10.856	12.401	13.848	15.659	33.196	36.415	39.364	42.980	45.558
25	10.519	11.523	13.120	14.611	16.473	34.381	37.652	40.646	44.313	46.925
26	11.160	12.198	13.844	15.379	17.292	35.563	38.885	41.923	45.642	48.290
27	11.807	12.878	14.573	16.151	18.114	36.741	40.113	43.194	46.962	49.642
28	12.461	13.565	15.308	16.928	18.939	37.916	41.337	44.461	48.278	50.993
29	13.120	14.256	16.147	17.708	19.768	39.087	42.557	45.772	49.586	52.333
30	13.787	14.954	16.791	18.493	20.599	40.256	43.773	46.979	50.892	53.672
31	14.457	15.655	17.538	19.280	21.433	41.422	44.985	48.231	52.190	55.000
32	15.134	16.362	18.291	20.072	22.271	42.585	46.194	49.480	53.486	56.328
33	15.814	17.073	19.046	20.866	23.110	43.745	47.400	50.724	54.774	57.646
34	16.501	17.789	19.806	21.664	23.952	44.903	48.602	51.966	56.061	58.964
35	17.191	18.508	20.569	22.465	24.796	46.059	49.802	53.203	57.340	60.272
36	17.887	19.233	21.336	23.269	25.643	47.212	50.998	54.437	58.619	61.581
37	18.584	19.960	22.105	24.075	26.492	48.363	52.192	55.667	59.891	62.880
38	19.289	20.691	22.878	24.884	27.343	49.513	53.384	56.896	61.162	64.181
39	19.994	21.425	23.654	25.695	28.196	50.660	54.572	58.119	62.426	65.473
40	20.706	22.164	24.433	26.509	29.050	51.805	55.758	59.342	63.691	66.766

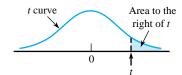
For 
$$\nu > 40$$
,  $\chi^2_{\alpha,\nu} \approx \nu \left(1 - \frac{2}{9\nu} + z_{\alpha} \sqrt{\frac{2}{9\nu}}\right)^3$ 

Table A.8t Curve Tail Areas

t curve		Area to the
*/		right of t
	0	<b>↑</b>

t v	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
0.0	.500	.500	.500	.500	.500	.500	.500	.500	.500	.500	.500	.500	.500	.500	.500	.500	.500	.500
0.1	.468	.465	.463	.463	.462.	.462	.462	.461	.461	.461	.461	.461	.461	.461	.461	.461	.461	.461
0.2 0.3	.437 .407	.430 .396	.427 .392	.426 .390	.425 .388	.424 .387	.424 .386	.423 .386	.423 .386	.423 .385	.423 .385	.422 .385	.422 .384	.422 .384	.422 .384	.422 .384	.422 .384	.422 .384
0.3	.379	.364	.358	.355	.353	.352	.351	.350	.349	.349	.348	.348	.348	.347	.347	.347	.347	.347
0.5	.352	.333	.326	.322	.319	.317	.316	.315	.315	.314	.313	.313	.313	.312	.312	.312	.312	.312
0.6	.328	.305	.295	.290	.287	.285	.284	.283	.282	.281	.280	.280	.279	.279	.279	.278	.278	.278
0.7	.306	.278	.267	.261	.258	.255	.253	.252	.251	.250	.249	.249	.248	.247	.247	.247	.247	.246
0.8	.285	.254	.241	.234	.230	.227	.225	.223	.222	.221	.220	.220	.219	.218	.218	.218	.217	.217
0.9 1.0	.267 .250	.232	.217 .196	.210 .187	.205 .182	.201 .178	.199 .175	.197 .173	.196 .172	.195 .170	.194 .169	.193 .169	.192 .168	.191 .167	.191 .167	.191 .166	.190 .166	.190 .165
1.1	.235	.193	.176	.167	.162	.157	.154	.173	.172	.149	.147	.146	.146	.144	.144	.144	.143	.143
1.2	.221	.177	.178	.148	.142	.138	.135	.132	.130	.129	.128	.127	.126	.124	.124	.124	.123	.123
1.3	.209	.162	.142	.132	.125	.121	.117	.115	.113	.111	.110	.109	.108	.107	.107	.106	.105	.105
1.4	.197	.148	.128	.117	.110	.106	.102	.100	.098	.096	.095	.093	.092	.091	.091	.090	.090	.089
1.5	.187	.136	.115	.104	.097	.092	.089	.086	.084	.082	.081	.080	.079	.077	.077	.077	.076	.075
1.6	.178	.125	.104	.092	.085	.080	.077	.074	.072	.070	.069	.068	.067	.065	.065	.065	.064	.064
1.7 1.8	.169 .161	.116 .107	.094 .085	.082	.075 .066	.070 .061	.065 .057	.064 .055	.062 .053	.060 .051	.059	.057 .049	.056 .048	.055 .046	.055 .046	.054 .045	.054 .045	.053 .044
1.9	.154	.099	.033	.065	.058	.053	.050	.033	.033	.043	.042	.049	.040	.038	.038	.043	.043	.037
2.0	.148	.092	.070	.058	.051	.046	.043	.040	.038	.037	.035	.034	.033	.032	.032	.031	.031	.030
2.1	.141	.085	.063	.052	.045	.040	.037	.034	.033	.031	.030	.029	.028	.027	.027	.026	.025	.025
2.2	.136	.079	.058	.046	.040	.035	.032	.029	.028	.026	.025	.024	.023	.022	.022	.021	.021	.021
2.3	.131	.074	.052	.041	.035	.031	.027	.025	.023	.022	.021	.020	.019	.018	.018	.018	.017	.017
2.4 2.5	.126 .121	.069 .065	.048 .044	.037	.031	.027	.024	.022	.020 .017	.019 .016	.018	.017 .014	.016 .013	.015 .012	.015 .012	.014 .012	.014 .011	.014 .011
2.6	.117	.061	.040	.030	.024	.020	.018	.016	.014	.013	.013	.012	.013	.012	.012	.012	.009	.009
2.7	.117	.057	.040	.027	.024	.020	.015	.014	.014	.013	.012	.012	.009	.008	.008	.008	.009	.007
2.8	.109	.054	.034	.024	.019	.016	.013	.012	.010	.009	.009	.008	.008	.007	.007	.006	.006	.006
2.9	.106	.051	.031	.022	.017	.014	.011	.010	.009	.008	.007	.007	.006	.005	.005	.005	.005	.005
3.0	.102	.048	.029	.020	.015	.012	.010	.009	.007	.007	.006	.006	.005	.004	.004	.004	.004	.004
3.1	.099	.045	.027	.018	.013	.011	.009	.007	.006	.006	.005	.005	.004	.004	.004	.003	.003	.003
3.2 3.3	.096 .094	.043	.025	.016 .015	.012 .011	.009	.008	.006	.005	.005	.004	.004	.003	.003	.003	.003	.003	.002
3.4	.094	.038	.023	.013	.010	.003	.007	.005	.003	.004	.004	.003	.003	.002	.002	.002	.002	.002
3.5	.089	.036	.020	.012	.009	.006	.005	.004	.003	.003	.002	.002	.002	.002	.002	.001	.001	.001
3.6	.086	.035	.018	.011	.008	.006	.004	.004	.003	.002	.002	.002	.002	.001	.001	.001	.001	.001
3.7	.084	.033	.017	.010	.007	.005	.004	.003	.002	.002	.002	.002	.001	.001	.001	.001	.001	.001
3.8	.082	.031	.016	.010	.006	.004	.003	.003	.002	.002	.001	.001	.001	.001	.001	.001	.001	.001
3.9 4.0	.080 .078	.030	.015 .014	.009	.006 .005	.004	.003	.002	.002	.001	.001	.001	.001	.001	.001	.001	.001	.001
T.U	.076	.04)	.014	.000	.005	.004	.005	.002	.002	.001	.001	.001	.001	.001	.001	.001	.000	.000

**Table A.8** t Curve Tail Areas (cont.)



t v	19	20	21	22	23	24	25	26	27	28	29	30	35	40	60	120	$\infty (= z)$
0.0	.500	.500	.500	.500	.500	.500	.500	.500	.500	.500	.500	.500	.500	.500	.500	.500	.500
0.1	.461	.461	.461	.461	.461	.461	.461	.461	.461	.461	.461	.461	.460	.460	.460	.460	.460
0.2	.422	.422	.422	.422	.422	.422	.422	.422	.421	.421	.421	.421	.421	.421	.421	.421	.421
0.3	.384	.384	.384	.383	.383	.383	.383	.383	.383	.383	.383	.383	.383	.383	.383	.382	.382
0.4	.347	.347	.347	.347	.346	.346	.346	.346	.346	.346	.346	.346	.346	.346	.345	.345	.345
0.5	.311	.311	.311	.311	.311	.311	.311	.311	.311	.310	.310	.310	.310	.310	.309	.309	.309
0.6	.278	.278	.278	.277	.277	.277	.277	.277	.277	.277	.277	.277	.276	.276	.275	.275	.274
0.7	.246	.246	.246	.246	.245	.245	.245	.245	.245	.245	.245	.245	.244	.244	.243	.243	.242
0.8	.217	.217	.216	.216	.216	.216	.216	.215	.215	.215	.215	.215	.215	.214	.213	.213	.212
0.9	.190	.189	.189	.189	.189	.189	.188	.188	.188	.188	.188	.188	.187	.187	.186	.185	.184
1.0	.165	.165	.164	.164	.164	.164	.163	.163	.163	.163	.163	.163	.162	.162	.161	.160	.159
1.1	.143	.142	.142	.142	.141	.141	.141	.141	.141	.140	.140	.140	.139	.139	.138	.137	.136
1.2	.122	.122	.122	.121	.121	.121	.121	.120	.120	.120	.120	.120	.119	.119	.117	.116	.115
1.3	.105	.104	.104	.104	.103	.103	.103	.103	.102	.102	.102	.102	.101	.101	.099	.098	.097
1.4	.089	.089	.088	.088	.087	.087	.087	.087	.086	.086	.086	.086	.085	.085	.083	.082	.081
1.5	.075	.075	.074	.074	.074	.073	.073	.073	.073	.072	.072	.072	.071	.071	.069	.068	.067
1.6	.063	.063	.062	.062	.062	.061	.061	.061	.061	.060	.060	.060	.059	.059	.057	.056	.055
1.7	.053	.052	.052	.052	.051	.051	.051	.051	.050	.050	.050	.050	.049	.048	.047	.046	.045
1.8	.044	.043	.043	.043	.042	.042	.042	.042	.042	.041	.041	.041	.040	.040	.038	.037	.036
1.9	.036	.036	.036	.035	.035	.035	.035	.034	.034	.034	.034	.034	.033	.032	.031	.030	.029
2.0	.030	.030	.029	.029	.029	.028	.028	.028	.028	.028	.027	.027	.027	.026	.025	.024	.023
2.1	.025	.024	.024	.024	.023	.023	.023	.023	.023	.022	.022	.022	.022	.021	.020	.019	.018
2.2	.020	.020	.020	.019	.019	.019	.019	.018	.018	.018	.018	.018	.017	.017	.016	.015	.014
2.3	.016	.016	.016	.016	.015	.015	.015	.015	.015	.015	.014	.014	.014	.013	.012	.012	.011
2.4	.013	.013	.013	.013	.012	.012	.012	.012	.012	.012	.012	.011	.011	.011	.010	.009	.008
2.5	.011	.011	.010	.010	.010	.010	.010	.010	.009	.009	.009	.009	.009	.008	.008	.007	.006
2.6	.009	.009	.008	.008	.008	.008	.008	.008	.007	.007	.007	.007	.007	.007	.006	.005	.005
2.7	.007	.007	.007	.007	.006	.006	.006	.006	.006	.006	.006	.006	.005	.005	.004	.004	.003
2.8	.006	.006	.005	.005	.005	.005	.005	.005	.005	.005	.005	.004	.004	.004	.003	.003	.003
2.9	.005	.004	.004	.004	.004	.004	.004	.004	.004	.004	.004	.003	.003	.003	.003	.002	.002
3.0	.004	.004	.003	.003	.003	.003	.003	.003	.003	.003	.003	.003	.002	.002	.002	.002	.001
3.1	.003	.003	.003	.003	.003	.002	.002	.002	.002	.002	.002	.002	.002	.002	.001	.001	.001
3.2	.002	.002	.002	.002	.002	.002	.002	.002	.002	.002	.002	.002	.001	.001	.001	.001	.001
3.3	.002	.002	.002	.002	.002	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	.000
3.4	.002	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	.000	.000
3.5	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	.000	.000	.000
3.6	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	.001	.000	.000	.000	.000	.000
3.7	.001	.001	.001	.001	.001	.001	.001	.001	.000	.000	.000	.000	.000	.000	.000	.000	.000
3.8	.001	.001	.001	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
3.9	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
4.0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

 Table A.9
 Critical Values for F Distributions

				ν	$y_1 = \text{numera}$	tor df				
	α	1	2	3	4	5	6	7	8	9
	.100 .050	39.86 161.45	49.50 199.50	53.59 215.71	55.83 224.58	57.24 230.16	58.20 233.99	58.91 236.77	59.44 238.88	59.86 240.54
1	.010	4052.2	4999.5	5403.4	5624.6	5763.6	5859.0	5928.4	5981.1	6022.5
	.001	405284	500000	540379	562500	576405	585937	592873	598144	602284
	.100	8.53	9.00	9.16	9.24	9.29	9.33	9.35	9.37	9.38
•	050	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38
2	.010	98.50	99.00	99.17	99.25	99.30	99.33	99.36	99.37	99.39
	.001	998.50	999.00	999.17	999.25	999.30	999.33	999.36	999.37	999.39
	.100	5.54	5.46	5.39	5.34	5.31	5.28	5.27	5.25	5.24
3	.050	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81
	.010	34.12	30.82	29.46	28.71	28.24	27.91	27.67	27.49	27.35
	.001	167.03	148.50	141.11	137.10	134.58	132.85	131.58	130.62	129.86
	.100 .050	4.54 7.71	4.32 6.94	4.19 6.59	4.11 6.39	4.05 6.26	4.01 6.16	3.98 6.09	3.95 6.04	3.94 6.00
4	.010	21.20	18.00	16.69	15.98	15.52	15.21	14.98	14.80	14.66
	.001	74.14	61.25	56.18	53.44	51.71	50.53	49.66	49.00	48.47
	.100	4.06	3.78	3.62	3.52	3.45	3.40	3.37	3.34	3.32
_	050	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77
5	.010	16.26	13.27	12.06	11.39	10.97	10.67	10.46	10.29	10.16
	.001	47.18	37.12	33.20	31.09	29.75	28.83	28.16	27.65	27.24
df	.100	3.78	3.46	3.29	3.18	3.11	3.05	3.01	2.98	2.96
<u>현</u> 6	.050	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10
ina	.010	13.75	10.92	9.78	9.15	8.75	8.47	8.26	8.10	7.98
<ul><li>denominator df</li><li>denominator df</li></ul>	.001	35.51	27.00	23.70	21.92	20.80	20.03	19.46	19.03	18.69
den	.100	3.59	3.26	3.07	2.96	2.88	2.83	2.78	2.75	2.72
II 7	.050	5.59 12.25	4.74 9.55	4.35 8.45	4.12 7.85	3.97 7.46	3.87 7.19	3.79 6.99	3.73 6.84	3.68 6.72
<b>2</b> ,	.010 .001	29.25	21.69	8.43 18.77	17.20	16.21	15.52	15.02	14.63	14.33
	.100	3.46	3.11	2.92	2.81	2.73	2.67	2.62	2.59	2.56
	050	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39
8	.010	11.26	8.65	7.59	7.01	6.63	6.37	6.18	6.03	5.91
	.001	25.41	18.49	15.83	14.39	13.48	12.86	12.40	12.05	11.77
	.100	3.36	3.01	2.81	2.69	2.61	2.55	2.51	2.47	2.44
9	.050	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18
,	.010	10.56	8.02	6.99	6.42	6.06	5.80	5.61	5.47	5.35
	.001	22.86	16.39	13.90	12.56	11.71	11.13	10.70	10.37	10.11
	.100	3.29	2.92	2.73	2.61	2.52	2.46	2.41	2.38	2.35
10	.050	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02
	.010 .001	10.04 21.04	7.56 14.91	6.55 12.55	5.99 11.28	5.64 10.48	5.39 9.93	5.20 9.52	5.06 9.20	4.94 8.96
	.100 .050	3.23 4.84	2.86 3.98	2.66 3.59	2.54 3.36	2.45 3.20	2.39 3.09	2.34 3.01	2.30 2.95	2.27 2.90
11	.010	9.65	7.21	6.22	5.67	5.32	5.07	4.89	4.74	4.63
	.001	19.69	13.81	11.56	10.35	9.58	9.05	8.66	8.35	8.12
	.100	3.18	2.81	2.61	2.48	2.39	2.33	2.28	2.24	2.21
12	050	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80
12	.010	9.33	6.93	5.95	5.41	5.06	4.82	4.64	4.50	4.39
	.001	18.64	12.97	10.80	9.63	8.89	8.38	8.00	7.71	7.48

**Table A.9** Critical Values for *F* Distributions (cont.)

				$ u_1$ :	= numerato	r df				
10	12	15	20	25	30	40	50	60	120	1000
60.19	60.71	61.22	61.74	62.05	62.26	62.53	62.69	62.79	63.06	63.30
241.88	243.91	245.95	248.01	249.26	250.10	251.14	251.77	252.20	253.25	254.19
6055.8	6106.3	6157.3	6208.7	6239.8	6260.6	6286.8	6302.5	6313.0	6339.4	6362.7
605621	610668	615764	620908	624017	626099	628712	630285	631337	633972	636301
9.39	9.41	9.42	9.44	9.45	9.46	9.47	9.47	9.47	9.48	9.49
19.40	19.41	19.43	19.45	19.46	19.46	19.47	19.48	19.48	19.49	19.49
99.40	99.42	99.43	99.45	99.46	99.47	99.47	99.48	99.48	99.49	99.50
999.40	999.42	999.43	999.45	999.46	999.47	999.47	999.48	999.48	999.49	999.50
5.23	5.22	5.20	5.18	5.17	5.17	5.16	5.15	5.15	5.14	5.13
8.79	8.74	8.70	8.66	8.63	8.62	8.59	8.58	8.57	8.55	8.53
27.23	27.05	26.87	26.69	26.58	26.50	26.41	26.35	26.32	26.22	26.14
129.25	128.32	127.37	126.42	125.84	125.45	124.96	124.66	124.47	123.97	123.53
3.92	3.90	3.87	3.84	3.83	3.82	3.80	3.80	3.79	3.78	3.76
5.96	5.91	5.86	5.80	5.77	5.75	5.72	5.70	5.69	5.66	5.63
14.55	14.37	14.20	14.02	13.91	13.84	13.75	13.69	13.65	13.56	13.47
48.05	47.41	46.76	46.10	45.70	45.43	45.09	44.88	44.75	44.40	44.09
3.30	3.27	3.24	3.21	3.19	3.17	3.16	3.15	3.14	3.12	3.11
4.74	4.68	4.62	4.56	4.52	4.50	4.46	4.44	4.43	4.40	4.37
10.05	9.89	9.72	9.55	9.45	9.38	9.29	9.24	9.20	9.11	9.03
26.92	26.42	25.91	25.39	25.08	24.87	24.60	24.44	24.33	24.06	23.82
2.94	2.90	2.87	2.84	2.81	2.80	2.78	2.77	2.76	2.74	2.72
4.06	4.00	3.94	3.87	3.83	3.81	3.77	3.75	3.74	3.70	3.67
7.87	7.72	7.56	7.40	7.30	7.23	7.14	7.09	7.06	6.97	6.89
18.41	17.99	17.56	17.12	16.85	16.67	16.44	16.31	16.21	15.98	15.77
2.70	2.67	2.63	2.59	2.57	2.56	2.54	2.52	2.51	2.49	2.47
3.64	3.57	3.51	3.44	3.40	3.38	3.34	3.32	3.30	3.27	3.23
6.62	6.47	6.31	6.16	6.06	5.99	5.91	5.86	5.82	5.74	5.66
14.08	13.71	13.32	12.93	12.69	12.53	12.33	12.20	12.12	11.91	11.72
2.54	2.50	2.46	2.42	2.40	2.38	2.36	2.35	2.34	2.32	2.30
3.35	3.28	3.22	3.15	3.11	3.08	3.04	3.02	3.01	2.97	2.93
5.81	5.67	5.52	5.36	5.26	5.20	5.12	5.07	5.03	4.95	4.87
11.54	11.19	10.84	10.48	10.26	10.11	9.92	9.80	9.73	9.53	9.36
2.42	2.38	2.34	2.30	2.27	2.25	2.23	2.22	2.21	2.18	2.16
3.14	3.07	3.01	2.94	2.89	2.86	2.83	2.80	2.79	2.75	2.71
5.26	5.11	4.96	4.81	4.71	4.65	4.57	4.52	4.48	4.40	4.32
9.89	9.57	9.24	8.90	8.69	8.55	8.37	8.26	8.19	8.00	7.84
2.32	2.28	2.24	2.20	2.17	2.16	2.13	2.12	2.11	2.08	2.06
2.98	2.91	2.85	2.77	2.73	2.70	2.66	2.64	2.62	2.58	2.54
4.85	4.71	4.56	4.41	4.31	4.25	4.17	4.12	4.08	4.00	3.92
8.75	8.45	8.13	7.80	7.60	7.47	7.30	7.19	7.12	6.94	6.78
2.25	2.21	2.17	2.12	2.10	2.08	2.05	2.04	2.03	2.00	1.98
2.85	2.79	2.72	2.65	2.60	2.57	2.53	2.51	2.49	2.45	2.41
4.54	4.40	4.25	4.10	4.01	3.94	3.86	3.81	3.78	3.69	3.61
7.92	7.63	7.32	7.01	6.81	6.68	6.52	6.42	6.35	6.18	6.02
2.19	2.15	2.10	2.06	2.03	2.01	1.99	1.97	1.96	1.93	1.91
2.75	2.69	2.62	2.54	2.50	2.47	2.43	2.40	2.38	2.34	2.30
4.30	4.16	4.01	3.86	3.76	3.70	3.62	3.57	3.54	3.45	3.37
7.29	7.00	6.71	6.40	6.22	6.09	5.93	5.83	5.76	5.59	5.44

**Table A.9** Critical Values for *F* Distributions *(cont.)* 

					$\nu_1 = \text{nu}$	merator df					
		α	1	2	3	4	5	6	7	8	9
	13	.100 .050 .010	3.14 4.67 9.07	2.76 3.81 6.70	2.56 3.41 5.74	2.43 3.18 5.21	2.35 3.03 4.86	2.28 2.92 4.62	2.23 2.83 4.44	2.20 2.77 4.30	2.16 2.71 4.19
	14	.001 .100 .050	17.82 3.10 4.60	12.31 2.73 3.74	10.21 2.52 3.34	9.07 2.39 3.11	8.35 2.31 2.96	7.86 2.24 2.85	7.49 2.19 2.76	7.21 2.15 2.70	6.98 2.12 2.65
	14	.010 .001 .100	8.86 17.14 3.07	6.51 11.78 2.70	5.56 9.73 2.49	5.04 8.62 2.36	4.69 7.92 2.27	4.46 7.44 2.21	4.28 7.08 2.16	4.14 6.80 2.12	4.03 6.58 2.09
	15	.050 .010 .001	4.54 8.68 16.59	3.68 6.36 11.34	3.29 5.42 9.34	3.06 4.89 8.25	2.90 4.56 7.57	2.79 4.32 7.09	2.71 4.14 6.74	2.64 4.00 6.47	2.59 3.89 6.26
	16	.100 .050 .010 .001	3.05 4.49 8.53 16.12	2.67 3.63 6.23 10.97	2.46 3.24 5.29 9.01	2.33 3.01 4.77 7.94	2.24 2.85 4.44 7.27	2.18 2.74 4.20 6.80	2.13 2.66 4.03 6.46	2.09 2.59 3.89 6.19	2.06 2.54 3.78 5.98
	17	.100 .050 .010 .001	3.03 4.45 8.40 15.72	2.64 3.59 6.11 10.66	2.44 3.20 5.19 8.73	2.31 2.96 4.67 7.68	2.22 2.81 4.34 7.02	2.15 2.70 4.10 6.56	2.10 2.61 3.93 6.22	2.06 2.55 3.79 5.96	2.03 2.49 3.68 5.75
ninator df	18	.100 .050 .010 .001	3.01 4.41 8.29 15.38	2.62 3.55 6.01 10.39	2.42 3.16 5.09 8.49	2.29 2.93 4.58 7.46	2.20 2.77 4.25 6.81	2.13 2.66 4.01 6.35	2.08 2.58 3.84 6.02	2.04 2.51 3.71 5.76	2.00 2.46 3.60 5.56
$\nu_2 = \text{denominator df}$	19	.100 .050 .010 .001	2.99 4.38 8.18 15.08	2.61 3.52 5.93 10.16	2.40 3.13 5.01 8.28	2.27 2.90 4.50 7.27	2.18 2.74 4.17 6.62	2.11 2.63 3.94 6.18	2.06 2.54 3.77 5.85	2.02 2.48 3.63 5.59	1.98 2.42 3.52 5.39
	20	.100 .050 .010 .001	2.97 4.35 8.10 14.82	2.59 3.49 5.85 9.95	2.38 3.10 4.94 8.10	2.25 2.87 4.43 7.10	2.16 2.71 4.10 6.46	2.09 2.60 3.87 6.02	2.04 2.51 3.70 5.69	2.00 2.45 3.56 5.44	1.96 2.39 3.46 5.24
	21	.100 .050 .010 .001	2.96 4.32 8.02 14.59	2.57 3.47 5.78 9.77	2.36 3.07 4.87 7.94	2.23 2.84 4.37 6.95	2.14 2.68 4.04 6.32	2.08 2.57 3.81 5.88	2.02 2.49 3.64 5.56	1.98 2.42 3.51 5.31	1.95 2.37 3.40 5.11
	22	.100 .050 .010 .001	2.95 4.30 7.95 14.38	2.56 3.44 5.72 9.61	2.35 3.05 4.82 7.80	2.22 2.82 4.31 6.81	2.13 2.66 3.99 6.19	2.06 2.55 3.76 5.76	2.01 2.46 3.59 5.44	1.97 2.40 3.45 5.19	1.93 2.34 3.35 4.99
	23	.100 .050 .010 .001	2.94 4.28 7.88 14.20	2.55 3.42 5.66 9.47	2.34 3.03 4.76 7.67	2.21 2.80 4.26 6.70	2.11 2.64 3.94 6.08	2.05 2.53 3.71 5.65	1.99 2.44 3.54 5.33	1.95 2.37 3.41 5.09	1.92 2.32 3.30 4.89
	24	.100 .050 .010	2.93 4.26 7.82 14.03	2.54 3.40 5.61 9.34	2.33 3.01 4.72 7.55	2.19 2.78 4.22 6.59	2.10 2.62 3.90 5.98	2.04 2.51 3.67 5.55	1.98 2.42 3.50 5.23	1.94 2.36 3.36 4.99	1.91 2.30 3.26 4.80

**Table A.9** Critical Values for *F* Distributions (cont.)

				$ u_1$	= numerato	or df				
10	12	15	20	25	30	40	50	60	120	1000
2.14	2.10	2.05	2.01	1.98	1.96	1.93	1.92	1.90	1.88	1.85
2.67	2.60	2.53	2.46	2.41	2.38	2.34	2.31	2.30	2.25	2.21
4.10	3.96	3.82	3.66	3.57	3.51	3.43	3.38	3.34	3.25	3.18
6.80	6.52	6.23	5.93	5.75	5.63	5.47	5.37	5.30	5.14	4.99
2.10	2.05	2.01	1.96	1.93	1.91	1.89	1.87	1.86	1.83	1.80
2.60	2.53	2.46	2.39	2.34	2.31	2.27	2.24	2.22	2.18	2.14
3.94	3.80	3.66	3.51	3.41	3.35	3.27	3.22	3.18	3.09	3.02
6.40	6.13	5.85	5.56	5.38	5.25	5.10	5.00	4.94	4.77	4.62
2.06	2.02	1.97	1.92	1.89	1.87	1.85	1.83	1.82	1.79	1.76
2.54	2.48	2.40	2.33	2.28	2.25	2.20	2.18	2.16	2.11	2.07
3.80	3.67	3.52	3.37	3.28	3.21	3.13	3.08	3.05	2.96	2.88
6.08	5.81	5.54	5.25	5.07	4.95	4.80	4.70	4.64	4.47	4.33
2.03	1.99	1.94	1.89	1.86	1.84	1.81	1.79	1.78	1.75	1.72
2.49	2.42	2.35	2.28	2.23	2.19	2.15	2.12	2.11	2.06	2.02
3.69	3.55	3.41	3.26	3.16	3.10	3.02	2.97	2.93	2.84	2.76
5.81	5.55	5.27	4.99	4.82	4.70	4.54	4.45	4.39	4.23	4.08
2.00	1.96	1.91	1.86	1.83	1.81	1.78	1.76	1.75	1.72	1.69
2.45	2.38	2.31	2.23	2.18	2.15	2.10	2.08	2.06	2.01	1.97
3.59	3.46	3.31	3.16	3.07	3.00	2.92	2.87	2.83	2.75	2.66
5.58	5.32	5.05	4.78	4.60	4.48	4.33	4.24	4.18	4.02	3.87
1.98	1.93	1.89	1.84	1.80	1.78	1.75	1.74	1.72	1.69	1.66
2.41	2.34	2.27	2.19	2.14	2.11	2.06	2.04	2.02	1.97	1.92
3.51	3.37	3.23	3.08	2.98	2.92	2.84	2.78	2.75	2.66	2.58
5.39	5.13	4.87	4.59	4.42	4.30	4.15	4.06	4.00	3.84	3.69
1.96	1.91	1.86	1.81	1.78	1.76	1.73	1.71	1.70	1.67	1.64
2.38	2.31	2.23	2.16	2.11	2.07	2.03	2.00	1.70	1.93	1.88
3.43	3.30	3.15	3.00	2.91	2.84	2.76	2.71	2.67	2.58	2.50
5.22	4.97	4.70	4.43	4.26	4.14	3.99	3.90	3.84	3.68	3.53
1.94	1.89	1.84	1.79	1.76	1.74	1.71	1.69	1.68	1.64	1.61
2.35	2.28	2.20	2.12	2.07	2.04	1.71	1.09	1.08	1.04	1.85
3.37	3.23	3.09	2.12	2.84	2.78	2.69	2.64	2.61	2.52	2.43
5.08	4.82	4.56	4.29	4.12	4.00	3.86	3.77	3.70	3.54	3.40
1.92	1.87	1.83	1.78	1.74	1.72	1.69	1.67	1.66	1.62	1.59
2.32	2.25	2.18	2.10	2.05	2.01	1.09	1.07	1.92	1.87	1.82
3.31	3.17	3.03	2.88	2.03	2.72	2.64	2.58	2.55	2.46	2.37
4.95	4.70	3.03 4.44	4.17	4.00	3.88	3.74	3.64	3.58	3.42	3.28
1.90	1.86	1.81	1.76	1.73	1.70	1.67	1.65	1.64	1.60	1.57
2.30	2.23	2.15 2.98	2.07 2.83	2.02 2.73	1.98	1.94	1.91 2.53	1.89	1.84	1.79
3.26 4.83	3.12	4.33		3.89	2.67 3.78	2.58	2.53 3.54	2.50	2.40	2.32 3.17
	4.58		4.06			3.63		3.48	3.32	
1.89	1.84	1.80	1.74	1.71	1.69	1.66	1.64	1.62	1.59	1.55
2.27	2.20	2.13	2.05	2.00	1.96	1.91	1.88	1.86	1.81	1.76
3.21	3.07	2.93	2.78	2.69	2.62	2.54	2.48	2.45	2.35	2.27
4.73	4.48	4.23	3.96	3.79	3.68	3.53	3.44	3.38	3.22	3.08
1.88	1.83	1.78	1.73	1.70	1.67	1.64	1.62	1.61	1.57	1.54
2.25	2.18	2.11	2.03	1.97	1.94	1.89	1.86	1.84	1.79	1.74
3.17	3.03	2.89	2.74	2.64	2.58	2.49	2.44	2.40	2.31	2.22
4.64	4.39	4.14	3.87	3.71	3.59	3.45	3.36	3.29	3.14	2.99

**Table A.9** Critical Values for *F* Distributions (cont.)

				$\nu_1 = \text{nu}$	merator df					
	α	1	2	3	4	5	6	7	8	9
	.100	2.92	2.53	2.32	2.18	2.09	2.02	1.97	1.93	1.89
25	.050	4.24	3.39	2.99	2.76	2.60	2.49	2.40	2.34	2.28
45	.010	7.77	5.57	4.68	4.18	3.85	3.63	3.46	3.32	3.22
	.001	13.88	9.22	7.45	6.49	5.89	5.46	5.15	4.91	4.71
	.100	2.91	2.52	2.31	2.17	2.08	2.01	1.96	1.92	1.88
26	.050	4.23	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27
20	.010	7.72	5.53	4.64	4.14	3.82	3.59	3.42	3.29	3.18
	.001	13.74	9.12	7.36	6.41	5.80	5.38	5.07	4.83	4.64
	.100	2.90	2.51	2.30	2.17	2.07	2.00	1.95	1.91	1.87
27	.050	4.21	3.35	2.96	2.73	2.57	2.46	2.37	2.31	2.25
21	.010	7.68	5.49	4.60	4.11	3.78	3.56	3.39	3.26	3.15
	.001	13.61	9.02	7.27	6.33	5.73	5.31	5.00	4.76	4.57
	.100	2.89	2.50	2.29	2.16	2.06	2.00	1.94	1.90	1.87
28	.050	4.20	3.34	2.95	2.71	2.56	2.45	2.36	2.29	2.24
20	.010	7.64	5.45	4.57	4.07	3.75	3.53	3.36	3.23	3.12
	.001	13.50	8.93	7.19	6.25	5.66	5.24	4.93	4.69	4.50
	.100	2.89	2.50	2.28	2.15	2.06	1.99	1.93	1.89	1.86
29	.050	4.18	3.33	2.93	2.70	2.55	2.43	2.35	2.28	2.22
29	.010	7.60	5.42	4.54	4.04	3.73	3.50	3.33	3.20	3.09
	.001	13.39	8.85	7.12	6.19	5.59	5.18	4.87	4.64	4.45
	.100	2.88	2.49	2.28	2.14	2.05	1.98	1.93	1.88	1.85
30	.050	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21
30	.010	7.56	5.39	4.51	4.02	3.70	3.47	3.30	3.17	3.07
	.001	13.29	8.77	7.05	6.12	5.53	5.12	4.82	4.58	4.39
	.100	2.84	2.44	2.23	2.09	2.00	1.93	1.87	1.83	1.79
40	.050	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12
40	.010	7.31	5.18	4.31	3.83	3.51	3.29	3.12	2.99	2.89
	.001	12.61	8.25	6.59	5.70	5.13	4.73	4.44	4.21	4.02
	.100	2.81	2.41	2.20	2.06	1.97	1.90	1.84	1.80	$1.7\epsilon$
<b>5</b> 0	.050	4.03	3.18	2.79	2.56	2.40	2.29	2.20	2.13	2.07
50	.010	7.17	5.06	4.20	3.72	3.41	3.19	3.02	2.89	2.78
	.001	12.22	7.96	6.34	5.46	4.90	4.51	4.22	4.00	3.82
	.100	2.79	2.39	2.18	2.04	1.95	1.87	1.82	1.77	1.74
60	.050	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04
60	.010	7.08	4.98	4.13	3.65	3.34	3.12	2.95	2.82	2.72
	.001	11.97	7.77	6.17	5.31	4.76	4.37	4.09	3.86	3.69
	.100	2.76	2.36	2.14	2.00	1.91	1.83	1.78	1.73	1.69
100	.050	3.94	3.09	2.70	2.46	2.31	2.19	2.10	2.03	1.97
100	.010	6.90	4.82	3.98	3.51	3.21	2.99	2.82	2.69	2.59
	.001	11.50	7.41	5.86	5.02	4.48	4.11	3.83	3.61	3.44
	.100	2.73	2.33	2.11	1.97	1.88	1.80	1.75	1.70	1.66
200	.050	3.89	3.04	2.65	2.42	2.26	2.14	2.06	1.98	1.93
200	.010	6.76	4.71	3.88	3.41	3.11	2.89	2.73	2.60	2.50
	.001	11.15	7.15	5.63	4.81	4.29	3.92	3.65	3.43	3.26
	.100	2.71	2.31	2.09	1.95	1.85	1.78	1.72	1.68	1.64
1000	.050	3.85	3.00	2.61	2.38	2.22	2.11	2.02	1.95	1.89
1000	.010	6.66	4.63	3.80	3.34	3.04	2.82	2.66	2.53	2.43
	.001	10.89	6.96	5.46	4.65	4.14	3.78	3.51	3.30	3.13

**Table A.9** Critical Values for *F* Distributions *(cont.)* 

				$ u_1 $	= numerato	r df				
10	12	15	20	25	30	40	50	60	120	1000
1.87	1.82	1.77	1.72	1.68	1.66	1.63	1.61	1.59	1.56	1.52
2.24	2.16	2.09	2.01	1.96	1.92	1.87	1.84	1.82	1.77	1.72
3.13	2.99	2.85	2.70	2.60	2.54	2.45	2.40	2.36	2.27	2.18
4.56	4.31	4.06	3.79	3.63	3.52	3.37	3.28	3.22	3.06	2.91
1.86	1.81	1.76	1.71	1.67	1.65	1.61	1.59	1.58	1.54	1.51
2.22	2.15	2.07	1.99	1.94	1.90	1.85	1.82	1.80	1.75	1.70
3.09	2.96	2.81	2.66	2.57	2.50	2.42	2.36	2.33	2.23	2.14
4.48	4.24	3.99	3.72	3.56	3.44	3.30	3.21	3.15	2.99	2.84
1.85	1.80	1.75	1.70	1.66	1.64	1.60	1.58	1.57	1.53	1.50
2.20	2.13	2.06	1.97	1.92	1.88	1.84	1.81	1.79	1.73	1.68
3.06	2.93	2.78	2.63	2.54	2.47	2.38	2.33	2.29	2.20	2.11
4.41	4.17	3.92	3.66	3.49	3.38	3.23	3.14	3.08	2.92	2.78
1.84	1.79	1.74	1.69	1.65	1.63	1.59	1.57	1.56	1.52	1.48
2.19	2.12	2.04	1.96	1.91	1.87	1.82	1.79	1.77	1.71	1.66
3.03	2.90	2.75	2.60	2.51	2.44	2.35	2.30	2.26	2.17	2.08
4.35	4.11	3.86	3.60	3.43	3.32	3.18	3.09	3.02	2.86	2.72
1.83	1.78	1.73	1.68	1.64	1.62	1.58	1.56	1.55	1.51	1.47
2.18	2.10	2.03	1.94	1.89	1.85	1.81	1.77	1.75	1.70	1.65
3.00	2.87	2.73	2.57	2.48	2.41	2.33	2.27	2.23	2.14	2.05
4.29	4.05	3.80	3.54	3.38	3.27	3.12	3.03	2.97	2.81	2.66
1.82	1.77	1.72	1.67	1.63	1.61	1.57	1.55	1.54	1.50	1.46
2.16	2.09	2.01	1.93	1.88	1.84	1.79	1.76	1.74	1.68	1.63
2.98	2.84	2.70	2.55	2.45	2.39	2.30	2.25	2.21	2.11	2.02
4.24	4.00	3.75	3.49	3.33	3.22	3.07	2.98	2.92	2.76	2.61
1.76	1.71	1.66	1.61	1.57	1.54	1.51	1.48	1.47	1.42	1.38
2.08	2.00	1.92	1.84	1.78	1.74	1.69	1.66	1.64	1.58	1.52
2.80	2.66	2.52	2.37	2.27	2.20	2.11	2.06	2.02	1.92	1.82
3.87	3.64	3.40	3.14	2.98	2.87	2.73	2.64	2.57	2.41	2.25
1.73	1.68	1.63	1.57	1.53	1.50	1.46	1.44	1.42	1.38	1.33
2.03	1.95	1.87	1.78	1.73	1.69	1.63	1.60	1.58	1.51	1.45
2.70	2.56	2.42	2.27	2.17	2.10	2.01	1.95	1.91	1.80	1.70
3.67	3.44	3.20	2.95	2.79	2.68	2.53	2.44	2.38	2.21	2.05
1.71	1.66	1.60	1.54	1.50	1.48	1.44	1.41	1.40	1.35	1.30
1.99	1.92	1.84	1.75	1.69	1.65	1.59	1.56	1.53	1.47	1.40
2.63	2.50	2.35	2.20	2.10	2.03	1.94	1.88	1.84	1.73	1.62
3.54	3.32	3.08	2.83	2.67	2.55	2.41	2.32	2.25	2.08	1.92
1.66	1.61	1.56	1.49	1.45	1.42	1.38	1.35	1.34	1.28	1.22
1.93	1.85	1.77	1.68	1.62	1.57	1.52	1.48	1.45	1.38	1.30
2.50	2.37	2.22	2.07	1.97	1.89	1.80	1.74	1.69	1.57	1.45
3.30	3.07	2.84	2.59	2.43	2.32	2.17	2.08	2.01	1.83	1.64
1.63	1.58	1.52	1.46	1.41	1.38	1.34	1.31	1.29	1.23	1.16
1.88	1.80	1.72	1.62	1.56	1.52	1.46	1.41	1.39	1.30	1.21
2.41	2.27	2.13	1.97	1.87	1.79	1.69	1.63	1.58	1.45	1.30
3.12	2.90	2.67	2.42	2.26	2.15	2.00	1.90	1.83	1.64	1.43
1.61	1.55	1.49	1.43	1.38	1.35	1.30	1.27	1.25	1.18	1.08
1.84	1.76	1.68	1.58	1.52	1.47	1.41	1.36	1.33	1.24	1.11
2.34	2.20	2.06	1.90	1.79	1.72	1.61	1.54	1.50	1.35	1.16
2.99	2.77	2.54	2.30	2.14	2.02	1.87	1.77	1.69	1.49	1.22

**Table A.10** Critical Values for Studentized Range Distributions

						m						
ν	α	2	3	4	5	6	7	8	9	10	11	12
5	.05	3.64	4.60	5.22	5.67	6.03	6.33	6.58	6.80	6.99	7.17	7.32
	.01	5.70	6.98	7.80	8.42	8.91	9.32	9.67	9.97	10.24	10.48	10.70
6	.05	3.46	4.34	4.90	5.30	5.63	5.90	6.12	6.32	6.49	6.65	6.79
	.01	5.24	6.33	7.03	7.56	7.97	8.32	8.61	8.87	9.10	9.30	9.48
7	.05	3.34	4.16	4.68	5.06	5.36	5.61	5.82	6.00	6.16	6.30	6.43
	.01	4.95	5.92	6.54	7.01	7.37	7.68	7.94	8.17	8.37	8.55	8.71
8	.05	3.26	4.04	4.53	4.89	5.17	5.40	5.60	5.77	5.92	6.05	6.18
	.01	4.75	5.64	6.20	6.62	6.96	7.24	7.47	7.68	7.86	8.03	8.18
9	.05	3.20	3.95	4.41	4.76	5.02	5.24	5.43	5.59	5.74	5.87	5.98
	.01	4.60	5.43	5.96	6.35	6.66	6.91	7.13	7.33	7.49	7.65	7.78
10	.05	3.15	3.88	4.33	4.65	4.91	5.12	5.30	5.46	5.60	5.72	5.83
	.01	4.48	5.27	5.77	6.14	6.43	6.67	6.87	7.05	7.21	7.36	7.49
11	.05	3.11	3.82	4.26	4.57	4.82	5.03	5.20	5.35	5.49	5.61	5.71
	.01	4.39	5.15	5.62	5.97	6.25	6.48	6.67	6.84	6.99	7.13	7.25
12	.05	3.08	3.77	4.20	4.51	4.75	4.95	5.12	5.27	5.39	5.51	5.61
	.01	4.32	5.05	5.50	5.84	6.10	6.32	6.51	6.67	6.81	6.94	7.06
13	.05	3.06	3.73	4.15	4.45	4.69	4.88	5.05	5.19	5.32	5.43	5.53
	.01	4.26	4.96	5.40	5.73	5.98	6.19	6.37	6.53	6.67	6.79	6.90
14	.05	3.03	3.70	4.11	4.41	4.64	4.83	4.99	5.13	5.25	5.36	5.46
	.01	4.21	4.89	5.32	5.63	5.88	6.08	6.26	6.41	6.54	6.66	6.77
15	.05	3.01	3.67	4.08	4.37	4.59	4.78	4.94	5.08	5.20	5.31	5.40
	.01	4.17	4.84	5.25	5.56	5.80	5.99	6.16	6.31	6.44	6.55	6.66
16	.05	3.00	3.65	4.05	4.33	4.56	4.74	4.90	5.03	5.15	5.26	5.35
	.01	4.13	4.79	5.19	5.49	5.72	5.92	6.08	6.22	6.35	6.46	6.56
17	.05	2.98	3.63	4.02	4.30	4.52	4.70	4.86	4.99	5.11	5.21	5.31
	.01	4.10	4.74	5.14	5.43	5.66	5.85	6.01	6.15	6.27	6.38	6.48
18	.05	2.97	3.61	4.00	4.28	4.49	4.67	4.82	4.96	5.07	5.17	5.27
	.01	4.07	4.70	5.09	5.38	5.60	5.79	5.94	6.08	6.20	6.31	6.41
19	.05	2.96 4.05	3.59 4.67	3.98 5.05	4.25 5.33	4.47 5.55	4.65 5.73	4.79 5.89	4.92 6.02	5.04 6.14	5.14 6.25	5.23 6.34
20	.05	2.95	3.58	3.96	4.23	4.45	4.62	4.77	4.90	5.01	5.11	5.20
	.01	4.02	4.64	5.02	5.29	5.51	5.69	5.84	5.97	6.09	6.19	6.28
24	.05	2.92 3.96	3.53 4.55	3.90 4.91	4.17 5.17	4.37 5.37	4.54 5.54	4.68 5.69	4.81 5.81	4.92 5.92	5.01 6.02	5.10 6.11
30	.05	2.89 3.89	3.49 4.45	3.85 4.80	4.10 5.05	4.30 5.24	4.46 5.40	4.60 5.54	4.72 5.65	4.82 5.76	4.92 5.85	5.00 5.93
40	.05	2.86 3.82	3.44 4.37	3.79 4.70	4.04 4.93	4.23 5.11	4.39 5.26	4.52 5.39	4.63 5.50	4.73 5.60	4.82 5.69	4.90 5.76
60	.05	2.83 3.76	3.40 4.28	3.74 4.59	3.98 4.82	4.16 4.99	4.31 5.13	4.44 5.25	4.55 5.36	4.65 5.45	4.73 5.53	4.81 5.60
120	.05	2.80 3.70	3.36 4.20	3.68 4.50	3.92 4.71	4.10 4.87	4.24 5.01	4.36 5.12	4.47 5.21	4.56 5.30	4.64 5.37	4.71 5.44
∞	.05	2.77 3.64	3.31 4.12	3.63 4.40	3.86 4.60	4.03 4.76	4.17 4.88	4.29 4.99	4.39 5.08	4.47 5.16	4.55 5.23	4.62 5.29

**Table A.11** Chi-Squared Curve Tail Areas

U <b>pper-tail Area</b>	$\nu = 1$	$\nu = 2$	$\nu = 3$	$\nu = 4$	$\nu = 5$
> .100	< 2.70	< 4.60	< 6.25	< 7.77	< 9.23
.100	2.70	4.60	6.25	7.77	9.23
.095	2.78	4.70	6.36	7.90	9.37
.090	2.87	4.81	6.49	8.04	9.52
.085	2.96	4.93	6.62	8.18	9.67
.080	3.06	5.05	6.75	8.33	9.83
.075	3.17	5.18	6.90	8.49	10.00
.070	3.28	5.31	7.06	8.66	10.19
.065	3.40	5.46	7.22	8.84	10.38
.060	3.53	5.62	7.40	9.04	10.59
.055	3.68	5.80	7.60	9.25	10.82
.050	3.84	5.99	7.81	9.48	11.07
.045	4.01	6.20	8.04	9.74	11.34
.040	4.21	6.43	8.31	10.02	11.64
.035	4.44	6.70	8.60	10.34	11.98
.030	4.70	7.01	8.94	10.71	12.37
.025	5.02	7.37	9.34	11.14	12.83
.020	5.41	7.82	9.83	11.66	13.38
.015	5.91	8.39	10.46	12.33	14.09
.010	6.63	9.21	11.34	13.27	15.08
.005	7.87	10.59	12.83	14.86	16.74
.001	10.82	13.81	16.26	18.46	20.51
< .001	> 10.82	> 13.81	> 16.26	> 18.46	> 20.51
Jpper-tail Area	$\nu = 6$	$\nu = 7$	$\nu = 8$	$\nu = 9$	$\nu = 10$
> .100	< 10.64	< 12.01	< 13.36	< 14.68	< 15.98
.100	10.64	12.01	13.36	14.68	15.98
.095	10.79	12.17	13.52	14.85	16.16
.090	10.79	12.33	13.69	15.03	16.35
.085	11.11	12.50	13.87	15.22	16.54
.080	11.11	12.69	14.06	15.42	16.75
.075	11.46	12.88	14.26	15.63	16.97
.070	11.65	13.08	14.48	15.85	17.20
.065	11.86	13.30	14.71	16.09	17.44
.060	12.08	13.53	14.95	16.34	17.71
.055	12.33	13.79	15.22	16.62	17.99
.050	12.59	14.06	15.50	16.91	18.30
.045	12.87	14.36	15.82	17.24	18.64
.040	13.19	14.70	16.17	17.60	19.02
.035	13.55	15.07	16.56	18.01	19.44
.030	13.96	15.50	17.01	18.47	19.92
.025	14.44	16.01	17.53	19.02	20.48
.020	15.03	16.62	18.16	19.67	21.16
.015	15.77	17.39	18.97	20.51	22.02
.010	16.81	18.47	20.09	21.66	23.20
		20.27	21.05	23.58	25.18
.005	18.54	20.27	21.95		
.005 .001 < .001	18.54 22.45 > 22.45	20.27 24.32 > 24.32	26.12 > 26.12	27.87 > 27.87	29.58 > 29.58

 Table A.11
 Chi-Squared Curve Tail Areas (cont.)

Upper-tail Area	$\nu = 11$	$\nu = 12$	$\nu = 13$	$\nu = 14$	$\nu = 15$
> .100	< 17.27	< 18.54	< 19.81	< 21.06	< 22.30
.100	17.27	18.54	19.81	21.06	22.30
.095	17.45	18.74	20.00	21.26	22.51
.090	17.65	18.93	20.21	21.47	22.73
.085	17.85	19.14	20.42	21.69	22.95
.080	18.06	19.36	20.65	21.93	23.19
.075	18.29	19.60	20.89	22.17	23.45
.070	18.53	19.84	21.15	22.44	23.72
.065	18.78	20.11	21.42	22.71	24.00
.060	19.06	20.39	21.71	23.01	24.31
.055	19.35	20.69	22.02	23.33	24.63
.050	19.67	21.02	22.36	23.68	24.99
.045	20.02	21.38	22.73	24.06	25.38
.040	20.41	21.78	23.14	24.48	25.81
.035	20.84	22.23	23.60	24.95	26.29
.030	21.34	22.74	24.12	25.49	26.84
.025	21.92	23.33	24.73	26.11	27.48
.020	22.61	24.05	25.47	26.87	28.25
.015	23.50	24.96	26.40	27.82	29.23
.010	24.72	26.21	27.68	29.14	30.57
.005	26.75	28.29	29.81	31.31	32.80
.001	31.26	32.90	34.52	36.12	37.69
< .001	> 31.26	> 32.90	> 34.52	> 36.12	> 37.69
Upper-tail Area	$\nu = 16$	$\nu = 17$	$\nu = 18$	$\nu = 19$	$\nu = 20$
> .100	< 23.54	< 24.77	< 25.98	< 27.20	< 28.41
> .100 .100	< 23.54 23.54	< 24.77 24.76	< 25.98 25.98	< 27.20 27.20	< 28.41 28.41
.100	23.54	24.76	25.98	27.20	28.41
.100 .095	23.54 23.75	24.76 24.98	25.98 26.21	27.20 27.43	28.41 28.64
.100 .095 .090	23.54 23.75 23.97	24.76 24.98 25.21	25.98 26.21 26.44	27.20 27.43 27.66	28.41 28.64 28.88
.100 .095 .090 .085	23.54 23.75 23.97 24.21	24.76 24.98 25.21 25.45	25.98 26.21 26.44 26.68	27.20 27.43 27.66 27.91	28.41 28.64 28.88 29.14
.100 .095 .090 .085 .080	23.54 23.75 23.97 24.21 24.45	24.76 24.98 25.21 25.45 25.70	25.98 26.21 26.44 26.68 26.94	27.20 27.43 27.66 27.91 28.18	28.41 28.64 28.88 29.14 29.40
.100 .095 .090 .085 .080	23.54 23.75 23.97 24.21 24.45 24.71	24.76 24.98 25.21 25.45 25.70 25.97	25.98 26.21 26.44 26.68 26.94 27.21	27.20 27.43 27.66 27.91 28.18 28.45	28.41 28.64 28.88 29.14 29.40 29.69
.100 .095 .090 .085 .080 .075	23.54 23.75 23.97 24.21 24.45 24.71 24.99	24.76 24.98 25.21 25.45 25.70 25.97 26.25	25.98 26.21 26.44 26.68 26.94 27.21 27.50	27.20 27.43 27.66 27.91 28.18 28.45 28.75	28.41 28.64 28.88 29.14 29.40 29.69 29.99
.100 .095 .090 .085 .080 .075 .070	23.54 23.75 23.97 24.21 24.45 24.71 24.99 25.28	24.76 24.98 25.21 25.45 25.70 25.97 26.25 26.55	25.98 26.21 26.44 26.68 26.94 27.21 27.50 27.81	27.20 27.43 27.66 27.91 28.18 28.45 28.75 29.06	28.41 28.64 28.88 29.14 29.40 29.69 29.99 30.30
.100 .095 .090 .085 .080 .075 .070	23.54 23.75 23.97 24.21 24.45 24.71 24.99 25.28 25.59	24.76 24.98 25.21 25.45 25.70 25.97 26.25 26.55 26.87	25.98 26.21 26.44 26.68 26.94 27.21 27.50 27.81 28.13	27.20 27.43 27.66 27.91 28.18 28.45 28.75 29.06 29.39	28.41 28.64 28.88 29.14 29.40 29.69 29.99 30.30 30.64
.100 .095 .090 .085 .080 .075 .070 .065	23.54 23.75 23.97 24.21 24.45 24.71 24.99 25.28 25.59 25.93	24.76 24.98 25.21 25.45 25.70 25.97 26.25 26.55 26.87 27.21 27.58	25.98 26.21 26.44 26.68 26.94 27.21 27.50 27.81 28.13 28.48 28.86	27.20 27.43 27.66 27.91 28.18 28.45 28.75 29.06 29.39 29.75 30.14	28.41 28.64 28.88 29.14 29.40 29.69 29.99 30.30 30.64 31.01 31.41
.100 .095 .090 .085 .080 .075 .070 .065 .060	23.54 23.75 23.97 24.21 24.45 24.71 24.99 25.28 25.59 25.93 26.29	24.76 24.98 25.21 25.45 25.70 25.97 26.25 26.55 26.87 27.21	25.98 26.21 26.44 26.68 26.94 27.21 27.50 27.81 28.13 28.48	27.20 27.43 27.66 27.91 28.18 28.45 28.75 29.06 29.39 29.75	28.41 28.64 28.88 29.14 29.40 29.69 29.99 30.30 30.64 31.01
.100 .095 .090 .085 .080 .075 .070 .065 .060 .055	23.54 23.75 23.97 24.21 24.45 24.71 24.99 25.28 25.59 25.93 26.29 26.69	24.76 24.98 25.21 25.45 25.70 25.97 26.25 26.55 26.87 27.21 27.58 27.99	25.98 26.21 26.44 26.68 26.94 27.21 27.50 27.81 28.13 28.48 28.86 29.28	27.20 27.43 27.66 27.91 28.18 28.45 28.75 29.06 29.39 29.75 30.14	28.41 28.64 28.88 29.14 29.40 29.69 29.99 30.30 30.64 31.01 31.41 31.84
.100 .095 .090 .085 .080 .075 .070 .065 .060 .055 .050	23.54 23.75 23.97 24.21 24.45 24.71 24.99 25.28 25.59 25.93 26.29 26.69 27.13	24.76 24.98 25.21 25.45 25.70 25.97 26.25 26.55 26.87 27.21 27.58 27.99 28.44	25.98 26.21 26.44 26.68 26.94 27.21 27.50 27.81 28.13 28.48 28.86 29.28 29.74	27.20 27.43 27.66 27.91 28.18 28.45 28.75 29.06 29.39 29.75 30.14 30.56 31.03	28.41 28.64 28.88 29.14 29.40 29.69 29.99 30.30 30.64 31.01 31.41 31.84 32.32
.100 .095 .090 .085 .080 .075 .070 .065 .060 .055 .050 .045	23.54 23.75 23.97 24.21 24.45 24.71 24.99 25.28 25.59 25.93 26.29 26.69 27.13 27.62	24.76 24.98 25.21 25.45 25.70 25.97 26.25 26.55 26.87 27.21 27.58 27.99 28.44 28.94	25.98 26.21 26.44 26.68 26.94 27.21 27.50 27.81 28.13 28.48 28.86 29.28 29.74 30.25	27.20 27.43 27.66 27.91 28.18 28.45 28.75 29.06 29.39 29.75 30.14 30.56 31.03 31.56	28.41 28.64 28.88 29.14 29.40 29.69 29.99 30.30 30.64 31.01 31.41 31.84 32.32 32.85
.100 .095 .090 .085 .080 .075 .070 .065 .060 .055 .050 .045 .040	23.54 23.75 23.97 24.21 24.45 24.71 24.99 25.28 25.59 25.93 26.29 26.69 27.13 27.62 28.19	24.76 24.98 25.21 25.45 25.70 25.97 26.25 26.55 26.87 27.21 27.58 27.99 28.44 28.94 29.52	25.98 26.21 26.44 26.68 26.94 27.21 27.50 27.81 28.13 28.48 29.28 29.74 30.25 30.84	27.20 27.43 27.66 27.91 28.18 28.45 28.75 29.06 29.39 29.75 30.14 30.56 31.03 31.56 32.15	28.41 28.64 28.88 29.14 29.40 29.69 29.99 30.30 30.64 31.01 31.41 31.84 32.32 32.85 33.46
.100 .095 .090 .085 .080 .075 .070 .065 .060 .055 .050 .045 .040	23.54 23.75 23.97 24.21 24.45 24.71 24.99 25.28 25.59 25.93 26.29 26.69 27.13 27.62 28.19 28.84	24.76 24.98 25.21 25.45 25.70 25.97 26.25 26.55 26.87 27.21 27.58 27.99 28.44 28.94 29.52 30.19	25.98 26.21 26.44 26.68 26.94 27.21 27.50 27.81 28.13 28.48 28.86 29.28 29.74 30.25 30.84 31.52	27.20 27.43 27.66 27.91 28.18 28.45 28.75 29.06 29.39 29.75 30.14 30.56 31.03 31.56 32.15 32.85	28.41 28.64 28.88 29.14 29.40 29.69 29.99 30.30 30.64 31.01 31.41 31.84 32.32 32.85 33.46 34.16
.100 .095 .090 .085 .080 .075 .070 .065 .060 .055 .050 .045 .040 .035 .030	23.54 23.75 23.97 24.21 24.45 24.71 24.99 25.28 25.59 25.93 26.29 26.69 27.13 27.62 28.19 28.84 29.63	24.76 24.98 25.21 25.45 25.70 25.97 26.25 26.55 26.87 27.21 27.58 27.99 28.44 28.94 29.52 30.19 30.99	25.98 26.21 26.44 26.68 26.94 27.21 27.50 27.81 28.13 28.48 29.28 29.74 30.25 30.84 31.52 32.34	27.20 27.43 27.66 27.91 28.18 28.45 28.75 29.06 29.39 29.75 30.14 30.56 31.03 31.56 32.15 32.85 33.68	28.41 28.64 28.88 29.14 29.40 29.69 29.99 30.30 30.64 31.01 31.41 31.84 32.32 32.85 33.46 34.16 35.01
.100 .095 .090 .085 .080 .075 .070 .065 .060 .055 .050 .045 .040 .035 .030	23.54 23.75 23.97 24.21 24.45 24.71 24.99 25.28 25.59 25.93 26.29 26.69 27.13 27.62 28.19 28.84 29.63 30.62	24.76 24.98 25.21 25.45 25.70 25.97 26.25 26.55 26.87 27.21 27.58 27.99 28.44 28.94 29.52 30.19 30.99 32.01	25.98 26.21 26.44 26.68 26.94 27.21 27.50 27.81 28.13 28.48 29.28 29.74 30.25 30.84 31.52 32.34 33.38	27.20 27.43 27.66 27.91 28.18 28.45 28.75 29.06 29.39 29.75 30.14 30.56 31.03 31.56 32.15 32.85 33.68 34.74	28.41 28.64 28.88 29.14 29.40 29.69 29.99 30.30 30.64 31.01 31.41 31.84 32.32 32.85 33.46 34.16 35.01 36.09
.100 .095 .090 .085 .080 .075 .070 .065 .060 .055 .050 .045 .040 .035 .030 .025 .020 .015	23.54 23.75 23.97 24.21 24.45 24.71 24.99 25.28 25.59 25.93 26.29 26.69 27.13 27.62 28.19 28.84 29.63 30.62 32.00	24.76 24.98 25.21 25.45 25.70 25.97 26.25 26.55 26.87 27.21 27.58 27.99 28.44 28.94 29.52 30.19 30.99 32.01 33.40	25.98 26.21 26.44 26.68 26.94 27.21 27.50 27.81 28.13 28.48 28.86 29.28 29.74 30.25 30.84 31.52 32.34 33.38 34.80	27.20 27.43 27.66 27.91 28.18 28.45 28.75 29.06 29.39 29.75 30.14 30.56 31.03 31.56 32.15 32.85 33.68 34.74 36.19	28.41 28.64 28.88 29.14 29.40 29.69 29.99 30.30 30.64 31.01 31.41 31.84 32.32 32.85 33.46 34.16 35.01 36.09 37.56

 Table A.12
 Critical Values for the Ryan–Joiner Test of Normality

			$\alpha$	
		.10	.05	.01
	5	.9033	.8804	.8320
	10	.9347	.9180	.8804
	15	.9506	.9383	.9110
	20	.9600	.9503	.9290
	25	.9662	.9582	.9408
n	30	.9707	.9639	.9490
	40	.9767	.9715	.9597
	50	.9807	.9764	.9664
	60	.9835	.9799	.9710
	75	.9865	.9835	.9757

 Table A.13
 Critical Values for the Wilcoxon Signed-Rank Test

 $P_0(S_+ \ge c_1) = P(S_+ \ge c_1 \text{ when } H_0 \text{ is true})$ 

n	$c_1$	$P_0(S_+ \ge c_1)$	n	$c_1$	$P_0(S_+ \ge c_1)$
3	6	.125		78	.011
4	9	.125		79	.009
	10	.062		81	.005
5	13	.094	14	73	.108
	14	.062		74	.097
	15	.031		79	.052
6	17	.109		84	.025
	19	.047		89	.010
	20	.031		92	.005
	21	.016	15	83	.104
7	22	.109		84	.094
	24	.055		89	.053
	26	.023		90	.047
	28	.008		95	.024
8	28	.098		100	.011
	30	.055		101	.009
	32	.027		104	.005
	34	.012	16	93	.106
	35	.008	10	94	.096
	36	.004		100	.052
9	34	.102		106	.025
	37	.049		112	.011
	39	.027		113	.009
	42	.010		116	.005
	44	.004	17	104	.103
10	41	.097	17	105	.095
10	44	.053		112	.049
	47	.024		118	.025
	50	.010		125	.010
	52	.005		129	.005
11	48	.103	18	116	.098
11	52	.051	10	124	.049
	55	.027		131	.024
	59	.009		138	.010
	61			143	
10		.005	19		.005
12	56 60	.102	19	128	.098
		.055		136	.052
	61	.046		137	.048
	64	.026		144	.025
	68	.010		152	.010
12	71	.005	20	157	.005
13	64	.108	20	140	.101
	65	.095		150	.049
	69	.055		158	.024
	70	.047		167	.010
	74	.024		172	.005

**Table A.14** Critical Values for the Wilcoxon Rank-Sum Test

 $P_0(W \ge c) = P(W \ge c \text{ when } H_0 \text{ is true})$ 

m	n	c	$P_0(W \ge c)$	m	n	c	$P_0(W \ge c)$
3	3	15	.05			40	.004
	4	17	.057		6	40	.041
		18	.029			41	.026
	5	20	.036			43	.009
		21	.018			44	.004
	6	22	.048		7	43	.053
		23	.024			45	.024
		24	.012			47	.009
	7	24	.058			48	.005
		26	.017		8	47	.047
		27	.008			49	.023
	8	27	.042			51	.009
		28	.024			52	.005
		29	.012	6	6	50	.047
		30	.006			52	.021
4	4	24	.057			54	.008
		25	.029			55	.004
		26	.014		7	54	.051
	5	27	.056			56	.026
		28	.032			58	.011
		29	.016			60	.004
		30	.008		8	58	.054
	6	30	.057			61	.021
		32	.019			63	.01
		33	.010			65	.004
		34	.005	7	7	66	.049
	7	33	.055			68	.027
		35	.021			71	.009
		36	.012			72	.006
		37	.006		8	71	.047
	8	36	.055			73	.027
		38	.024			76	.01
		40	.008			78	.005
		41	.004	8	8	84	.052
5	5	36	.048			87	.025
		37	.028			90	.01
		39	.008			92	.005

 Table A.15
 Critical Values for the Wilcoxon Signed-Rank Interval

 $(\overline{x}_{(n(n+1)/2-c+1)},\overline{x}_{(c)})$ 

n	Confidence Level (%)	c	n	Confidence Level (%)	c	n	Confidence Level (%)	c
5	93.8	15	13	99.0	81	20	99.1	173
	87.5	14		95.2	74		95.2	158
6	96.9	21		90.6	70		90.3	150
	93.7	20	14	99.1	93	21	99.0	188
	90.6	19		95.1	84		95.0	172
7	98.4	28		89.6	79		89.7	163
	95.3	26	15	99.0	104	22	99.0	204
	89.1	24		95.2	95		95.0	187
8	99.2	36		90.5	90		90.2	178
	94.5	32	16	99.1	117	23	99.0	221
	89.1	30		94.9	106		95.2	203
9	99.2	44		89.5	100		90.2	193
	94.5	39	17	99.1	130	24	99.0	239
	90.2	37		94.9	118		95.1	219
10	99.0	52		90.2	112		89.9	208
	95.1	47	18	99.0	143	25	99.0	257
	89.5	44		95.2	131		95.2	236
11	99.0	61		90.1	124		89.9	224
	94.6	55	19	99.1	158			
	89.8	52		95.1	144			
12	99.1	71		90.4	137			
	94.8	64						
	90.8	61						

 Table A.16
 Critical Values for the Wilcoxon Rank-Sum Interval

 $(d_{ij(mn-c+1)},\,d_{ij(c)})$ 

Smaller	Sample	Size
Sillaller	Sample	SIZE

	5		6		7		8	
Larger Sample Size	Confidence Level (%)	c						
5	99.2	25						
	94.4	22						
	90.5	21						
6	99.1	29	99.1	34				
	94.8	26	95.9	31				
	91.8	25	90.7	29				
7	99.0	33	99.2	39	98.9	44		
	95.2	30	94.9	35	94.7	40		
	89.4	28	89.9	33	90.3	38		
8	98.9	37	99.2	44	99.1	50	99.0	56
	95.5	34	95.7	40	94.6	45	95.0	51
	90.7	32	89.2	37	90.6	43	89.5	48
9	98.8	41	99.2	49	99.2	56	98.9	62
	95.8	38	95.0	44	94.5	50	95.4	57
	88.8	35	91.2	42	90.9	48	90.7	54
10	99.2	46	98.9	53	99.0	61	99.1	69
	94.5	41	94.4	48	94.5	55	94.5	62
	90.1	39	90.7	46	89.1	52	89.9	59
11	99.1	50	99.0	58	98.9	66	99.1	75
	94.8	45	95.2	53	95.6	61	94.9	68
	91.0	43	90.2	50	89.6	57	90.9	65
12	99.1	54	99.0	63	99.0	72	99.0	81
	95.2	49	94.7	57	95.5	66	95.3	74
	89.6	46	89.8	54	90.0	62	90.2	70

## **Smaller Sample Size**

	9		10		11		12	
Larger Sample Size	Confidence Level (%)	с	Confidence Level (%)	c	Confidence Level (%)	с	Confidence Level (%)	c
9	98.9	69						
	95.0	63						
	90.6	60						
10	99.0	76	99.1	84				
	94.7	69	94.8	76				
	90.5	66	89.5	72				
11	99.0	83	99.0	91	98.9	99		
	95.4	76	94.9	83	95.3	91		
	90.5	72	90.1	79	89.9	86		
12	99.1	90	99.1	99	99.1	108	99.0	116
	95.1	82	95.0	90	94.9	98	94.8	106
	90.5	78	90.7	86	89.6	93	89.9	101

**Table A.17**  $\beta$  Curves for t Tests

