

Table 1

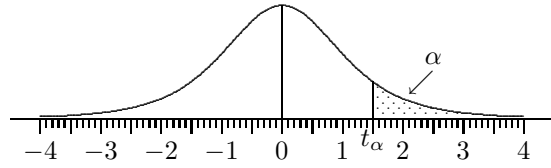
CDF for Standard Normal.

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	.9279	.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

 $\Phi(0.6745) = 0.75 \quad \Phi(1.6449) = 0.95 \quad \Phi(2.3263) = 0.99 \quad \Phi(3.0902) = 0.999$
 $\Phi(1.2816) = 0.90 \quad \Phi(1.9600) = 0.975 \quad \Phi(2.5758) = 0.995 \quad \Phi(3.2905) = 0.9995$

TABLE 2 Critical Values for Student's t

$$\alpha = \int_{t_\alpha}^{\infty} c \frac{dt}{(1+t^2/\nu)^{(\nu+1)/2}}$$



ν	$t_{.40}$	$t_{.30}$	$t_{.20}$	$t_{.15}$	$t_{.10}$	$t_{.05}$	$t_{.025}$	$t_{.01}$	$t_{.005}$	$t_{.001}$	$t_{.0005}$	$t_{.0001}$
1	0.325	0.727	1.376	1.9626	3.078	6.314	12.76	31.82	63.66	318.3	636.6	3183.
2	0.289	0.617	1.061	1.3862	1.886	2.920	4.303	6.965	9.925	22.33	31.60	70.70
3	0.277	0.584	0.978	1.2498	1.638	2.353	3.182	4.541	5.841	10.22	12.92	22.20
4	0.271	0.569	0.941	1.1896	1.533	2.132	2.776	3.747	4.604	7.173	8.610	13.03
5	0.267	0.559	0.920	1.1558	1.476	2.015	2.571	3.365	4.032	5.893	6.869	9.678
6	0.265	0.553	0.906	1.1342	1.440	1.943	2.447	3.143	3.707	5.208	5.959	8.025
7	0.263	0.549	0.896	1.1192	1.415	1.895	2.365	2.998	3.499	4.785	5.408	7.063
8	0.262	0.546	0.889	1.1081	1.397	1.860	2.306	2.896	3.355	4.501	5.041	6.442
9	0.261	0.543	0.883	1.0997	1.383	1.833	2.262	2.821	3.250	4.297	4.781	6.010
10	0.260	0.542	0.879	1.0931	1.372	1.812	2.228	2.764	3.169	4.144	4.587	5.694
11	0.260	0.540	0.876	1.0877	1.363	1.796	2.201	2.718	3.106	4.025	4.437	5.453
12	0.259	0.539	0.873	1.0832	1.356	1.782	2.179	2.681	3.055	3.930	4.318	5.263
13	0.259	0.538	0.870	1.0795	1.350	1.771	2.160	2.650	3.012	3.852	4.221	5.111
14	0.258	0.537	0.868	1.0763	1.345	1.761	2.145	2.624	2.977	3.787	4.140	4.985
15	0.258	0.536	0.866	1.0735	1.341	1.753	2.131	2.602	2.947	3.733	4.073	4.880
16	0.258	0.535	0.865	1.0711	1.337	1.746	2.120	2.583	2.921	3.686	4.015	4.791
17	0.257	0.534	0.863	1.0690	1.333	1.740	2.110	2.567	2.898	3.646	3.965	4.714
18	0.257	0.534	0.862	1.0672	1.330	1.734	2.101	2.552	2.878	3.610	3.922	4.648
19	0.257	0.533	0.861	1.0655	1.328	1.729	2.093	2.539	2.861	3.579	3.883	4.590
20	0.257	0.533	0.860	1.0640	1.325	1.725	2.086	2.528	2.845	3.552	3.85	4.539
21	0.257	0.532	0.859	1.0627	1.323	1.721	2.080	2.518	2.831	3.527	3.819	4.493
22	0.256	0.532	0.858	1.0614	1.321	1.717	2.074	2.508	2.819	3.505	3.792	4.452
23	0.256	0.532	0.858	1.0603	1.319	1.714	2.069	2.500	2.807	3.485	3.768	4.415
24	0.256	0.531	0.857	1.0593	1.318	1.711	2.064	2.492	2.797	3.467	3.745	4.382
25	0.256	0.531	0.856	1.0584	1.316	1.708	2.060	2.485	2.787	3.450	3.725	4.352
26	0.256	0.531	0.856	1.0575	1.315	1.706	2.056	2.479	2.779	3.435	3.707	4.324
27	0.256	0.531	0.855	1.0567	1.314	1.703	2.052	2.473	2.771	3.421	3.690	4.299
28	0.256	0.530	0.855	1.0560	1.313	1.701	2.048	2.467	2.763	3.408	3.674	4.275
29	0.256	0.530	0.854	1.0553	1.311	1.699	2.045	2.462	2.756	3.396	3.659	4.254
30	0.256	0.530	0.854	1.0547	1.310	1.697	2.042	2.457	2.750	3.385	3.646	4.234
40	0.255	0.529	0.851	1.0500	1.303	1.684	2.021	2.423	2.704	3.307	3.551	4.094
60	0.254	0.527	0.848	1.0455	1.296	1.671	2.000	2.390	2.660	3.232	3.460	3.962
120	0.254	0.526	0.845	1.0409	1.289	1.658	1.980	2.358	2.617	3.160	3.373	3.837
∞	0.253	0.524	0.842	1.0364	1.282	1.645	1.960	2.326	2.576	3.090	3.291	3.719

Distributions

Binomial	$\Pr[X = x] = \binom{n}{x} p^x q^{(n-x)}, x = 0, 1, \dots, n$	$\mu = np, \sigma^2 = npq$
Poisson	$\Pr[X = k] = \lambda^k e^{-\lambda} / k!, k = 0, 1, \dots$	$\mu = \lambda, \sigma^2 = \lambda$
Geometric	$\Pr[X = x] = pq^x, y = 0, 1, 2, \dots$	$\mu = q/p, \sigma^2 = q/p^2$
Exponential	$\Pr[X \leq x] = 1 - e^{-\lambda x}, x \in (0, \infty)$	$\mu = 1/\lambda, \sigma^2 = 1/\lambda^2$
	$f(x) = \lambda e^{-\lambda x}, x > 0; 0, x \leq 0$	
Uniform	$\Pr[X \leq x] = (x - a)/(b - a), x \in (a, b)$	$\mu = \frac{a+b}{2}, \sigma^2 = \frac{(b-a)^2}{12}$
	$f(x) = \frac{1}{b-a}, a < x < b; 0, x \notin (a, b)$	
Normal	$\Pr[X \leq x] = \Phi\left(\frac{x - \mu}{\sigma}\right), x \in \mathbb{R}$	$\mu = \mu, \sigma^2 = \sigma^2$
	$f(x) = \frac{1}{\sqrt{2\pi}\sigma} e^{-(x-\mu)^2/2\sigma^2}, x \in \mathbb{R}$	

$$P_k^n = \frac{n!}{(n-k)!} = \overbrace{(n)(n-1) \cdots (n-k+1)}^{k \text{ terms}}$$

$$\text{"}n \text{ choose } k\text{"}: \binom{n}{k} = \frac{n!}{k!(n-k)!} = \frac{(n)(n-1) \cdots (n-k+1)}{(k)(k-1) \cdots (1)}$$

$$(a+b)^n = \sum_{k=0}^n \binom{n}{k} a^k b^{n-k}$$

$$\sum_{k=0}^{\infty} ar^k = a/(1-r)$$

$$\sum_{k=0}^n ar^k = (a - ar^{n+1})/(1-r)$$

$$\Pr[X \leq x] = F(x) = \int_{-\infty}^x f(t) dt$$

$$f(x) = F'(x)$$

$$\mathbb{E}[g(X)] = \int g(x)f(x) dx$$

$$\mathbb{E}[g(X)] = \sum_x g(x)P(x)$$

$$\mu = \mathbb{E}[X] = \int_{-\infty}^{\infty} xf(x) dx$$

$$\sigma^2 = \mathbb{E}[(X - \mu)^2] = \mathbb{E}[X^2] - \mu^2$$

$$A \text{ and } B : A \cap B \quad \text{not } A : A^c$$

$$A \text{ or } B : A \cup B$$

$$P[A|B] = P[A \cap B]/P[B]$$

$$P[B|A] = P[A \cap B]/P[A]$$

$$P[A \cap B] = P[A|B] P[B]$$

$$P[A \cup B] = P[A] + P[B] - P[A \cap B]$$

$$\text{Independent} \Leftrightarrow P[A \cap B] = P[A] P[B];$$

$$\text{Exclusive} \Leftrightarrow P[A \cap B] = 0$$

$$\text{Bayes: } P[A_i|B] = \frac{P[B|A_i]P[A_i]}{P[B|A_1]P[A_1] + \dots + P[B|A_k]P[A_k]}$$

$$A_i \cap A_j = \emptyset, \quad P[A_1] + \dots + P[A_k] = 1$$

	Continuous	Discrete
Mean	$\mu = \mathbb{E}[X] = \int_{-\infty}^{\infty} x f(x) dx$	$= \sum x p(x)$
Variance	$\sigma^2 = \text{Var}[X] = \int_{-\infty}^{\infty} (x - \mu)^2 f(x) dx$ $= \mathbb{E}[X^2] - \mathbb{E}[X]^2$	$= \sum (x - \mu)^2 p(x)$ $= \mathbb{E}[X^2] - \mathbb{E}[X]^2$
Expectation	$\mathbb{E}[g(X, Y)] = \iint g(x, y) f(x, y) dx dy$	$= \sum_x \sum_y g(x, y) p(x, y)$
Covariance	$\text{Cov}[X, Y] = \iint (x - \mu_x)(y - \mu_y) f(x, y) dx dy$ $= \mathbb{E}[XY] - \mathbb{E}[X]\mathbb{E}[Y]$	$= \sum_x \sum_y (x - \mu_x)(y - \mu_y) p(x, y)$ $= \mathbb{E}[XY] - \mathbb{E}[X]\mathbb{E}[Y]$
Correlation coefficient	$\rho[X, Y] = \text{Cov}[X, Y] / \sigma_X \sigma_Y$	
Conditional	$f(x y) = f(x, y) / f_2(y)$	$= p(x, y) / p_2(y)$
Marginal	$f_1(x) = \int_{-\infty}^{\infty} f(x, y) dy$	$= \sum_y p(x, y)$
	$f_2(y) = \int_{-\infty}^{\infty} f(x, y) dx$	$= \sum_x p(x, y)$
Independent	$\Leftrightarrow f(x, y) = f_1(x) f_2(y)$	$\Leftrightarrow p(x, y) = p_1(x) p_2(y)$
	$\Leftrightarrow f(x y) = f_1(x)$	$\Leftrightarrow p(x y) = p_1(x)$
	$\Leftrightarrow f(y x) = f_2(y)$	$\Leftrightarrow p(y x) = p_2(y)$
Conf. Intervals	$\mu = \bar{x} \pm z_{\alpha/2} S / \sqrt{n}$ $= \bar{x} \pm t_{\alpha/2} S / \sqrt{n}$ $p = \hat{p} \pm z_{\alpha/2} \sqrt{\hat{p} \hat{q} / n}$	Large Sample Small Sample (normal) Population Proportion
Sample Mean	$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i$	
Sample Variance	$s^2 = \frac{1}{n-1} \sum_{i=1}^n (x_i - \bar{x})^2$	Deg fdm: $\nu = n - 1$