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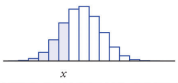
Chapter 12

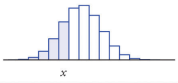
Appendix

Figure 12.1 *Cumulative Binomial Probability*



Cumulative Binomial Probability $P(X \le x)$

		p								
n	x	0.05	0.10	0.25	$0.\overline{33}$	0.50	$0.\overline{66}$	0.75	0.90	0.95
5	0	0.7738	0.5905	0.2373	0.1317	0.0313	0.0041	0.0010	0.0000	0.0000
	1	0.9774	0.9185	0.6328	0.4609	0.1875	0.0453	0.0156	0.0005	0.0000
	2	0.9988	0.9914	0.8965	0.7901	0.5000	0.2099	0.1035	0.0086	0.0012
	3	1.0000	0.9995	0.9844	0.9547	0.8125	0.5391	0.3672	0.0815	0.0226
	4	1.0000	1.0000	0.9990	0.9959	0.9688	0.8683	0.7627	0.4095	0.2262
7	0	0.6983	0.4783	0.1335	0.0585	0.0078	0.0005	0.0000	0.0000	0.0000
	1	0.9556	0.8503	0.4449	0.2634	0.0625	0.0069	0.0013	0.0000	0.0000
	2	0.9962	0.9743	0.7564	0.5706	0.2266	0.0453	0.0129	0.0002	0.0000
	3	0.9998	0.9973	0.9294	0.8267	0.5000	0.1733	0.0706	0.0027	0.0002
	4	1.0000	0.9998	0.9871	0.9547	0.7734	0.4294	0.2436	0.0257	0.0038
	5	1.0000	1.0000	0.9987	0.9931	0.9375	0.7366	0.5551	0.1497	0.0444
	6	1.0000	1.0000	0.9999	0.9995	0.9922	0.9415	0.8665	0.5217	0.3017
10	0	0.5987	0.3487	0.0563	0.0173	0.0010	0.0000	0.0000	0.0000	0.0000
	1	0.9139	0.7361	0.2440	0.1040	0.0107	0.0004	0.0000	0.0000	0.0000
	2	0.9885	0.9298	0.5256	0.2991	0.0547	0.0034	0.0004	0.0000	0.0000
	3	0.9990	0.9872	0.7759	0.5593	0.1719	0.0197	0.0035	0.0000	0.0000
	4	0.9999	0.9984	0.9219	0.7869	0.3770	0.0766	0.0197	0.0001	0.0000
	5	1.0000	0.9999	0.9803	0.9234	0.6230	0.2131	0.0781	0.0016	0.0000
	6	1.0000	1.0000	0.9965	0.9803	0.8281	0.4407	0.2241	0.0128	0.0010
	7	1.0000	1.0000	0.9996	0.9966	0.9453	0.7009	0.4744	0.0702	0.0115
	8	1.0000	1.0000	1.0000	0.9996	0.9893	0.8960	0.7560	0.2639	0.0861
	9	1.0000	1.0000	1.0000	1.0000	0.9990	0.9827	0.9437	0.6513	0.4013
12	0	0.5404	0.2824	0.0317	0.0077	0.0002	0.0000	0.0000	0.0000	0.0000
	1	0.8816	0.6590	0.1584	0.0540	0.0032	0.0000	0.0000	0.0000	0.0000
	2	0.9804	0.8891	0.3907	0.1811	0.0193	0.0005	0.0000	0.0000	0.0000
	3	0.9978	0.9744	0.6488	0.3931	0.0730	0.0039	0.0004	0.0000	0.0000
	4	0.9998	0.9957	0.8424	0.6315	0.1938	0.0188	0.0028	0.0000	0.0000
	5	1.0000	0.9995	0.9456	0.8223	0.3872	0.0664	0.0143	0.0000	0.0000
	6	1.0000	0.9999	0.9857	0.9336	0.6128	0.1777	0.0544	0.0005	0.0000
	7	1.0000	1.0000	0.9972	0.9812	0.8062	0.3685	0.1576	0.0043	0.0002
	8	1.0000	1.0000	0.9996	0.9961	0.9270	0.6069	0.3512	0.0256	0.0022
	9	1.0000	1.0000	1.0000	0.9995	0.9807	0.8189	0.6093	0.1109	0.0196
	10	1.0000	1.0000	1.0000	1.0000	0.9968	0.9460	0.8416	0.3410	0.1184
	11	1.0000	1.0000	1.0000	1.0000	0.9998	0.9923	0.9683	0.7176	0.4596



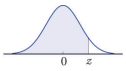
Cumulative Binomial Probability $P(X \le x)$

		p								
n	x	0.05	0.10	0.25	$0.\overline{33}$	0.50	$0.\overline{66}$	0.75	0.90	0.95
15	0	0.4633	0.2059	0.0134	0.0023	0.0000	0.0000	0.0000	0.0000	0.0000
	1	0.8290	0.5490	0.0802	0.0194	0.0005	0.0000	0.0000	0.0000	0.0000
	2	0.9638	0.8159	0.2361	0.0794	0.0037	0.0000	0.0000	0.0000	0.0000
	3	0.9945	0.9444	0.4613	0.2092	0.0176	0.0003	0.0000	0.0000	0.0000
	4	0.9994	0.9873	0.6865	0.4041	0.0592	0.0018	0.0001	0.0000	0.0000
	5	0.9999	0.9978	0.8516	0.6184	0.1509	0.0085	0.0008	0.0000	0.0000
	6	1.0000	0.9997	0.9434	0.7970	0.3036	0.0308	0.0042	0.0000	0.0000
	7	1.0000	1.0000	0.9827	0.9118	0.5000	0.0882	0.0173	0.0000	0.0000
	8	1.0000	1.0000	0.9958	0.9692	0.6964	0.2030	0.0566	0.0003	0.0000
	9	1.0000	1.0000	0.9992	0.9915	0.8491	0.3816	0.1484	0.0022	0.0000
	10	1.0000	1.0000	0.9999	0.9982	0.9408	0.5959	0.3135	0.0127	0.0006
	11	1.0000	1.0000	1.0000	0.9997	0.9824	0.7908	0.5387	0.0556	0.0055
	12	1.0000	1.0000	1.0000	1.0000	0.9963	0.9206	0.7639	0.1841	0.0362
	13	1.0000	1.0000	1.0000	1.0000	0.9995	0.9806	0.9198	0.4510	0.1710
	14	1.0000	1.0000	1.0000	1.0000	1.0000	0.9977	0.9866	0.7941	0.5367
20	0	0.3585	0.1216	0.0032	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000
	1	0.7358	0.3917	0.0243	0.0033	0.0000	0.0000	0.0000	0.0000	0.0000
	2	0.9245	0.6769	0.0913	0.0176	0.0002	0.0000	0.0000	0.0000	0.0000
	3	0.9841	0.8670	0.2252	0.0604	0.0013	0.0000	0.0000	0.0000	0.0000
	4	0.9974	0.9568	0.4148	0.1515	0.0059	0.0000	0.0000	0.0000	0.0000
	5	0.9997	0.9887	0.6172	0.2972	0.0207	0.0002	0.0000	0.0000	0.0000
	6	1.0000	0.9976	0.7858	0.4793	0.0577	0.0009	0.0000	0.0000	0.0000
	7	1.0000	0.9996	0.8982	0.6615	0.1316	0.0037	0.0002	0.0000	0.0000
	8	1.0000	0.9999	0.9591	0.8095	0.2517	0.0130	0.0009	0.0000	0.0000
	9	1.0000	1.0000	0.9861	0.9081	0.4119	0.0376	0.0039	0.0000	0.0000
	10	1.0000	1.0000	0.9961	0.9624	0.5881	0.0919	0.0139	0.0000	0.0000
	11	1.0000	1.0000	0.9991	0.9870	0.7483	0.1905	0.0409	0.0001	0.0000
	12	1.0000	1.0000	0.9998	0.9963	0.8684	0.3385	0.1018	0.0004	0.0000
	13	1.0000	1.0000	1.0000	0.9991	0.9423	0.5207	0.2142	0.0024	0.0000
	14	1.0000	1.0000	1.0000	0.9998	0.9793	0.7028	0.3828	0.0113	0.0003
	15	1.0000	1.0000	1.0000	1.0000	0.9941	0.8485	0.5852	0.0432	0.0026
	16	1.0000	1.0000	1.0000	1.0000	0.9987	0.9396	0.7748	0.1330	0.0159
	17	1.0000	1.0000	1.0000	1.0000	0.9998	0.9824	0.9087	0.3231	0.0755
	18	1.0000	1.0000	1.0000	1.0000	1.0000	0.9967	0.9757	0.6083	0.2642
	19	1.0000	1.0000	1.0000	1.0000	1.0000	0.9997	0.9968	0.8784	0.6415

Figure 12.2 *Cumulative Normal Probability*

Cumulative Probability $P(Z \le z)$

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
−3.9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
−3.8	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
−3.7	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
−3.6	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
−3.5	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
−3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
−3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
−3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
−3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
−3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
−2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
−2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
−2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
−2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
−2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
−2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
−2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
−2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
−2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
−2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
−1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
−1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
−1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
−1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
−1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
−1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
−1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
−1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
−1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
−1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
−0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
−0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
−0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
−0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
−0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
−0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
−0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
−0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
−0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
−0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641



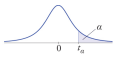
Cumulative Probability $P(Z \le z)$

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8304	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998
3.5	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998
3.6	0.9998	0.9998	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.7	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.8	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.9	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Figure 12.3 *Critical Values of t*

Critical Values of t

df	$t_{0.200}$	$t_{0.100}$	$t_{0.050}$	$t_{0.025}$	$t_{0.010}$	$t_{0.005}$	$t_{0.0025}$	$t_{0.001}$	$t_{0.0005}$
1	1.376	3.078	6.314	12.706	31.821	63.657	127.321	318.309	636.619
2	1.061	1.886	2.920	4.303	6.965	9.925	14.089	22.327	31.599
3	0.978	1.638	2.353	3.182	4.541	5.841	7.453	10.215	12.924
4	0.941	1.533	2.132	2.776	3.747	4.604	5.598	7.173	8.610
5	0.920	1.476	2.015	2.571	3.365	4.032	4.773	5.893	6.869
6	0.906	1.440	1.943	2.447	3.143	3.707	4.317	5.208	5.959
7	0.896	1.415	1.895	2.365	2.998	3.499	4.029	4.785	5.408
8	0.889	1.397	1.860	2.306	2.896	3.355	3.833	4.501	5.041
9	0.883	1.383	1.833	2.262	2.821	3.250	3.690	4.297	4.781
10	0.879	1.372	1.812	2.228	2.764	3.169	3.581	4.144	4.587
11	0.876	1.363	1.796	2.201	2.718	3.106	3.497	4.025	4.437
12	0.873	1.356	1.782	2.179	2.681	3.055	3.428	3.930	4.318
13	0.870	1.350	1.771	2.160	2.650	3.012	3.372	3.852	4.221
14	0.868	1.345	1.761	2.145	2.624	2.977	3.326	3.787	4.140
15	0.866	1.341	1.753	2.131	2.602	2.947	3.286	3.733	4.073
16	0.865	1.337	1.746	2.120	2.583	2.921	3.252	3.686	4.015
17	0.863	1.333	1.740	2.110	2.576	2.898	3.222	3.646	3.965
18	0.862	1.330	1.734	2.101	2.552	2.878	3.197	3.610	3.922
19	0.861	1.328	1.729	2.093	2.539	2.861	3.174	3.579	3.883
20	0.860	1.325	1.725	2.086	2.528	2.845	3.153	3.552	3.850
21	0.859	1.323	1.721	2.080	2.518	2.831	3.135	3.527	3.819
22	0.858	1.321	1.717	2.074	2.508	2.819	3.119	3.505	3.792
23	0.858	1.319	1.714	2.069	2.500	2.807	3.104	3.485	3.768
24	0.857	1.318	1.711	2.064	2.492	2.797	3.091	3.467	3.745
25	0.856	1.316	1.708	2.060	2.485	2.787	3.078	3.450	3.725
26	0.856	1.315	1.706	2.056	2.479	2.779	3.067	3.435	3.707
27	0.855	1.314	1.703	2.052	2.473	2.771	3.057	3.421	3.690
28	0.855	1.313	1.701	2.048	2.467	2.763	3.047	3.408	3.674
29	0.854	1.311	1.699	2.045	2.462	2.756	3.038	3.396	3.659
30	0.854	1.310	1.697	2.042	2.457	2.750	3.030	3.385	3.646
31	0.853	1.309	1.696	2.040	2.453	2.744	3.022	3.375	3.633
32	0.853	1.309	1.694	2.037	2.449	2.738	3.015	3.365	3.622
33	0.853	1.308	1.692	2.035	2.445	2.733	3.008	3.356	3.611
34	0.852	1.307	1.691	2.032	2.441	2.728	3.002	3.348	3.601
35	0.852	1.306	1.690	2.030	2.438	2.724	2.996	3.340	3.591
36	0.852	1.306	1.688	2.028	2.434	2.719	2.990	3.333	3.582
37	0.851	1.305	1.687	2.026	2.431	2.715	2.985	3.326	3.574
38	0.851	1.304	1.686	2.024	2.429	2.712	2.980	3.319	3.566
39	0.851	1.304	1.685	2.023	2.426	2.708	2.976	3.313	3.558
40	0.851	1.303	1.684	2.021	2.423	2.704	2.971	3.307	3.551
41	0.851	1.303	1.683	2.020	2.421	2.701	2.967	3.301	3.544
42	0.851	1.302	1.682	2.018	2.418	2.698	2.963	3.296	3.538
43	0.851	1.302	1.681	2.017	2.416	2.695	2.959	3.291	3.532
44	8.850	1.301	1.680	2.015	2.414	2.692	2.956	3.286	3.526
45	0.850	1.301	1.679	2.014	2.412	2.690	2.952	3.281	3.520
46	0.850	1.300	1.679	2.013	2.410	2.687	2.949	3.277	3.515
47	0.849	1.300	1.678	2.012	2.408	2.685	2.946	3.273	3.510
48	0.849	1.299	1.677	2.011	2.407	2.682	2.943	3.269	3.505
49	0.849	1.299	1.677	2.010	2.405	2.680	2.940	3.265	3.500
50	0.849	1.299	1.676	2.009	2.403	2.678	2.937	3.261	3.496



Critical Values of *t*

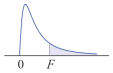
df	$t_{0.200}$	$t_{0.100}$	$t_{0.050}$	$t_{0.025}$	$t_{0.010}$	$t_{0.005}$	$t_{0.0025}$	$t_{0.001}$	$t_{0.0005}$
51	0.849	1.298	1.675	2.008	2.402	2.676	2.934	3.258	3.492
52	0.849	1.298	1.675	2.007	2.400	2.674	2.932	3.255	3.488
53	0.849	1.298	1.674	2.006	2.399	2.672	2.929	3.251	3.484
54	0.848	1.297	1.674	2.005	2.397	2.670	2.927	3.248	3.480
55	0.848	1.297	1.673	2.004	2.396	2.668	2.925	3.245	3.476
56	0.848	1.297	1.673	2.003	2.395	2.667	2.923	3.242	3.473
57	0.848	1.297	1.672	2.002	2.394	2.665	2.920	3.239	3.470
58	0.848	1.296	1.672	2.002	2.392	2.663	2.918	3.237	3.466
59	0.848	1.296	1.671	2.001	2.391	2.662	2.916	3.234	3.463
60	0.848	1.296	1.671	2.000	2.390	2.660	2.915	3.232	3.460
61	0.848	1.296	1.670	2.000	2.389	2.659	2.913	3.229	3.457
62	0.848	1.295	1.670	1.999	2.388	2.657	2.911	3.227	3.454
63	0.847	1.295	1.669	1.998	2.387	2.656	2.909	3.225	3.452
64	0.847	1.295	1.669	1.998	2.386	2.655	2.908	3.223	3.449
65	0.847	1.295	1.669	1.997	2.385	2.654	2.906	3.220	3.447
66	0.847	1.295	1.668	1.997	2.384	2.652	2.904	3.218	3.444
67	0.847	1.294	1.668	1.996	2.383	2.651	2.903	3.216	3.442
68	0.847	1.294	1.668	1.995	2.382	2.650	2.902	3.214	3.439
69	0.847	1.294	1.667	1.995	2.382	2.649	2.900	3.213	3.437
70	0.847	1.294	1.667	1.994	2.381	2.648	2.899	3.211	3.435
71	0.847	1.294	1.667	1.994	2.380	2.647	2.897	3.209	3.433
72	0.847	1.293	1.666	1.993	2.379	2.646	2.896	3.207	3.431
73	0.847	1.293	1.666	1.993	2.379	2.645	2.895	3.206	3.429
74	0.847	1.293	1.666	1.993	2.378	2.644	2.894	3.204	3.427
75	0.846	1.293	1.665	1.992	2.377	2.643	2.892	3.202	3.425
76	0.846	1.293	1.665	1.992	2.376	2.642	2.891	3.201	3.423
77	0.846	1.293	1.665	1.991	2.376	2.641	2.890	3.199	3.421
78	0.846	1.292	1.665	1.991	2.375	2.640	2.889	3.198	3.420
79	0.846	1.292	1.664	1.990	2.374	2.640	2.888	3.197	3.418
80	0.846	1.292	1.664	1.990	2.374	2.639	2.887	3.195	3.416
81	0.846	1.292	1.664	1.990	2.373	2.638	2.886	3.194	3.415
82	0.846	1.292	1.664	1.989	2.373	2.637	2.885	3.193	3.413
83	0.846	1.292	1.663	1.989	2.372	2.636	2.884	3.191	3.412
84	0.846	1.292	1.663	1.989	2.372	2.636	2.883	3.190	3.410
85	0.846	1.292	1.663	1.988	2.371	2.635	2.882	3.189	3.409
86	0.846	1.291	1.663	1.988	2.370	2.634	2.881	3.188	3.407
87	0.846	1.291	1.663	1.988	2.370	2.634	2.880	3.187	3.406
88	0.846	1.291	1.662	1.987	2.369	2.633	2.880	3.185	3.405
89	0.846	1.291	1.662	1.987	2.369	2.632	2.879	3.184	3.403
90	0.846	1.291	1.662	1.987	2.368	2.632	2.878	3.183	3.402
91	0.846	1.291	1.662	1.986	2.368	2.631	2.877	3.182	3.401
92	0.846	1.291	1.662	1.986	2.368	2.630	2.876	3.181	3.399
93	0.846	1.291	1.661	1.986	2.367	2.630	2.876	3.180	3.398
94	0.846	1.291	1.661	1.986	2.367	2.629	2.875	3.179	3.397
95	0.845	1.291	1.661	1.985	2.366	2.629	2.874	3.178	3.396
96	0.845	1.290	1.661	1.985	2.366	2.628	2.873	3.177	3.395
97	0.845	1.290	1.661	1.985	2.365	2.627	2.873	3.176	3.394
98	0.845	1.290	1.661	1.984	2.365	2.627	2.872	3.175	3.393
99	0.845	1.290	1.660	1.984	2.365	2.626	2.871	3.175	3.392
100	0.845	1.290	1.660	1.984	2.364	2.626	2.871	3.174	3.390
∞ [*z*]	0.842	1.282	1.645	1.960	2.326	2.576	2.807	3.090	3.291

Figure 12.4 *Critical Values of Chi-Square Distributions*

Critical Values of Chi-Square Distributions

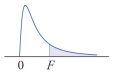
	x^2 Right-Tail Area									
df	0.995	0.99	0.975	0.95	0.90	0.10	0.05	0.025	0.01	0.005
1	0.000	0.000	0.001	0.004	0.016	2.706	3.841	5.024	6.635	7.879
2	0.010	0.020	0.051	0.103	0.211	4.605	5.991	7.378	9.210	10.597
3	0.072	0.115	0.216	0.352	0.584	6.251	7.815	9.348	11.345	12.838
4	0.207	0.297	0.484	0.711	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	12.833	15.086	16.750
6	0.676	0.872	1.237	1.635	2.204	10.645	12.592	14.449	16.812	18.548
7	0.989	1.239	1.690	2.167	2.833	12.017	14.067	16.013	18.475	20.278
8	1.344	1.646	2.180	2.733	3.490	13.362	15.507	17.535	20.090	21.955
9	1.735	2.088	2.700	3.325	4.168	14.684	16.919	19.023	21.666	23.589
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	24.725	26.757
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	7.042	19.812	22.362	24.736	27.688	29.819
14	4.075	4.660	5.629	6.571	7.790	21.064	23.685	26.119	29.141	31.319
15	4.601	5.229	6.262	7.261	8.547	22.307	24.996	27.488	30.578	32.801
16	5.142	5.812	6.908	7.962	9.312	23.542	26.296	28.845	32.000	34.267
17	5.697	6.408	7.564	8.672	10.085	24.769	27.587	30.191	33.409	35.718
18	6.265	7.015	8.231	9.390	10.865	25.989	28.869	31.526	34.805	37.156
19	6.844	7.633	8.907	10.117	11.651	27.204	30.144	32.852	36.191	38.582
20	7.434	8.260	9.591	10.851	12.443	28.412	31.410	34.170	37.566	39.997
21	8.034	8.897	10.283	11.591	13.240	29.615	32.671	35.479	38.932	41.401
22	8.643	9.542	10.982	12.338	14.041	30.813	33.924	36.781	40.289	42.796
23	9.260	10.196	11.689	13.091	14.848	32.007	35.172	38.076	41.638	44.181
24	9.886	10.856	12.401	13.848	15.659	33.196	36.415	39.364	42.980	45.559
25	10.520	11.524	13.120	14.611	16.473	34.382	37.652	40.646	44.314	46.928
26	11.160	12.198	13.844	15.379	17.292	35.563	38.885	41.923	45.642	48.290
27	11.808	12.879	14.573	16.151	18.114	36.741	40.113	43.195	46.963	49.645
28	12.461	13.565	15.308	16.928	18.939	37.916	41.337	44.461	48.278	50.993
29	13.121	14.256	16.047	17.708	19.768	39.087	42.557	45.722	49.588	52.336
30	13.787	14.953	16.791	18.493	20.599	40.256	43.773	46.979	50.892	53.672
31	14.458	15.655	17.539	19.281	21.434	41.422	44.985	48.232	52.191	55.003
32	15.134	16.362	18.291	20.072	22.271	42.585	46.194	49.480	53.486	56.328
33	15.815	17.074	19.047	20.867	23.110	43.745	47.400	50.725	54.776	57.648
34	16.501	17.789	19.806	21.664	23.952	44.903	48.602	51.966	56.061	58.964
35	17.192	18.509	20.569	22.465	24.797	46.059	49.802	53.203	57.342	60.275
36	17.887	19.233	21.336	23.269	25.643	47.212	50.998	54.437	58.619	61.581
37	18.586	19.96	22.106	24.075	26.492	48.363	52.192	55.668	59.893	62.883
38	19.289	20.691	22.878	24.884	27.343	49.513	53.384	56.896	61.162	64.181
39	19.996	21.426	23.654	25.695	28.196	50.660	54.572	58.120	62.428	65.476
40	20.707	22.164	24.433	26.509	29.051	51.805	55.758	59.342	63.691	66.766
41	21.421	22.906	25.215	27.326	29.907	52.949	56.942	60.561	64.950	68.053
42	22.138	23.650	25.999	28.144	30.765	54.090	58.124	61.777	66.206	69.336
43	22.859	24.398	26.785	28.965	31.625	55.230	59.304	62.990	67.459	70.616
44	23.584	25.148	27.575	29.787	32.487	56.369	60.481	64.201	68.710	71.893
45	24.311	25.901	28.366	30.612	33.350	57.505	61.656	65.410	69.957	73.166
100	67.328	70.065	74.222	77.929	82.358	118.498	124.342	129.561	135.807	140.169

Figure 12.5 *Upper Critical Values of F-Distributions*



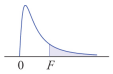
Upper Critical Values of *F*-Distributions

F tail area	df_1 / df_2	1	2	3	4	5	6	7	8	9	10	15	20	30	60
0.005	1	16211	20000	21615	22500	23056	23437	23715	23925	24091	24224	24630	24836	25044	25253
0.01	1	4052	5000	5403	5625	5764	5859	5928	5981	6022	6056	6157	6209	6261	6313
0.025	1	648	800	864	900	922	937	948	957	963	969	985	993	1001	1010
0.05	1	161	200	216	225	230	234	237	239	241	242	246	248	250	252
0.10	1	39.9	49.5	53.6	55.8	57.2	58.2	58.9	59.4	59.9	60.2	61.2	61.7	62.3	62.8
0.005	2	199	199	199	199	199	199	199	199	199	199	199	199	199	199
0.01	2	98.5	99.0	99.2	99.3	99.3	99.3	99.4	99.4	99.4	99.4	99.4	99.5	99.5	99.5
0.025	2	38.5	39.0	39.2	39.3	39.3	39.3	39.4	39.4	39.4	39.4	39.4	39.5	39.5	39.5
0.05	2	18.5	19.0	19.2	19.3	19.3	19.3	19.4	19.4	19.4	19.4	19.4	19.5	19.5	19.5
0.10	2	8.53	9.00	9.16	9.24	9.29	9.33	9.35	9.37	9.38	9.39	9.42	9.44	9.46	9.47
0.005	3	55.6	49.8	47.5	46.2	45.4	44.9	44.4	44.1	43.9	43.7	43.1	42.8	42.5	42.2
0.01	3	34.1	30.8	29.5	28.7	28.2	27.9	27.7	27.5	27.4	27.2	26.9	26.7	26.5	26.3
0.025	3	17.4	16.0	15.4	15.1	14.9	14.7	14.6	14.5	14.5	14.4	14.3	14.2	14.1	14.0
0.05	3	10.1	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79	8.70	8.66	8.62	8.57
0.10	3	5.54	5.46	5.39	5.34	5.31	5.28	5.27	5.25	5.24	5.23	5.20	5.18	5.17	5.15
0.005	4	31.3	26.3	24.3	23.2	22.5	22.0	21.6	21.4	21.1	21.0	20.4	20.2	19.9	19.6
0.01	4	21.2	18.0	16.8	16.0	15.5	15.2	15.0	14.8	14.7	14.6	14.2	14.0	13.9	13.7
0.025	4	12.2	10.7	9.98	9.60	9.36	9.20	9.07	8.98	8.90	8.84	8.66	8.56	8.46	8.36
0.05	4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96	5.86	5.80	5.75	5.69
0.10	4	4.54	4.32	4.19	4.11	4.05	4.01	3.98	3.95	3.94	3.92	3.87	3.84	3.82	3.79
0.005	5	22.8	18.3	16.5	15.6	14.9	14.5	14.2	14.0	13.8	13.6	13.2	12.9	12.7	12.4
0.01	5	16.3	13.3	12.1	11.4	11.0	10.7	10.5	10.3	10.2	10.1	9.72	9.55	9.38	9.20
0.025	5	10.0	8.43	7.76	7.39	7.15	6.98	6.85	6.76	6.68	6.62	6.43	6.33	6.23	6.12
0.05	5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74	4.62	4.56	4.50	4.43
0.10	5	4.06	3.78	3.62	3.52	3.45	3.40	3.37	3.34	3.32	3.30	3.24	3.21	3.17	3.14
0.005	6	18.6	14.5	12.9	12.0	11.5	11.1	10.8	10.6	10.4	10.3	9.81	9.59	9.36	9.12
0.01	6	13.8	10.9	9.78	9.15	8.75	8.47	8.26	8.10	7.98	7.87	7.56	7.40	7.23	7.06
0.025	6	8.81	7.26	6.60	6.23	5.99	5.82	5.70	5.60	5.52	5.46	5.27	5.17	5.07	4.96
0.05	6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06	3.94	3.87	3.81	3.74
0.10	6	3.78	3.46	3.29	3.18	3.11	3.05	3.01	2.98	2.96	2.94	2.87	2.84	2.80	2.76
0.005	7	16.2	12.4	10.9	10.1	9.52	9.16	8.89	8.68	8.51	8.38	7.97	7.75	7.53	7.31
0.01	7	12.3	9.55	8.45	7.85	7.46	7.19	6.99	6.84	6.72	6.62	6.31	6.16	5.99	5.82
0.025	7	8.07	6.54	5.89	5.52	5.29	5.12	4.99	4.90	4.82	4.76	4.57	4.47	4.36	4.25
0.05	7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64	3.51	3.44	3.38	3.30
0.10	7	3.59	3.26	3.07	2.96	2.88	2.83	2.78	2.75	2.72	2.70	2.63	2.59	2.56	2.51



Upper Critical Values of *F*-Distributions

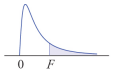
F tail area	df_1 / df_2	1	2	3	4	5	6	7	8	9	10	15	20	30	60
0.005	8	14.7	11.0	9.60	8.81	8.30	7.95	7.69	7.50	7.34	7.21	6.81	6.61	6.40	6.18
0.01	8	11.3	8.65	7.59	7.01	6.63	6.37	6.18	6.03	5.91	5.81	5.52	5.36	5.20	5.03
0.025	8	7.57	6.06	5.42	5.05	4.82	4.65	4.53	4.43	4.36	4.30	4.10	4.00	3.89	3.78
0.05	8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35	3.22	3.15	3.08	3.01
0.10	8	3.46	3.11	2.92	2.81	2.73	2.67	2.62	2.59	2.56	2.54	2.46	2.42	2.38	2.34
0.005	9	13.6	10.1	8.72	7.96	7.47	7.13	6.88	6.69	6.54	6.42	6.03	5.83	5.62	5.41
0.01	9	10.6	8.02	6.99	6.42	6.06	5.80	5.61	5.47	5.35	5.26	4.96	4.81	4.65	4.48
0.025	9	7.21	5.71	5.08	4.72	4.48	4.32	4.20	4.10	4.03	3.96	3.77	3.67	3.56	3.45
0.05	9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14	3.01	2.94	2.86	2.79
0.10	9	3.36	3.01	2.81	2.69	2.61	2.55	2.51	2.47	2.44	2.42	2.34	2.30	2.25	2.21
0.005	10	12.8	9.43	8.08	7.34	6.87	6.54	6.30	6.12	5.97	5.85	5.47	5.27	5.07	4.86
0.01	10	10.0	7.56	6.55	5.99	5.64	5.39	5.20	5.06	4.94	4.85	4.56	4.41	4.25	4.08
0.025	10	6.94	5.46	4.83	4.47	4.24	4.07	3.95	3.85	3.78	3.72	3.52	3.42	3.31	3.20
0.05	10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98	2.85	2.77	2.70	2.62
0.10	10	3.29	2.92	2.73	2.61	2.52	2.46	2.41	2.38	2.35	2.32	2.24	2.20	2.16	2.11
0.005	11	12.2	8.91	7.60	6.88	6.42	6.10	5.86	5.68	5.54	5.42	5.05	4.86	4.65	4.45
0.01	11	9.65	7.21	6.22	5.67	5.32	5.07	4.89	4.74	4.63	4.54	4.25	4.10	3.94	3.78
0.025	11	6.72	5.26	4.63	4.28	4.04	3.88	3.76	3.66	3.59	3.53	3.33	3.23	3.12	3.00
0.05	11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.85	2.72	2.65	2.57	2.49
0.10	11	3.23	2.86	2.66	2.54	2.45	2.39	2.34	2.30	2.27	2.25	2.17	2.12	2.08	2.03
0.005	12	11.8	8.51	7.23	6.52	6.07	5.76	5.52	5.35	5.20	5.09	4.72	4.53	4.33	4.12
0.01	12	9.33	6.93	5.95	5.41	5.06	4.82	4.64	4.50	4.39	4.30	4.01	3.86	3.70	3.54
0.025	12	6.55	5.10	4.47	4.12	3.89	3.73	3.61	3.51	3.44	3.37	3.18	3.07	2.96	2.85
0.05	12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75	2.62	2.54	2.47	2.38
0.10	12	3.18	2.81	2.61	2.48	2.39	2.33	2.28	2.24	2.21	2.19	2.10	2.06	2.01	1.96
0.005	13	11.4	8.19	6.93	6.23	5.79	5.48	5.25	5.08	4.94	4.82	4.46	4.27	4.07	3.87
0.01	13	9.07	6.70	5.74	5.21	4.86	4.62	4.44	4.30	4.19	4.10	3.82	3.66	3.51	3.34
0.025	13	6.41	4.97	4.35	4.00	3.77	3.60	3.48	3.39	3.31	3.25	3.05	2.95	2.84	2.72
0.05	13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67	2.53	2.46	2.38	2.30
0.10	13	3.14	2.76	2.56	2.43	2.35	2.28	2.23	2.20	2.16	2.14	2.05	2.01	1.96	1.90
0.005	14	11.1	7.92	6.68	6.00	5.56	5.26	5.03	4.86	4.72	4.60	4.25	4.06	3.86	3.66
0.01	14	8.86	6.51	5.56	5.04	4.69	4.46	4.28	4.14	4.03	3.94	3.66	3.51	3.35	3.18
0.025	14	6.30	4.86	4.24	3.89	3.66	3.50	3.38	3.29	3.21	3.15	2.95	2.84	2.73	2.61
0.05	14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65	2.60	2.46	2.39	2.31	2.22
0.10	14	3.10	2.73	2.52	2.39	2.31	2.24	2.19	2.15	2.12	2.10	2.01	1.96	1.91	1.86



Upper Critical Values of *F*-Distributions

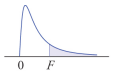
F tail area	df_1 / df_2	1	2	3	4	5	6	7	8	9	10	15	20	30	60
0.005	15	10.8	7.70	6.48	5.80	5.37	5.07	4.85	4.67	4.54	4.42	4.07	3.88	3.69	3.48
0.01	15	8.68	6.36	5.42	4.89	4.56	4.32	4.14	4.00	3.89	3.80	3.52	3.37	3.21	3.05
0.025	15	6.20	4.77	4.15	3.80	3.58	3.41	3.29	3.20	3.12	3.06	2.86	2.76	2.64	2.52
0.05	15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59	2.54	2.40	2.33	2.25	2.16
0.10	15	3.07	2.70	2.49	2.36	2.27	2.21	2.16	2.12	2.09	2.06	1.97	1.92	1.87	1.82
0.005	20	9.94	6.99	5.82	5.17	4.76	4.47	4.26	4.09	3.96	3.85	3.50	3.32	3.12	2.92
0.01	20	8.10	5.85	4.94	4.43	4.10	3.87	3.70	3.56	3.46	3.37	3.09	2.94	2.78	2.61
0.025	20	5.87	4.46	3.86	3.51	3.29	3.13	3.01	2.91	2.84	2.77	2.57	2.46	2.35	2.22
0.05	20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39	2.35	2.20	2.12	2.04	1.95
0.10	20	2.97	2.59	2.38	2.25	2.16	2.09	2.04	2.00	1.96	1.94	1.84	1.79	1.74	1.68
0.005	30	9.18	6.35	5.24	4.62	4.23	3.95	3.74	3.58	3.45	3.34	3.01	2.82	2.63	2.42
0.01	30	7.56	5.39	4.51	4.02	3.70	3.47	3.30	3.17	3.07	2.98	2.70	2.55	2.39	2.21
0.025	30	5.57	4.18	3.59	3.25	3.03	2.87	2.75	2.65	2.57	2.51	2.31	2.20	2.07	1.94
0.05	30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.16	2.01	1.93	1.84	1.74
0.10	30	2.88	2.49	2.28	2.14	2.05	1.98	1.93	1.88	1.85	1.82	1.72	1.67	1.61	1.54
0.005	40	8.83	6.07	4.98	4.37	3.99	3.71	3.51	3.35	3.22	3.12	2.78	2.60	2.40	2.18
0.01	40	7.31	5.18	4.31	3.83	3.51	3.29	3.12	2.99	2.89	2.80	2.52	2.37	2.20	2.02
0.025	40	5.42	4.05	3.46	3.13	2.90	2.74	2.62	2.53	2.45	2.39	2.18	2.07	1.94	1.80
0.05	40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.08	1.92	1.84	1.74	1.64
0.10	40	2.84	2.44	2.23	2.09	2.00	1.93	1.87	1.83	1.79	1.76	1.66	1.61	1.54	1.47
0.005	50	8.63	5.90	4.83	4.23	3.85	3.58	3.38	3.22	3.09	2.99	2.65	2.47	2.27	2.05
0.01	50	7.17	5.06	4.20	3.72	3.41	3.19	3.02	2.89	2.78	2.70	2.42	2.27	2.10	1.91
0.025	50	5.34	3.97	3.39	3.05	2.83	2.67	2.55	2.46	2.38	2.32	2.11	1.99	1.87	1.72
0.05	50	4.03	3.18	2.79	2.56	2.40	2.29	2.20	2.13	2.07	2.03	1.87	1.78	1.69	1.58
0.10	50	2.81	2.41	2.20	2.06	1.97	1.90	1.84	1.80	1.76	1.73	1.63	1.57	1.50	1.42
0.005	60	8.49	5.79	4.73	4.14	3.76	3.49	3.29	3.13	3.01	2.90	2.57	2.39	2.19	1.96
0.01	60	7.08	4.98	4.13	3.65	3.34	3.12	2.95	2.82	2.72	2.63	2.35	2.20	2.03	1.84
0.025	60	5.29	3.93	3.34	3.01	2.79	2.63	2.51	2.41	2.33	2.27	2.06	1.94	1.82	1.67
0.05	60	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04	1.99	1.84	1.75	1.65	1.53
0.10	60	2.79	2.39	2.18	2.04	1.95	1.87	1.82	1.77	1.74	1.71	1.60	1.54	1.48	1.40
0.005	100	8.24	5.59	4.54	3.96	3.59	3.33	3.13	2.97	2.85	2.74	2.41	2.23	2.02	1.79
0.01	100	6.90	4.82	3.98	3.51	3.21	2.99	2.82	2.69	2.59	2.50	2.22	2.07	1.89	1.69
0.025	100	5.18	3.83	3.25	2.92	2.70	2.54	2.42	2.32	2.24	2.18	1.97	1.85	1.71	1.56
0.05	100	3.94	3.09	2.70	2.46	2.31	2.19	2.10	2.03	1.97	1.93	1.77	1.68	1.57	1.45
0.10	100	2.76	2.36	2.14	2.00	1.91	1.83	1.78	1.73	1.69	1.66	1.56	1.49	1.42	1.34

Figure 12.6 *Lower Critical Values of F-Distributions*



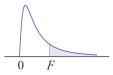
Lower Critical Values of F-Distributions

F tail area	df_1 / df_2	1	2	3	4	5	6	7	8	9	10	15	20	30	60
0.90	1	0.03	0.12	0.18	0.22	0.25	0.26	0.28	0.29	0.30	0.30	0.33	0.34	0.35	0.36
0.95	1	0.01	0.05	0.10	0.13	0.15	0.17	0.18	0.19	0.20	0.20	0.22	0.23	0.24	0.25
0.975	1	0.00	0.03	0.06	0.08	0.10	0.11	0.12	0.13	0.14	0.14	0.16	0.17	0.18	0.19
0.99	1	0.00	0.01	0.03	0.05	0.06	0.07	0.08	0.09	0.09	0.10	0.12	0.12	0.13	0.14
0.995	1	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.07	0.08	0.09	0.10	0.11	0.12
0.90	2	0.02	0.11	0.18	0.23	0.26	0.29	0.31	0.32	0.33	0.34	0.37	0.39	0.40	0.42
0.95	2	0.01	0.05	0.10	0.14	0.17	0.19	0.21	0.22	0.23	0.24	0.27	0.29	0.30	0.32
0.975	2	0.00	0.03	0.06	0.09	0.12	0.14	0.15	0.17	0.17	0.18	0.21	0.22	0.24	0.25
0.99	2	0.00	0.01	0.03	0.06	0.08	0.09	0.10	0.12	0.12	0.13	0.16	0.17	0.19	0.20
0.995	2	0.00	0.01	0.02	0.04	0.05	0.07	0.08	0.09	0.10	0.11	0.13	0.14	0.16	0.17
0.90	3	0.02	0.11	0.19	0.24	0.28	0.30	0.33	0.34	0.36	0.37	0.40	0.42	0.44	0.46
0.95	3	0.00	0.05	0.11	0.15	0.18	0.21	0.23	0.25	0.26	0.27	0.30	0.32	0.34	0.36
0.975	3	0.00	0.03	0.06	0.10	0.13	0.15	0.17	0.18	0.20	0.21	0.24	0.26	0.28	0.30
0.99	3	0.00	0.01	0.03	0.06	0.08	0.10	0.12	0.13	0.14	0.15	0.18	0.20	0.22	0.24
0.995	3	0.00	0.01	0.02	0.04	0.06	0.08	0.09	0.10	0.11	0.12	0.15	0.17	0.19	0.21
0.90	4	0.02	0.11	0.19	0.24	0.28	0.31	0.34	0.36	0.37	0.38	0.42	0.44	0.47	0.49
0.95	4	0.00	0.05	0.11	0.16	0.19	0.22	0.24	0.26	0.28	0.29	0.33	0.35	0.37	0.40
0.975	4	0.00	0.03	0.07	0.10	0.14	0.16	0.18	0.20	0.21	0.22	0.26	0.28	0.31	0.33
0.99	4	0.00	0.01	0.03	0.06	0.09	0.11	0.13	0.14	0.16	0.17	0.20	0.23	0.25	0.27
0.995	4	0.00	0.01	0.02	0.04	0.06	0.08	0.10	0.11	0.13	0.14	0.17	0.19	0.22	0.24
0.90	5	0.02	0.11	0.19	0.25	0.29	0.32	0.35	0.37	0.38	0.40	0.44	0.46	0.49	0.51
0.95	5	0.00	0.05	0.11	0.16	0.20	0.23	0.25	0.27	0.29	0.30	0.34	0.37	0.39	0.42
0.975	5	0.00	0.03	0.07	0.11	0.14	0.17	0.19	0.21	0.22	0.24	0.28	0.30	0.33	0.36
0.99	5	0.00	0.01	0.04	0.06	0.09	0.11	0.13	0.15	0.17	0.18	0.22	0.24	0.27	0.30
0.995	5	0.00	0.01	0.02	0.04	0.07	0.09	0.11	0.12	0.13	0.15	0.19	0.21	0.24	0.27
0.90	6	0.02	0.11	0.19	0.25	0.29	0.33	0.35	0.37	0.39	0.41	0.45	0.48	0.50	0.53
0.95	6	0.00	0.05	0.11	0.16	0.20	0.23	0.26	0.28	0.30	0.31	0.36	0.38	0.41	0.44
0.975	6	0.00	0.03	0.07	0.11	0.14	0.17	0.20	0.21	0.23	0.25	0.29	0.32	0.35	0.38
0.99	6	0.00	0.01	0.04	0.07	0.09	0.12	0.14	0.16	0.17	0.19	0.23	0.26	0.29	0.32
0.995	6	0.00	0.01	0.02	0.05	0.07	0.09	0.11	0.13	0.14	0.15	0.2	00.22	0.25	0.29
0.90	7	0.02	0.11	0.19	0.25	0.30	0.33	0.36	0.38	0.40	0.41	0.46	0.49	0.52	0.55
0.95	7	0.00	0.05	0.11	0.16	0.21	0.24	0.26	0.29	0.30	0.32	0.37	0.40	0.43	0.46
0.975	7	0.00	0.03	0.07	0.11	0.15	0.18	0.20	0.22	0.24	0.25	0.30	0.33	0.36	0.40
0.99	7	0.00	0.01	0.04	0.07	0.10	0.12	0.14	0.16	0.18	0.19	0.24	0.27	0.30	0.34
0.995	7	0.00	0.01	0.02	0.05	0.07	0.09	0.11	0.13	0.15	0.16	0.21	0.23	0.27	0.3



Lower Critical Values of F-Distributions

F tail area	df_1 / df_2	1	2	3	4	5	6	7	8	9	10	15	20	30	60
0.90	8	0.02	0.11	0.19	0.25	0.30	0.34	0.36	0.39	0.40	0.42	0.47	0.50	0.53	0.56
0.95	8	0.00	0.05	0.11	0.17	0.21	0.24	0.27	0.29	0.31	0.33	0.38	0.41	0.44	0.48
0.975	8	0.00	0.03	0.07	0.11	0.15	0.18	0.20	0.23	0.24	0.26	0.31	0.34	0.38	0.41
0.99	8	0.00	0.01	0.04	0.07	0.10	0.12	0.15	0.17	0.18	0.20	0.25	0.28	0.32	0.35
0.995	8	0.00	0.01	0.02	0.05	0.07	0.09	0.12	0.13	0.15	0.16	0.21	0.24	0.28	0.32
0.90	9	0.02	0.11	0.19	0.25	0.30	0.34	0.37	0.39	0.41	0.43	0.48	0.51	0.54	0.58
0.95	9	0.00	0.05	0.11	0.17	0.21	0.24	0.27	0.30	0.31	0.33	0.39	0.42	0.45	0.49
0.975	9	0.00	0.03	0.07	0.11	0.15	0.18	0.21	0.23	0.25	0.26	0.32	0.35	0.39	0.43
0.99	9	0.00	0.01	0.04	0.07	0.10	0.13	0.15	0.17	0.19	0.20	0.26	0.29	0.33	0.37
0.995	9	0.00	0.01	0.02	0.05	0.07	0.10	0.12	0.14	0.15	0.17	0.22	0.25	0.29	0.33
0.90	10	0.02	0.11	0.19	0.26	0.30	0.34	0.37	0.39	0.41	0.43	0.49	0.52	0.55	0.59
0.95	10	0.00	0.05	0.11	0.17	0.21	0.25	0.27	0.30	0.32	0.34	0.39	0.43	0.46	0.50
0.975	10	0.00	0.03	0.07	0.11	0.15	0.18	0.21	0.23	0.25	0.27	0.33	0.36	0.40	0.44
0.99	10	0.00	0.01	0.04	0.07	0.10	0.13	0.15	0.17	0.19	0.21	0.26	0.30	0.34	0.38
0.995	10	0.00	0.01	0.02	0.05	0.07	0.10	0.12	0.14	0.16	0.17	0.23	0.26	0.30	0.34
0.90	11	0.02	0.11	0.19	0.26	0.30	0.34	0.37	0.40	0.42	0.43	0.49	0.52	0.56	0.60
0.95	11	0.00	0.05	0.11	0.17	0.21	0.25	0.28	0.30	0.32	0.34	0.40	0.43	0.47	0.51
0.975	11	0.00	0.03	0.07	0.11	0.15	0.18	0.21	0.24	0.26	0.27	0.33	0.37	0.41	0.45
0.99	11	0.00	0.01	0.04	0.07	0.10	0.13	0.15	0.17	0.19	0.21	0.27	0.30	0.34	0.39
0.995	11	0.00	0.01	0.02	0.05	0.07	0.10	0.12	0.14	0.16	0.17	0.23	0.27	0.31	0.36
0.90	12	0.02	0.11	0.19	0.26	0.31	0.34	0.37	0.40	0.42	0.44	0.50	0.53	0.56	0.60
0.95	12	0.00	0.05	0.11	0.17	0.21	0.25	0.28	0.30	0.33	0.34	0.40	0.44	0.48	0.52
0.975	12	0.00	0.03	0.07	0.11	0.15	0.19	0.21	0.24	0.26	0.28	0.34	0.37	0.41	0.46
0.99	12	0.00	0.01	0.04	0.07	0.10	0.13	0.15	0.18	0.20	0.21	0.27	0.31	0.35	0.40
0.995	12	0.00	0.01	0.02	0.05	0.07	0.10	0.12	0.14	0.16	0.18	0.24	0.27	0.31	0.36
0.90	13	0.02	0.11	0.19	0.26	0.31	0.35	0.38	0.40	0.42	0.44	0.50	0.53	0.57	0.61
0.95	13	0.00	0.05	0.11	0.17	0.21	0.25	0.28	0.31	0.33	0.35	0.41	0.44	0.48	0.53
0.975	13	0.00	0.03	0.07	0.11	0.15	0.19	0.22	0.24	0.26	0.28	0.34	0.38	0.42	0.47
0.99	13	0.00	0.01	0.04	0.07	0.10	0.13	0.16	0.18	0.20	0.22	0.28	0.31	0.36	0.41
0.995	13	0.00	0.01	0.02	0.05	0.08	0.10	0.12	0.14	0.16	0.18	0.24	0.28	0.32	0.37
0.90	14	0.02	0.11	0.19	0.26	0.31	0.35	0.38	0.40	0.43	0.44	0.50	0.54	0.58	0.62
0.95	14	0.00	0.05	0.11	0.17	0.22	0.25	0.28	0.31	0.33	0.35	0.41	0.45	0.49	0.54
0.975	14	0.00	0.03	0.07	0.12	0.15	0.19	0.22	0.24	0.26	0.28	0.35	0.38	0.43	0.48
0.99	14	0.00	0.01	0.04	0.07	0.10	0.13	0.16	0.18	0.20	0.22	0.28	0.32	0.36	0.42
0.995	14	0.00	0.01	0.02	0.05	0.08	0.10	0.12	0.15	0.16	0.18	0.24	0.28	0.33	0.38



Lower Critical Values of *F*-Distributions

F tail area	df_1 / df_2	1	2	3	4	5	6	7	8	9	10	15	20	30	60
0.90	15	0.02	0.11	0.19	0.26	0.31	0.35	0.38	0.41	0.43	0.45	0.51	0.54	0.58	0.62
0.95	15	0.00	0.05	0.11	0.17	0.22	0.25	0.28	0.31	0.33	0.35	0.42	0.45	0.50	0.54
0.975	15	0.00	0.03	0.07	0.12	0.16	0.19	0.22	0.24	0.27	0.28	0.35	0.39	0.43	0.49
0.99	15	0.00	0.01	0.04	0.07	0.10	0.13	0.16	0.18	0.20	0.22	0.28	0.32	0.37	0.43
0.995	15	0.00	0.01	0.02	0.05	0.08	0.10	0.13	0.15	0.17	0.18	0.25	0.29	0.33	0.39
0.90	20	0.02	0.11	0.19	0.26	0.31	0.35	0.39	0.41	0.44	0.45	0.52	0.56	0.60	0.65
0.95	20	0.00	0.05	0.12	0.17	0.22	0.26	0.29	0.32	0.34	0.36	0.43	0.47	0.52	0.57
0.975	20	0.00	0.03	0.07	0.12	0.16	0.19	0.22	0.25	0.27	0.29	0.36	0.41	0.46	0.51
0.99	20	0.00	0.01	0.04	0.07	0.10	0.14	0.16	0.19	0.21	0.23	0.30	0.34	0.39	0.45
0.995	20	0.00	0.01	0.02	0.05	0.08	0.1	00.13	0.15	0.17	0.19	0.26	0.30	0.35	0.42
0.90	30	0.02	0.11	0.19	0.26	0.32	0.36	0.39	0.42	0.44	0.46	0.53	0.58	0.62	0.68
0.95	30	0.00	0.05	0.12	0.17	0.22	0.26	0.30	0.32	0.35	0.37	0.45	0.49	0.54	0.61
0.975	30	0.00	0.03	0.07	0.12	0.16	0.20	0.23	0.26	0.28	0.30	0.38	0.43	0.48	0.55
0.99	30	0.00	0.01	0.04	0.07	0.11	0.14	0.17	0.19	0.22	0.24	0.31	0.36	0.42	0.49
0.995	30	0.00	0.01	0.02	0.05	0.08	0.11	0.13	0.16	0.18	0.20	0.27	0.32	0.38	0.46
0.90	40	0.02	0.11	0.19	0.26	0.32	0.36	0.39	0.42	0.45	0.47	0.54	0.59	0.64	0.70
0.95	40	0.00	0.05	0.12	0.17	0.22	0.26	0.30	0.33	0.35	0.38	0.45	0.50	0.56	0.63
0.975	40	0.00	0.03	0.07	0.12	0.16	0.20	0.23	0.26	0.29	0.31	0.39	0.44	0.50	0.57
0.99	40	0.00	0.01	0.04	0.07	0.11	0.14	0.17	0.20	0.22	0.24	0.32	0.37	0.43	0.52
0.995	40	0.00	0.01	0.02	0.05	0.08	0.11	0.13	0.16	0.18	0.20	0.28	0.33	0.40	0.48
0.90	50	0.02	0.11	0.19	0.26	0.32	0.36	0.40	0.43	0.45	0.47	0.55	0.59	0.64	0.71
0.95	50	0.00	0.05	0.12	0.18	0.23	0.27	0.30	0.33	0.36	0.38	0.46	0.51	0.57	0.64
0.975	50	0.00	0.03	0.07	0.12	0.16	0.20	0.23	0.26	0.29	0.31	0.39	0.44	0.51	0.59
0.99	50	0.00	0.01	0.04	0.07	0.11	0.14	0.17	0.20	0.22	0.24	0.32	0.38	0.45	0.53
0.995	50	0.00	0.01	0.02	0.05	0.08	0.11	0.14	0.16	0.18	0.20	0.28	0.34	0.41	0.50
0.90	60	0.02	0.11	0.19	0.26	0.32	0.36	0.40	0.43	0.45	0.47	0.55	0.60	0.65	0.72
0.95	60	0.00	0.05	0.12	0.18	0.23	0.27	0.30	0.33	0.36	0.38	0.46	0.51	0.57	0.65
0.975	60	0.00	0.03	0.07	0.12	0.16	0.20	0.24	0.26	0.29	0.31	0.40	0.45	0.52	0.60
0.99	60	0.00	0.01	0.04	0.07	0.11	0.14	0.17	0.20	0.22	0.24	0.33	0.38	0.45	0.54
0.995	60	0.00	0.01	0.02	0.05	0.08	0.11	0.14	0.16	0.18	0.21	0.29	0.34	0.41	0.51
0.90	100	0.02	0.11	0.19	0.26	0.32	0.36	0.40	0.43	0.46	0.48	0.56	0.61	0.66	0.74
0.95	100	0.00	0.05	0.12	0.18	0.23	0.27	0.31	0.34	0.36	0.39	0.47	0.52	0.59	0.68
0.975	100	0.00	0.03	0.07	0.12	0.16	0.20	0.24	0.27	0.29	0.32	0.40	0.46	0.53	0.63
0.99	100	0.00	0.01	0.04	0.07	0.11	0.14	0.17	0.20	0.23	0.25	0.34	0.39	0.47	0.57
0.995	100	0.00	0.01	0.02	0.05	0.08	0.11	0.14	0.16	0.19	0.21	0.29	0.35	0.43	0.54