

Some Common Probability Distributions

Area under the Standard Normal Curve

$A(z_\alpha) = \int_0^{z_\alpha} \frac{1}{\sqrt{2\pi}} e^{-\frac{z^2}{2}} dz$

Distribution of X		Probability mass/density function		$E(X)$	$\text{Var}(X)$	Moment generating function $M_X(t)$
Bernoulli where $0 < p < 1$	Ber(p)	$p^x(1-p)^{1-x}$ for $x = 0, 1$		p	$p(1-p)$	$pe^t + 1 - p$ for $t \in \mathbb{R}$
Binomial where $n \in \mathbb{N}, 0 < p < 1$	B(n, p)	$\binom{n}{x} p^x(1-p)^{n-x}$ for $x = 0, 1, 2, \dots, n$		np	$np(1-p)$	$(pe^t + 1 - p)^n$ for $t \in \mathbb{R}$
Geometric where $0 < p < 1$	Geo(p)	$(1-p)^{x-1}p$ for $x = 1, 2, 3, \dots$		$\frac{1}{p}$	$\frac{1-p}{p^2}$	$\frac{pe^t}{1-(1-p)e^t}$ for $t < -\ln(1-p)$
Negative binomial where $r \in \mathbb{N}, 0 < p < 1$	NB(r, p)	$\binom{x-1}{r-1} (1-p)^{x-r} p^r$ for $x = r, r+1, r+2, \dots$		$\frac{r}{p}$	$\frac{r(1-p)}{p^2}$	$\left[\frac{pe^t}{1-(1-p)e^t} \right]^r$ for $t < -\ln(1-p)$
Hypergeometric where $N \in \mathbb{N}, m, n \in \{0, \dots, N\}$	Hyp(N, m, n)	$\frac{\binom{m}{x} \binom{N-m}{n-x}}{\binom{N}{n}}$ for $x \in \{\max(0, n+m-N), \dots, \min(n, m)\}$		$\frac{nm}{N}$	$\left(\frac{N-n}{N-1}\right) n \left(\frac{m}{N}\right) \left(1 - \frac{m}{N}\right)$	
Poisson where $\lambda > 0$	Po(λ)	$\frac{e^{-\lambda} \lambda^x}{x!}$ for $x = 0, 1, 2, \dots$		λ	λ	$e^{\lambda(e^t-1)}$ for $t \in \mathbb{R}$
Uniform where $a, b \in \mathbb{R}, a < b$	U(a, b)	$\frac{1}{b-a}$ for $a < x < b$		$\frac{a+b}{2}$	$\frac{(b-a)^2}{12}$	
Exponential where $\lambda > 0$	Exp(λ)	$\lambda e^{-\lambda x}$ for $x > 0$		$\frac{1}{\lambda}$	$\frac{1}{\lambda^2}$	$\frac{\lambda}{\lambda-t}$ for $t < \lambda$
Gamma where $\alpha, \lambda > 0$	$\Gamma(\alpha, \lambda)$	$\frac{\lambda^\alpha}{\Gamma(\alpha)} x^{\alpha-1} e^{-\lambda x}$ for $x > 0$		α/λ	$\left(\frac{\lambda}{\lambda-t}\right)^\alpha$	for $t < \lambda$
Normal where $\mu \in \mathbb{R}, \sigma > 0$	N(μ, σ^2)	$\frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$ for $x \in \mathbb{R}$		μ	σ^2	$e^{\mu t + \frac{1}{2}\sigma^2 t^2}$ for $t \in \mathbb{R}$
Chi-squared where $r \in \mathbb{N}$	$\chi^2(r)$	$\frac{1}{\Gamma(\frac{r}{2}) 2^{\frac{r}{2}}} x^{\frac{r}{2}-1} e^{-\frac{x}{2}}$ for $x > 0$		r	$2r$	$\frac{1}{(1-2t)^{\frac{r}{2}}}$ for $t < \frac{1}{2}$
Student's t where $r \in \mathbb{N}$	$t(r)$	$\frac{\Gamma(\frac{r+1}{2})}{\sqrt{r\pi}\Gamma(\frac{r}{2})} \left(1 + \frac{x^2}{r}\right)^{-\frac{r+1}{2}}$ for $x \in \mathbb{R}$		0 for $r > 1$	$\frac{r}{r-2}$ for $r > 2$	
Snedecor's F where $m, n \in \mathbb{N}$	$F(m, n)$	$\frac{\Gamma(\frac{m+n}{2})}{\Gamma(\frac{m}{2}) \Gamma(\frac{n}{2})} \left(\frac{m}{n}\right)^{\frac{m}{2}} x^{\frac{m}{2}-1} \left(1 + \frac{m}{n}x\right)^{-\frac{m+n}{2}}$ for $x > 0$		$\frac{n}{n-2}$ for $n > 2$	$\frac{2n^2(m+n-2)}{m(n-2)^2(n-4)}$ for $n > 4$	
Beta where $\alpha, \beta > 0$	Beta(α, β)	$\frac{\Gamma(\alpha+\beta)}{\Gamma(\alpha)\Gamma(\beta)} x^{\alpha-1} (1-x)^{\beta-1}$ for $0 < x < 1$		$\frac{\alpha}{\alpha+\beta}$	$\frac{\alpha\beta}{(\alpha+\beta)^2(\alpha+\beta+1)}$	

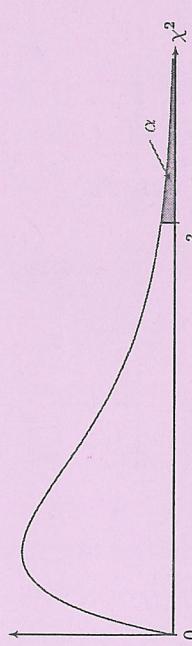
Notes: $\Gamma(\alpha) = \int_0^\infty x^{\alpha-1} e^{-x} dx$ for $\alpha > 0$; $\Gamma(\alpha) = (\alpha-1)\Gamma(\alpha-1)$, $\Gamma(1) = 1$, $\Gamma(\frac{1}{2}) = \sqrt{\pi}$.

z_α	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4986	0.4986	
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990
3.1	0.4990	0.4991	0.4991	0.4991	0.4992	0.4992	0.4992	0.4993	0.4993	
3.2	0.4993	0.4993	0.4994	0.4994	0.4994	0.4994	0.4994	0.4995	0.4995	
3.3	0.4995	0.4995	0.4995	0.4996	0.4996	0.4996	0.4996	0.4996	0.4996	
3.4	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	
3.5	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	
3.6	0.4998	0.4998	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	

$$A(z_\alpha) = \int_0^{z_\alpha} \frac{1}{\sqrt{2\pi}} e^{-\frac{z^2}{2}} dz$$

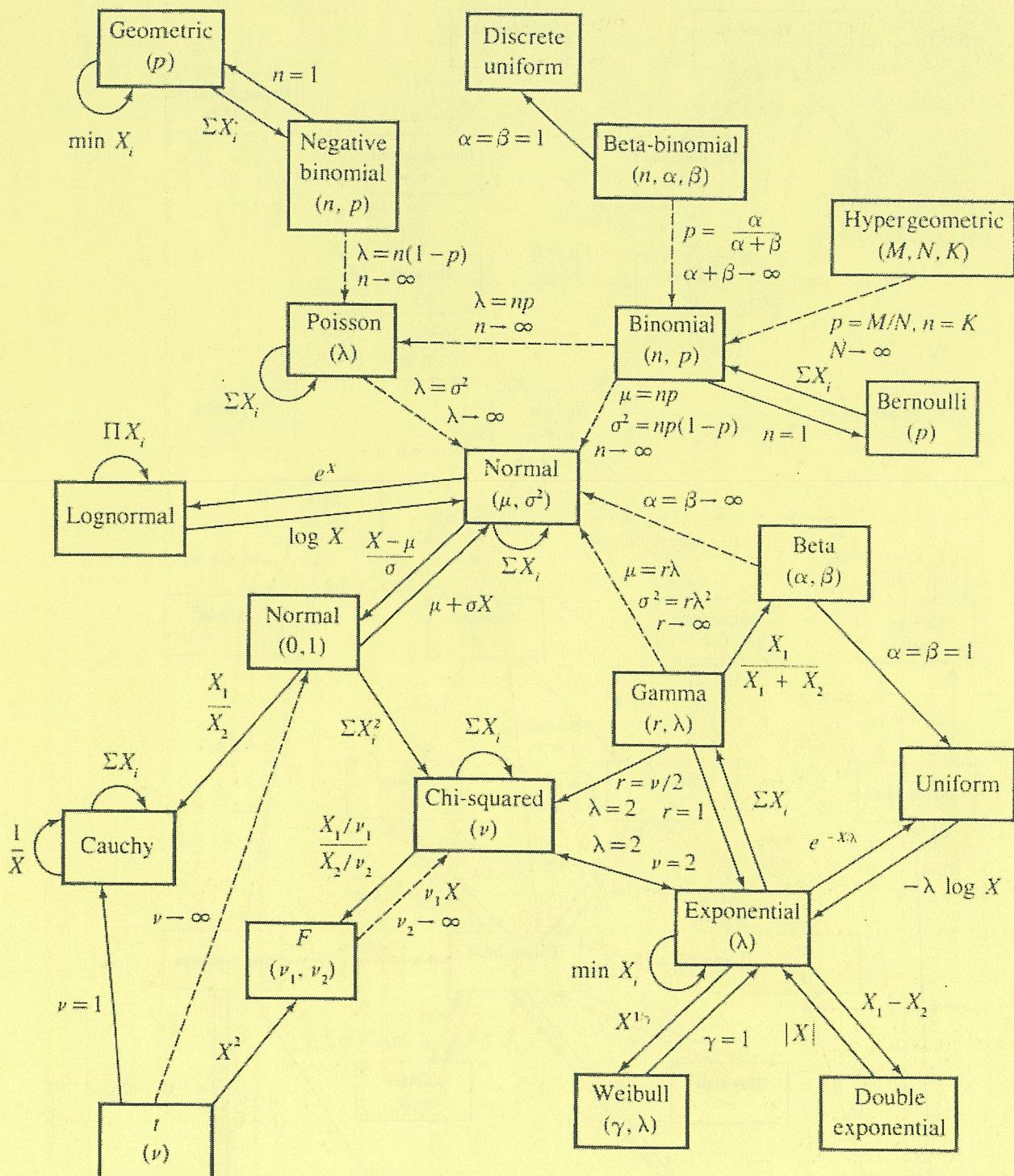
The Chi-Squared Distribution Table

The *t*-Distribution Table

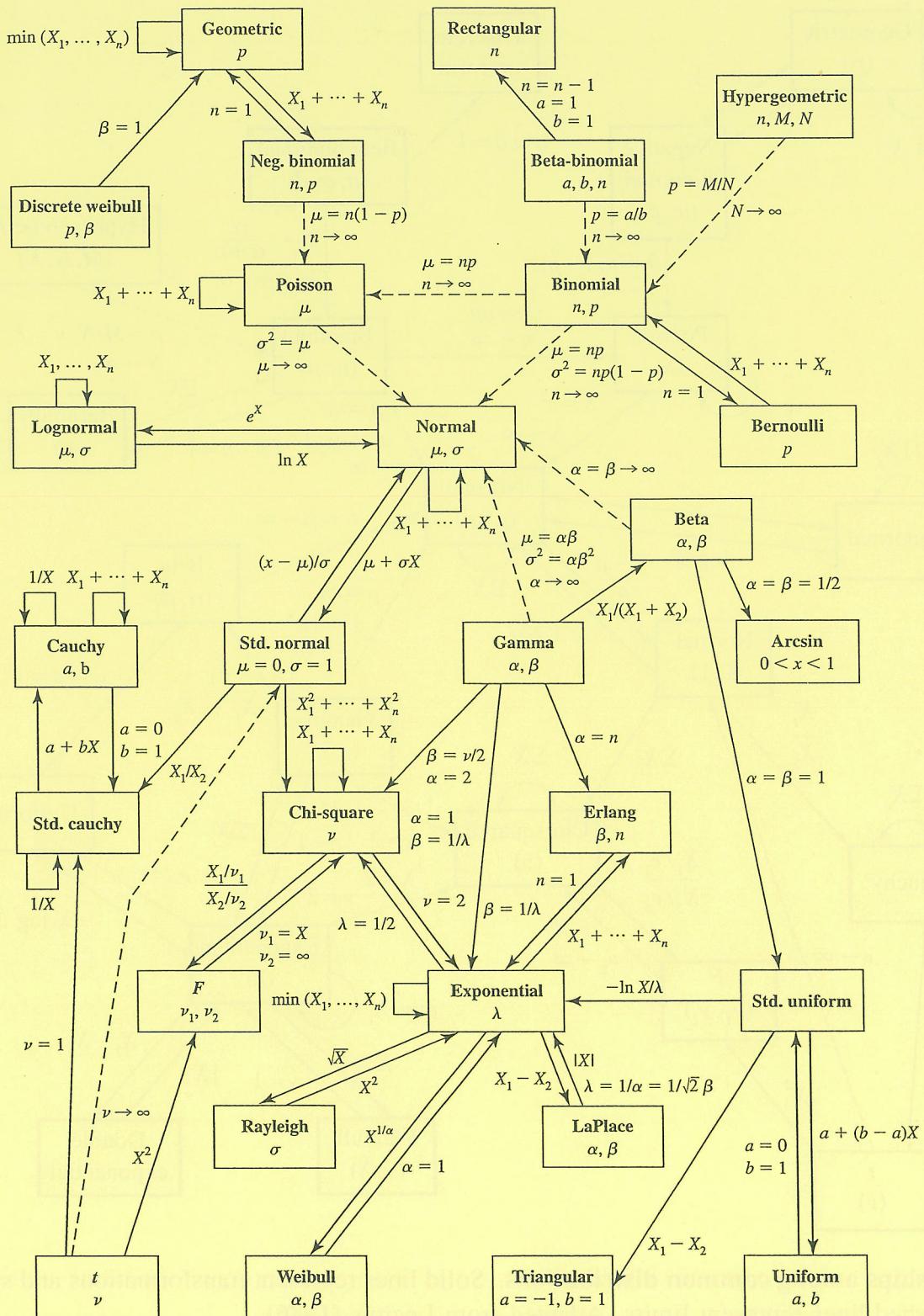


		Tail probability α											
df	ν	0.25	0.2	0.15	0.1	0.05	0.025	0.01	0.005	0.0025	0.001	0.0005	
1	0.999	0.995	0.99	0.975	0.95	0.9	0.75	0.5	0.25	0.1	0.05	0.025	0.01
1	0.000	0.000	0.000	0.001	0.004	0.016	0.022	0.045	0.102	0.204	0.435	0.879	10.828
2	0.002	0.010	0.020	0.051	0.103	0.211	0.575	1.386	2.773	4.605	5.991	7.378	9.210
3	0.024	0.072	0.115	0.216	0.352	0.584	1.213	2.366	4.108	6.251	7.815	9.348	11.345
4	0.091	0.207	0.297	0.484	0.711	1.064	1.923	3.357	5.385	7.779	9.488	11.143	13.277
5	0.210	0.412	0.554	0.831	1.145	1.610	2.675	4.351	6.626	9.236	11.070	12.833	15.086
6	0.381	0.676	0.872	1.237	1.635	2.204	3.455	5.348	7.841	10.645	12.592	14.449	16.812
7	0.598	0.989	1.239	1.690	2.167	2.833	4.255	6.346	9.037	12.017	14.067	16.013	18.475
8	0.857	1.344	1.646	2.180	2.733	3.490	5.071	7.344	10.219	13.362	15.507	17.535	20.690
9	1.152	1.735	2.088	2.700	3.325	4.168	5.899	8.343	11.389	14.684	16.919	19.023	21.666
10	1.479	2.156	2.558	3.247	3.940	4.865	6.737	9.342	12.549	15.987	18.307	20.483	23.209
11	1.834	2.603	3.053	3.816	4.575	5.578	7.584	10.341	13.701	17.275	19.675	21.920	24.725
12	2.214	3.074	3.571	4.404	5.226	6.304	8.438	11.340	14.845	18.549	21.026	23.337	26.217
13	2.617	3.565	4.107	5.009	5.892	7.042	9.299	12.340	15.984	19.812	22.320	24.736	27.688
14	3.041	4.075	4.660	5.629	6.571	7.790	10.165	13.339	17.117	21.064	23.685	26.119	29.909
15	3.483	4.601	5.229	6.262	7.261	8.547	11.037	14.339	18.245	22.307	24.906	27.488	30.578
16	3.942	5.142	5.812	6.908	7.902	9.312	11.912	15.338	19.369	23.542	26.296	28.845	32.000
17	4.416	5.697	6.408	7.564	8.672	10.085	12.792	16.338	20.489	24.769	27.537	30.191	33.409
18	4.905	6.265	7.015	8.231	9.390	10.865	13.675	17.338	21.605	25.969	28.869	31.526	34.805
19	5.407	6.844	7.633	8.907	10.117	11.651	14.562	18.338	22.718	27.204	30.144	32.852	36.191
20	5.921	7.434	8.260	9.591	10.851	12.443	15.452	19.337	23.828	28.412	31.410	34.170	37.566
21	6.447	8.034	8.897	10.233	11.591	13.240	16.344	20.337	24.935	29.615	32.671	35.479	38.332
22	6.983	8.643	9.542	10.982	12.338	14.041	17.240	21.337	26.039	30.813	33.924	36.781	40.289
23	7.529	9.260	10.196	11.659	13.091	14.848	18.137	22.337	27.141	32.007	35.172	38.076	41.638
24	8.085	9.886	10.856	12.401	13.846	15.659	19.037	23.337	28.241	33.196	36.415	39.364	42.880
25	8.649	10.520	11.524	13.120	14.611	16.473	19.339	24.337	29.339	34.332	37.652	40.646	44.314
26	9.222	11.160	12.198	13.844	15.379	17.292	20.843	25.336	30.435	35.563	38.885	41.923	45.642
27	9.803	11.808	12.879	14.573	16.151	18.114	21.749	26.336	31.528	36.741	40.113	43.195	46.963
28	10.391	12.461	13.505	15.308	16.928	18.939	22.657	27.336	32.620	37.916	41.337	44.461	48.278
29	10.986	13.121	14.256	16.047	17.708	19.768	23.567	28.336	33.711	39.087	42.557	45.722	49.588
30	11.583	13.787	14.953	16.791	18.493	20.599	24.478	29.336	34.800	40.256	43.773	46.979	50.892
40	17.916	20.707	22.164	24.433	26.509	29.051	33.660	39.335	45.616	51.805	55.758	59.342	63.691
50	24.674	27.991	29.707	32.357	34.764	37.689	42.942	49.335	56.334	63.167	67.505	71.420	76.154
60	31.738	35.534	37.485	40.482	43.188	46.459	52.294	59.335	66.981	74.397	79.082	83.279	91.952
70	39.036	43.275	45.442	48.758	51.739	55.329	61.698	69.334	77.577	85.527	90.531	100.425	112.317
80	46.520	51.172	53.540	57.153	60.391	64.278	71.145	79.334	88.130	96.578	101.879	106.629	112.329
90	54.155	59.196	61.754	65.647	69.126	73.291	80.625	89.334	98.650	107.565	113.145	118.136	124.116
100	61.918	67.328	70.065	74.222	77.929	82.358	90.133	99.334	109.141	118.498	124.342	135.807	140.169
120	77.755	83.852	86.923	91.573	95.705	100.624	109.220	119.334	130.055	140.233	146.567	152.211	158.950

df	ν	0.25	0.2	0.15	0.1	0.05	0.025	0.01	0.005	0.0025	0.001	0.0005
1	1	1.000	1.376	1.963	3.078	6.314	12.706	15.895	31.821	63.657	127.321	318.309
2	2	0.816	1.061	1.386	1.886	2.920	4.303	4.849	6.925	9.925	14.089	22.327
3	3	0.765	0.978	1.250	1.638	2.353	3.182	3.482	4.541	5.841	7.453	10.215
4	4	0.741	0.941	1.190	1.533	2.132	2.776	2.969	3.747	4.604	5.598	7.173
5	5	0.727	0.920	1.156	1.476	2.015	2.571	2.757	3.365	4.032	4.773	5.893
6	6	0.718	0.906	1.134	1.440	1.943	2.447	2.612	3.143	3.707	4.317	5.208
7	7	0.711	0.896	1.119	1.415	1.895	2.365	2.517	2.998	3.499	4.029	4.785
8	8	0.706	0.889	1.108	1.397	1.860	2.306	2.449	2.896	3.355	3.833	4.501
9	9	0.703	0.883	1.100	1.363	1.833	2.262	2.398	2.821	3.250	3.690	4.297
10	10	0.700	0.879	1.093	1.372	1.812	2.228	2.359	2.764	3.169	3.581	4.144
11	11	0.697	0.876	1.088	1.363	1.796	2.201	2.328	2.718	3.106	3.497	4.025
12	12	0.695	0.873	1.083	1.356	1.782	2.179	2.303	2.681	3.055	3.428	3.930
13	13	0.694	0.870	1.079	1.350	1.771	2.160	2.282	2.650	3.012	3.372	3.852
14	14	0.692	0.868	1.076	1.345	1.761	2.145	2.264	2.624	2.977	3.326	3.787
15	15	0.691	0.866	1.074	1.341	1.753	2.131	2.249	2.602	2.947	3.286	3.733
16	16	0.690	0.865	1.071	1.337	1.746	2.120	2.235	2.583	2.921	3.252	3.686
17	17	0.689	0.863	1.069	1.333	1.740	2.110	2.224	2.567	2.898	3.222	3.646
18	18	0.688	0.862	1.067	1.330	1.734	2.101	2.214	2.552	2.878	3.197	3.610
19	19	0.688	0.861	1.066	1.328	1.729	2.093	2.205	2.539	2.861	3.174	3.579
20	20	0.687	0.860	1.064	1.325	1.725	2.086	2.197	2.528	2.845	3.153	3.552
21	21	0.686	0.859	1.063	1.323	1.721	2.080	2.189	2.518	2.831	3.135	3.527
22	22	0.686	0.858	1.061	1.321	1.717	2.074	2.183	2.508	2.819	3.119	3.505
23	23	0.685	0.858	1.060	1.319	1.714	2.069	2.177	2.500	2.807	3.104	3.485
24	24	0.685	0.857	1.059	1.318	1.711	2.064	2.172	2.492	2.797	3.091	3.467
25	25	0.684	0.856	1.058	1.316	1.708	2.060	2.167	2.485	2.787	3.078	3.450
26	26	0.684	0.856	1.058	1.315	1.706	2.056	2.162	2.479	2.779	3.067	3.435
27	27	0.684	0.855	1.057	1.314	1.703	2.052	2.158	2.473	2.771	3.057	3.421
28	28	0.683	0.855	1.056	1.313	1.701	2.048	2.154	2.467	2.763	3.047	3.408
29	29	0.683	0.854	1.055	1.311	1.699	2.045	2.150	2.462	2.756	3.038	3.396
30	30	0.683	0.854	1.055	1.310	1.697	2.042	2.147	2.457	2.750	3.030	3.385
40	40	0.681	0.851	1.050	1.303	1.684	2.021	2.123	2.423	2.704	2.971	3.307
50	50	0.679	0.849	1.04								



Relationships among common distributions. Solid lines represent transformations and special cases, dashed lines represent limits. Adapted from Leemis (1986).



Adapted from Leemis, L. M. (1986), "Relationships among common univariate distributions," *The American Statistician*, Vol. 40, No. 2, pp. 143–146. With permission.