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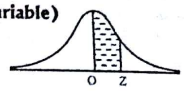
Area under Normal Curve (Table of Standard Normal Variable)

Entry represents area under the standard normal distribution from the mean to Z

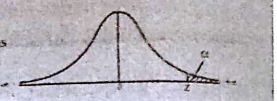


Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	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	0.2612	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	0.4985	0.4986	0.4986
3.0	0.49865	0.49869	0.49874	0.49878	0.49882	0.49886	0.49889	0.49893	0.49897	0.49900
3.1	0.49903	0.49906	0.49910	0.49913	0.49916	0.49918	0.49921	0.49924	0.49926	0.49929
3.2	0.49931	0.49934	0.49936	0.49938	0.49940	0.49942	0.49944	0.49946	0.49948	0.49950
3.3	0.49952	0.49953	0.49955	0.49957	0.49958	0.49960	0.49961	0.49962	0.49964	0.49965
3.4	0.49966	0.49968	0.49969	0.49970	0.49971	0.49972	0.49973	0.49974	0.49975	0.49976
3.5	0.49977	0.49978	0.49978	0.49979	0.49980	0.49981	0.49981	0.49982	0.49983	0.49983
3.6	0.49984	0.49985	0.49985	0.49986	0.49986	0.49987	0.49987	0.49988	0.49988	0.49989
3.7	0.49989	0.49990	0.49990	0.49990	0.49991	0.49991	0.49992	0.49992	0.49992	0.49992
3.8	0.49993	0.49993	0.49993	0.49994	0.49994	0.49994	0.49995	0.49995	0.49995	0.49995
3.9	0.49995	0.49995	0.49996	0.49996	0.49996	0.49996	0.49996	0.49996	0.49997	0.49997

Short Cut Key for Critical Values of Z

Critical Values (Z_α)	Level of significance (α)		
	1%	5%	10%
Two tailed test	$\lvert Z_\alpha \rvert = 2.575$	$\lvert Z_\alpha \rvert = 1.96$	$\lvert Z_\alpha \rvert = 1.645$
Right tailed test	$Z_\alpha = 2.33$	$Z_\alpha = 1.645$	$Z_\alpha = 1.28$
Left tailed test	$Z_\alpha = -2.33$	$Z_\alpha = -1.645$	$Z_\alpha = -1.28$

Tail area (probability) under standard normal probability curve from z to ∞ i.e.
$P(Z > z_\alpha) = p_\alpha$, the probabilities associated with values as extreme as observed values of z in the standard normal distribution. Where



$Z = \frac{X - \mu}{\sigma} \sim N(0, 1)$, $X \sim N(\mu, \sigma^2)$. That is

$P(Z < -z_\alpha) = P(Z > z_\alpha) = \alpha$ and $\Phi(z) = 1 - \Phi(-z)$

Z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641
.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2775
.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
.7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1171
1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681
1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
1.6	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
2.0	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
2.3	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
2.4	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
2.5	.0062	.0060	.0059	.0057	.0055	.0054	.0052	.0051	.0049	.0048
2.6	.0047	.0045	.0044	.0043	.0041	.0040	.0039	.0038	.0037	.0036
2.7	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0028	.0027	.0026
2.8	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
2.9	.0019	.0018	.0018	.0017	.0016	.0016	.0015	.0015	.0014	.0014
3.0	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010
3.1	.0010	.0009	.0009	.0009	.0008	.0008	.0008	.0008	.0007	.0007
3.2	.0007	.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
3.3	.0005	.0005	.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
3.4	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	0.0002
3.5	.00023									
3.6	.00016									
3.7	.00011									
3.8	.00007									
3.9	.00005									
4.0	.00003									

Critical values of T in the Wilconxon Matched-Pairs signed-Ranks Test.

n	Level of significance for one-tailed test			
	0.05	.025	.01	.005
	Level of significance for two-tailed test			
	0.10	.05	.02	.01
5	1	–	–	–
6	2	1	–	–
7	4	2	0	–
8	6	4	2	0
9	8	6	3	2
10	11	8	5	3
11	14	11	7	5
12	17	14	10	7
13	21	17	13	10
14	26	21	16	13
15	30	25	20	16
16	36	30	24	20
17	41	35	26	23
18	47	40	33	28
19	54	46	38	32
20	60	52	43	38
21	68	59	49	43
22	75	66	56	49
23	83	73	62	55
24	92	81	69	61
25	101	90	77	68

Critical values of the Kolmogorov-Smirnov One Sample Test statistics D_n.
This table gives the values of $D^+_{n,\alpha}$ and $D^-_{n,\alpha}$ for which $\alpha \geq P(D^+_n > D^+_{n,\alpha})$ and $\alpha \geq P(D_n > D_{n,\alpha})$ for some selected values of n and α.

One-Sided Test:					
α =	.10	.05	.025	.01	.005
Two-Sided Test:					
α =	.20	.10	.05	.02	.01
n = 1	.900	.950	.975	.990	.995
2	.684	.776	.842	.900	.929
3	.565	.636	.708	.785	.829
4	.493	.565	.624	.689	.734
5	.447	.509	.563	.627	.669
6	.410	.468	.519	.577	.617
7	.381	.436	.483	.538	.576
8	.358	.410	.454	.507	.542
9	.339	.387	.430	.480	.513
10	.323	.369	.409	.457	.489
11	.308	.352	.391	.437	.468
12	.296	.338	.375	.419	.449
13	.285	.325	.361	.404	.432
14	.275	.314	.349	.390	.418
15	.266	.304	.338	.377	.404
16	.258	.295	.327	.366	.392
17	.250	.286	.318	.355	.381
18	.244	.279	.309	.346	.371
19	.237	.271	.301	.337	.361
20	.232	.265	.294	.329	.352
21	.226	.259	.287	.321	.344
22	.221	.253	.281	.314	.337
23	.216	.247	.275	.307	.330
24	.212	.242	.269	.301	.322
25	.208	.238	.264	.295	.317
26	.204	.233	.259	.290	.311
27	.200	.229	.254	.284	.305
28	.197	.225	.250	.279	.300
29	.193	.221	.246	.275	.295
30	.190	.218	.242	.270	.290
31	.187	.214	.238	.266	.285
32	.184	.211	.234	.262	.281
33	.182	.208	.231	.258	.277
34	.179	.205	.227	.254	.273
35	.177	.202	.224	.251	.269
36	.174	.199	.221	.247	.265
37	.172	.196	.218	.244	.262
38	.170	.194	.215	.241	.258
39	.168	.191	.213	.238	.255
40	.165	.189	.210	.235	.252
approx for n > 40	$\frac{1.07}{\sqrt{n}}$	$\frac{1.22}{\sqrt{n}}$	$\frac{1.36}{\sqrt{n}}$	$\frac{1.52}{\sqrt{n}}$	$\frac{1.63}{\sqrt{n}}$

Critical values of the Kolmogorov-Smirnov Test statistics for two samples of equal size
This table gives the values of $D^+_{n,n,\alpha}$ and $D_{n,n,\alpha}$ for which $\alpha \geq P(D^+_{n,n} > D^+_{n,n,\alpha})$ and $\alpha \geq P(D_{n,n} > D_{n,n,\alpha})$ for some selected values of n and α.

One-Sided Test:					
α =	.10	.05	.025	.01	.005
Two-Sided Test:					
α =	.20	.10	.05	.02	.01
n = 3	2/3	2/3			
4	3/4	3/4	3/4		
5	3/5	3/5	4/5	4/5	4/5
6	3/6	4/6	4/6	5/6	5/6
7	4/7	4/7	5/7	5/7	5/7
8	4/8	4/8	5/8	5/8	6/8
9	4/9	5/9	5/9	6/9	6/9
10	4/10	5/10	6/10	6/10	7/10
11	5/11	5/11	6/11	7/11	7/11
12	5/12	5/12	6/12	7/12	7/12
13	5/13	6/13	6/13	7/13	8/13
14	5/14	6/14	7/14	7/14	8/14
15	5/15	6/15	7/15	8/15	8/15
16	6/16	6/16	7/16	8/16	9/16
17	6/17	7/17	7/17	8/17	9/17
18	6/18	7/18	8/18	9/18	9/18
19	6/19	7/19	8/19	9/19	9/19
20	6/20	7/20	8/20	9/20	10/20
21	6/21	7/21	8/21	9/21	10/21
22	7/22	8/22	9/22	10/22	10/22
23	7/23	8/23	9/23	10/23	10/23
24	7/24	8/24	9/24	10/24	11/24
25	7/25	8/25	9/25	10/25	11/25
26	7/26	8/26	9/26	10/26	11/26
27	7/29	8/27	9/27	11/27	11/27
28	8/28	9/28	10/28	11/28	11/28
29	8/29	9/29	10/29	11/29	12/29
30	8/30	9/30	10/30	11/30	12/30
31	8/31	9/31	10/31	11/31	12/31
32	8/32	9/32	10/32	12/32	12/32
34	8/34	10/34	11/34	12/34	13/34
36	9/36	10/36	11/36	12/36	13/36
38	9/38	10/38	11/38	13/38	14/38
40	9/40	10/40	12/40	13/40	14/40
approx for n > 40	$\frac{1.52}{\sqrt{n}}$	$\frac{1.73}{\sqrt{n}}$	$\frac{1.92}{\sqrt{n}}$	$\frac{2.15}{\sqrt{n}}$	$\frac{2.30}{\sqrt{n}}$

Critical values of the Kolmogorov-Smirnov Test Statistic for Two Samples of Unequal Size.

This table gives the values of $D^*_{n_1, n_2, \alpha}$ and $D_{n_1, n_2, \alpha}$ for which $\alpha \geq P[D^*_{n_1, n_2} \geq D^*_{n_1, n_2, \alpha}]$ and $\alpha \geq P[D_{n_1, n_2} \geq D_{n_1, n_2}]$ for some selected values of n_1 = smaller sample size n_2 = larger sample size, and α.

One-Sided Test:						
	α =	.10	.05	.025	.01	.005
Two-Sided Test:						
	α =	.20	.10	.05	.02	.01
$n_1 = 1$	$n_2 = 9$	17/18				
	10	9/10				
$n_1 = 2$	$n_2 = 3$	5/6				
	4	3/4				
	5	4/5	4/5			
	6	5/6	5/6			
	7	5/7	6/7			
	8	3/4	7/8	7/8		
	9	7/9	8/9	8/9		
	10	7/10	4/5	9/10		
$n_1 = 3$	$n_2 = 4$	3/4	3/4			
	5	2/3	4/5	4/5		
	6	2/3	2/3	5/6		
	7	2/3	5/7	6/7	6/7	
	8	5/8	3/4	3/4	7/8	
	9	2/3	2/3	7/9	8/9	8/9
	10	3/5	7/10	4/5	9/10	9/10
	12	7/12	2/3	3/4	5/6	11/12
$n_1 = 4$	$n_2 = 5$	3/5	3/4	4/5	4/5	
	6	7/12	2/3	3/4	5/6	5/6
	7	17/28	5/7	3/4	6/7	6/7
	8	5/8	5/8	3/4	7/8	7/8
	9	5/9	2/3	3/4	7/9	8/9
	10	11/20	13/20	7/10	4/5	4/5
	12	7/12	2/3	2/3	3/4	5/6
	16	9/16	5/8	11/16	3/4	12/16
$n_1 = 5$	$n_2 = 6$	3/6	2/3	2/3	5/6	5/6
	7	4/7	23/35	5/7	29/35	6/7
	8	11/20	5/8	27/40	4/5	4/5
	9	5/9	3/5	31/45	7/9	4/5
	10	1/2	3/5	7/10	7/10	4/5
	15	8/15	3/5	2/3	11/15	11/15
	20	1/2	11/20	3/5	7/10	3/4

$n_1 = 6$	$n_2 = 7$	23/42	4/7	29/42	5/7	6/7
	8	1/2	7/12	2/3	3/4	3/4
	9	1/2	5/9	2/3	13/18	7/9
	10	1/2	17/30	19/30	7/10	11/15
	12	1/2	7/12	7/12	2/3	3/4
	18	4/9	5/9	11/18	2/3	13/18
	24	11/24	1/2	7/12	5/8	2/3
$n_1 = 7$	$n_2 = 8$	27/56	33/56	5/8	41/56	3/4
	9	31/63	5/9	40/63	5/7	47/63
	10	33/70	39/70	43/70	7/10	5/7
	14	3/7	1/2	4/7	9/14	5/7
	28	3/7	13/28	15/28	17/28	9/14
$n_1 = 8$	$n_2 = 9$	4/9	13/24	5/8	2/3	¾
	10	19/40	21/40	23/40	27/40	7/10
	12	11/24	½	7/12	5/8	2/3
	16	7/16	½	9/16	5/8	5/8
	32	13/32	7/16	1/2	9/16	19/32
$n_1 = 9$	$n_2 = 10$	7/15	½	26/45	2/3	31/45
	12	4/9	½	5/9	11/18	2/3
	15	19/45	22/45	8/15	3/5	23/45
	18	7/18	4/9	½	5/9	11/18
	36	13/36	5/12	17/36	19/36	5/9
$n_1 = 10$	$n_2 = 15$	2/5	7/15	½	17/30	19/30
	20	2/5	9/20	½	11/20	3/5
	40	7/20	2/5	9/20	1/2	
$n_1 = 12$	$n_2 = 15$	23/60	9/20	½	11/20	7/12
	16	3/8	7/15	23/48	13/24	7/12
	18	11/36	5/12	17/36	19/36	5/9
	20	13/30	5/12	7/15	31/60	17/30
$n_1 = 15$	$n_2 = 20$	7/20	2/5	13/30	23/60	31/60
$n_1 = 16$	$n_2 = 20$	27/80	31/80	17/40	19/40	41/80
Large sample approx.		∞	$1.07\sqrt{\frac{n_1+n_2}{n_1 n_2}}$	$1.22\sqrt{\frac{n_1+n_2}{n_1 n_2}}$	$1.36\sqrt{\frac{n_1+n_2}{n_1 n_2}}$	$1.52\sqrt{\frac{n_1+n_2}{n_1 n_2}}$	$1.63\sqrt{\frac{n_1+n_2}{n_1 n_2}}$

Probabilities associated with values as large as observed values of Friedman Statistic F_r
i.e. $p_0 = P(F_r \geq F_r^*)$ where F_r^* is the calculated value of F_r.

Table for k = 3

n = 2		n = 3		n = 4		n = 5	
F_r	p	F_r	p	F_r	p	F_r	p
0	1.000	.000	1.000	0	1.000	.0	1.000
1	.833	.667	.944	.5	.931	.8	.954
3	.500	2.000	.528	1.5	.653	1.2	.691
4	.167	2.667	.361	2.0	.431	1.6	.522
		4.667	.194	3.5	.273	2.8	.367
		6.000	.028	4.5	.125	3.6	.182
				6.0	.069	4.8	.124
				6.5	.042	5.2	.093
				8.0	.0046	6.4	.039
						7.6	.024
						8.4	.0085
						10.0	.00077

n = 6		n = 7		n = 8		n = 9	
F_r	p	F_r	p	F_r	p	F_r	p
.00	1.000	.000	1.000	.00	1.000	.000	1.000
.33	.956	.286	.964	.25	.967	.222	.971
1.00	.740	.857	.768	.75	.794	.667	.814
1.33	.570	1.143	.620	1.00	.654	.889	.865
2.33	.430	2.000	.486	1.75	.531	1.556	.569
3.00	.252	2.571	.305	2.25	.355	2.000	.398
4.00	.184	3.429	.237	3.00	.285	2.667	.328
4.33	.142	3.714	.192	3.25	.236	2.889	.278
5.33	.072	4.571	.112	4.00	.149	3.556	.187
6.33	.052	5.429	.085	4.75	.120	4.222	.154
7.00	.029	6.000	.052	5.25	.079	4.667	.107
8.33	.012	7.143	.027	6.25	.047	5.556	.069
9.00	.0081	7.714	.021	6.75	.039	6.000	.057
9.33	.0055	8.000	.016	7.00	.030	6.222	.048
10.33	.0017	8.857	.0084	7.75	.018	6.889	.031
12.00	.00010	10.286	.0036	9.00	.0099	8.000	.019
		10.571	.0027	9.25	.0080	8.222	.016
		11.143	.0012	9.75	.0048	8.667	.010
		12.286	.00032	10.75	.0024	9.556	.0060
		14.000	.000021	12.00	.0011	10.667	.0035
				12.25	.00086	10.889	.0029
				13.00	.00026	11.556	.0013
				14.25	.000061	12.667	.00066
				16.00	.0000036	13.556	.00035
						14.000	.00020
						14.222	.000097
						14.889	.000054
						16.222	.000011
						18.000	.0000006

Table for k = 4

n = 2		n = 3		n = 4		n = 5	
F_r	p	F_r	p	F_r	p	F_r	p
0	1.000	.2	1.000	.0	1.000	.57	1.000
.6	.958	.8	.958	.3	.992	.60	.109
1.2	.834	1.8	.910	.6	.928	.63	.101
1.8	.792	1.8	.727	.9	.900	.66	.087
2.4	.625	2.2	.608	1.2	.800	.69	.082
3.0	.542	2.6	.524	1.8	.754	.72	.056
3.6	.458	3.4	.445	1.8	.677	.75	.052
4.2	.375	3.8	.342	2.1	.630	.78	.035
4.8	.208	4.2	.300	2.4	.524	.81	.032
5.4	.167	5.0	.207	2.7	.508	.84	.019
6.0	.042	5.4	.175	3.0	.432	.87	.014
		5.6	.148	3.3	.386	.90	.011
		6.6	.075	3.6	.355	.93	.0063
		7.0	.054	3.9	.324	.96	.0042
		7.4	.033	4.5	.242	1.02	.0027
		8.2	.017	4.8	.200	1.08	.0016
		9.0	.0017	5.1	.190	1.11	.00097
				5.4	.158	1.20	.00032

Critical Values of Student's t-distribution

d.f.	Level of significance for one-tailed test					
	0.10	0.05	0.025	0.01	0.005	0.0005
	Level of significance for two-tailed test					
	0.20	0.10	0.05	0.02	0.01	0.001
1	3.078	6.314	12.706	31.821	63.657	636.619
2	1.886	2.920	4.303	6.965	9.925	31.598
3	1.638	2.353	3.182	4.541	5.841	12.941
4	1.533	2.132	2.776	3.747	4.604	8.610
5	1.476	2.015	2.571	3.365	4.032	6.859
6	1.440	1.943	2.447	3.143	3.707	5.959
7	1.415	1.895	2.365	2.998	3.499	5.405
8	1.397	1.860	2.306	2.896	3.355	5.041
9	1.383	1.833	2.262	2.821	3.250	4.781
10	1.372	1.812	2.228	2.764	3.169	4.587
11	1.363	1.796	2.201	2.718	3.106	4.437
12	1.356	1.782	2.179	2.681	3.055	4.318
13	1.350	1.771	2.160	2.650	3.012	4.221
14	1.345	1.761	2.145	2.624	2.977	4.140
15	1.341	1.753	2.131	2.602	2.947	4.073
16	1.337	1.746	2.120	2.583	2.921	4.015
17	1.333	1.740	2.110	2.567	2.898	3.965
18	1.330	1.734	2.101	2.552	2.878	3.922
19	1.328	1.729	2.093	2.539	2.861	3.883
20	1.325	1.725	2.086	2.528	2.845	3.850
21	1.323	1.721	2.080	2.518	2.831	3.819
22	1.321	1.717	2.074	2.508	2.819	3.792
23	1.319	1.714	2.069	2.500	2.807	3.767
24	1.318	1.711	2.064	2.492	2.797	3.745
25	1.316	1.708	2.060	2.485	2.787	3.725
26	1.315	1.706	2.056	2.479	2.779	3.707
27	1.314	1.703	2.052	2.473	2.771	3.690
28	1.313	1.701	2.048	2.467	2.763	3.674
29	1.311	1.699	2.045	2.462	2.756	3.659
30	1.310	1.697	2.042	2.457	2.750	3.646
40	1.303	1.684	2.021	2.423	2.704	3.551
60	1.296	1.671	2.000	2.390	2.660	3.460
120	1.289	1.658	1.980	2.358	2.617	3.373
∞	1.282	1.645	1.960	2.326	2.576	3.291

Critical Value of the F-distribution at a 1 percent level of significance, $\alpha = 0.01$

Degree of Freedom for the numerator

Degree of Freedom for the Denominator	1	2	3	4	5	6	7	8	9	10
1	4052	5000	5403	5625	5764	5859	5928	5981	6022	6056
2	98.5	99.0	99.2	99.2	99.3	99.3	99.4	99.4	99.4	99.4
3	34.1	30.8	29.5	28.7	28.2	27.9	27.7	27.5	27.3	27.2
4	21.2	18.0	16.7	16.0	15.5	15.2	15.0	14.8	14.7	14.5
5	16.3	13.3	12.1	11.4	11.0	10.7	10.5	10.3	10.2	10.1
6	13.7	10.9	9.78	9.15	8.75	8.47	8.26	8.10	7.98	7.87
7	12.2	9.55	8.45	7.85	7.46	7.19	6.99	6.84	6.72	6.62
8	11.3	8.65	7.59	7.01	6.63	6.37	6.18	6.03	5.91	5.81
9	10.6	8.02	6.99	6.42	6.06	5.80	5.61	5.47	5.35	5.26
10	10.0	7.56	6.55	5.99	5.64	5.39	5.20	5.06	4.94	4.85
11	9.65	7.21	6.22	5.67	5.32	5.07	4.89	4.74	4.63	4.54
12	9.33	6.93	5.95	5.41	5.06	4.82	4.64	4.50	4.39	4.30
13	9.07	6.70	5.74	5.21	4.86	4.62	4.44	4.30	4.19	4.10
14	8.86	6.51	5.56	5.04	4.69	4.46	4.28	4.14	4.03	3.94
15	8.68	6.36	5.42	4.89	4.56	4.32	4.14	4.00	3.89	3.80
16	8.53	6.23	5.29	4.77	4.44	4.20	4.03	3.89	3.78	3.69
17	8.40	6.11	5.18	4.67	4.34	4.10	3.93	3.79	3.68	3.59
18	8.29	6.01	5.09	4.58	4.25	4.01	3.84	3.71	3.60	3.51
19	8.18	5.93	5.01	4.50	4.17	3.94	3.77	3.63	3.52	3.43
20	8.10	5.85	4.94	4.43	4.10	3.87	3.70	3.56	3.46	3.37
21	8.02	5.78	4.87	4.37	4.04	3.81	3.64	3.51	3.40	3.31
22	7.95	5.72	4.82	4.31	3.99	3.76	3.59	3.45	3.35	3.26
23	7.88	5.66	4.76	4.26	3.94	3.71	3.54	3.41	3.30	3.21
24	7.82	5.61	4.72	4.22	3.90	3.67	3.50	3.36	3.26	3.17
25	7.77	5.57	4.68	4.18	3.85	3.63	3.46	3.32	3.22	3.13
30	7.56	5.39	4.51	4.02	3.70	3.47	3.30	3.17	3.07	2.98
40	7.31	5.18	4.31	3.83	3.51	3.29	3.12	2.99	2.89	2.80
60	7.08	4.98	4.13	3.65	3.34	3.12	2.95	2.82	2.72	2.63
120	6.85	4.79	3.95	3.48	3.17	2.96	2.79	2.66	2.56	2.47
∞	6.63	4.61	3.78	3.32	3.02	2.80	2.64	2.51	2.41	2.32

Cntd...

Degree of Freedom for the numerator

Degree of Freedom for the Denominator	12	15	20	24	30	40	60	120	∞
1	6106	6157	6209	6235	6261	6287	6313	6339	6366
2	99.4	99.4	99.4	99.4	99.5	99.5	99.5	99.5	99.5
3	27.1	26.9	26.7	26.6	26.5	26.4	26.3	26.2	26.1
4	14.4	14.2	14.0	13.9	13.8	13.7	13.7	13.6	13.5
5	9.89	9.72	9.55	9.47	9.38	9.29	9.20	9.11	9.02
6	7.72	7.56	7.40	7.31	7.23	7.14	7.06	6.97	6.88
7	6.47	6.31	6.16	6.07	5.99	5.91	5.82	5.74	5.65
8	5.67	5.52	5.36	5.28	5.20	5.12	5.03	4.95	4.86
9	5.11	4.96	4.81	4.73	4.65	4.57	4.48	4.40	4.31
10	4.71	4.56	4.41	4.33	4.25	4.17	4.08	4.00	3.91
11	4.40	4.25	4.10	4.02	3.94	3.86	3.78	3.69	3.60
12	4.16	4.01	3.86	3.78	3.70	3.62	3.54	3.45	3.36
13	3.96	3.82	3.66	3.59	3.51	3.43	3.34	3.25	3.17
14	3.80	3.66	3.51	3.43	3.35	3.27	3.18	3.09	3.00
15	3.67	3.52	3.37	3.29	3.21	3.13	3.05	2.96	2.87
16	3.55	3.41	3.26	3.18	3.10	3.02	2.93	2.84	2.75
17	3.46	3.31	3.16	3.08	3.00	2.92	2.83	2.75	2.65
18	3.37	3.23	3.08	3.00	2.92	2.84	2.75	2.66	2.57
19	3.30	3.15	3.00	2.92	2.84	2.76	2.67	2.58	2.49
20	3.23	3.09	2.94	2.86	2.78	2.69	2.61	2.52	2.42
21	3.17	3.03	2.88	2.80	2.72	2.64	2.55	2.46	2.36
22	3.12	2.98	2.83	2.75	2.67	2.58	2.50	2.40	2.31
23	3.07	2.93	2.78	2.70	2.62	2.54	2.45	2.35	2.26
24	3.03	2.89	2.74	2.66	2.58	2.49	2.40	2.31	2.21
25	2.99	2.85	2.70	2.62	2.54	2.45	2.36	2.27	2.17
30	2.84	2.70	2.55	2.47	2.39	2.30	2.21	2.11	2.01
40	2.66	2.52	2.37	2.29	2.20	2.11	2.02	1.92	1.81
60	2.50	2.35	2.20	2.12	2.03	1.94	1.84	1.73	1.60
120	2.34	2.19	2.03	1.95	1.86	1.76	1.66	1.53	1.38
∞	2.18	2.04	1.88	1.79	1.70	1.59	1.47	1.32	1.00

Critical Value of the F-distribution at a 5 percent level of significance, $\alpha = 0.05$

Degree of Freedom for the numerator

Degree of Freedom for the Denominator	1	2	3	4	5	6	7	8	9	10
1	161	200	216	225	230	234	237	239	241	242
2	18.5	19.0	19.2	19.2	19.3	19.3	19.4	19.4	19.4	19.4
3	10.1	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.85
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75
13	4.67	3.81	3.41	3.18	3.03	2.92	1.83	2.77	2.71	2.67
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65	2.60
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59	2.54
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49
17	4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.49	2.45
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42	2.38
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39	2.35
21	4.32	3.47	3.07	2.84	2.68	2.57	2.49	2.42	2.37	2.32
22	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34	2.30
23	4.28	3.42	3.03	2.80	2.64	2.53	2.44	2.37	2.32	2.27
24	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30	2.25
25	4.24	3.39	2.99	2.76	2.60	2.49	2.40	2.34	2.28	2.24
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.16
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.08
60	4.00	3.14	2.76	2.53	2.37	2.25	2.17	2.10	2.04	1.99
120	3.92	3.07	2.68	2.45	2.29	2.18	2.09	2.02	1.96	1.91
∞	3.84	3.00	2.60	2.37	2.21	2.10	2.01	1.94	1.88	1.83

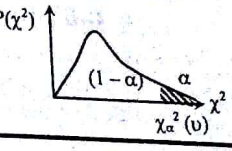
Cntd...

Degree of Freedom for the numerator

Degree of Freedom for the Denominator	12	15	20	24	30	40	60	120	∞
1	244	246	248	249	250	251	252	253	254
2	19.4	19.4	19.4	19.5	19.5	19.5	19.5	19.5	19.5
3	8.74	8.70	8.66	8.64	8.62	8.59	8.57	8.55	8.53
4	5.91	5.86	5.80	5.77	5.75	5.72	5.69	5.66	5.63
5	4.68	4.62	4.56	4.53	4.50	4.46	4.43	4.40	4.37
6	4.00	3.94	3.87	3.84	3.81	3.77	3.74	3.70	3.67
7	3.57	3.51	3.44	3.41	3.38	3.34	3.30	3.27	3.23
8	3.28	3.22	3.15	3.12	3.08	3.04	3.01	2.97	2.93
9	3.07	3.01	2.94	2.90	2.86	2.83	2.79	2.75	2.71
10	2.91	2.85	2.77	2.74	2.70	2.66	2.62	2.58	2.54
11	2.79	2.72	2.65	2.61	2.57	2.53	2.49	2.45	2.40
12	2.69	2.62	2.54	2.51	2.47	2.43	2.38	2.34	2.30
13	2.60	2.53	2.46	2.42	2.38	2.34	2.30	2.25	2.21
14	2.53	2.46	2.39	2.35	2.31	2.27	2.22	2.18	2.13
15	2.48	2.40	2.33	2.29	2.25	2.20	2.16	2.11	2.07
16	2.42	2.35	2.28	2.24	2.19	2.15	2.11	2.06	2.01
17	2.38	2.31	2.23	2.19	2.15	2.10	2.06	2.01	1.96
18	2.34	2.27	2.19	2.15	2.11	2.06	2.02	1.97	1.92
19	2.31	2.23	2.16	2.11	2.07	2.03	1.98	1.93	1.88
20	2.28	2.20	2.12	2.08	2.04	1.99	1.95	1.90	1.84
21	2.25	2.18	2.10	2.05	2.01	1.96	1.92	1.87	1.81
22	2.23	2.15	2.07	2.03	1.98	1.94	1.89	1.84	1.78
23	2.20	2.13	2.05	2.01	1.96	1.91	1.86	1.81	1.76
24	2.18	2.11	2.03	1.98	1.94	1.89	1.84	1.79	1.73
25	2.16	2.09	2.01	1.96	1.92	1.87	1.82	1.77	1.71
30	2.09	2.01	1.93	1.89	1.84	1.79	1.74	1.68	1.62
40	200	1.92	1.84	1.79	1.74	1.69	1.64	1.58	1.51
60	1.92	1.84	1.75	1.70	1.65	1.59	1.53	1.47	1.39
120	1.83	1.75	1.66	1.61	1.55	1.50	1.43	1.35	1.25
∞	1.75	1.67	1.57	1.52	1.46	1.39	1.32	1.22	1.00

Critical Values of Chi-Square

This table contains the values of χ^2 that correspond to a specific right-tail area and specific number of degrees of freedom df.



Degree of Freedom	Right-tail Area			
	0.10	0.05	0.02	0.01
1	2.706	3.841	5.412	6.635
2	4.605	5.991	7.824	9.210
3	6.251	7.815	9.837	11.345
4	7.779	9.488	11.668	13.277
5	9.236	11.070	13.388	15.086
6	10.645	12.592	15.033	16.812
7	12.017	14.067	16.622	18.475
8	13.362	15.507	18.168	20.090
9	14.684	16.919	19.679	21.666
10	15.987	18.307	21.161	23.209
11	17.275	19.675	22.618	24.725
12	18.549	21.026	24.054	26.217
13	19.812	22.362	25.472	27.688
14	21.064	23.685	26.873	29.141
15	22.307	24.996	28.259	30.578
16	23.542	26.296	29.633	32.000
17	24.769	27.587	30.995	33.409
18	25.989	28.869	32.346	34.805
19	27.204	30.144	33.687	36.191
20	28.412	31.410	35.020	37.566
21	29.615	32.671	36.343	38.932
22	30.813	33.924	37.659	40.289
23	32.007	35.172	38.968	41.638
24	33.196	36.415	40.270	42.980
25	34.382	37.652	41.566	44.314
26	35.563	38.885	42.856	45.642
27	36.741	40.113	44.140	46.963
28	37.916	41.337	45.419	48.278
29	39.087	42.557	46.693	49.588
30	40.256	43.773	47.962	50.892

Critical values for total number of runs 'r' at α = 0.05 for two tailed test.

The smaller critical value for a left-hand critical region, the larger for a right-hand critical region. For a one tailed test $\alpha = 0.025$ and use only-one of the critical values of r.

The Smaller of n_1 and n_2	The larger of n_1 and n_2														
	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2								2 6	2 6	2 6	2 6	2 6	2 6	2 6	2 6	2 6
3		2 8	2 8	2 8	2 8	2 8	2 8	2 8	2 8	2 8	3 8	3 8	3 8	3 8	3 8	3 8
4	2 9	2 9	2 10	3 10	3 10	3 10	3 10	3 10	3 10	3 10	3 10	4 10	4 10	4 10	4 10	4 10
5	2 10	3 10	3 11	3 11	3 12	3 12	4 12	4 12	4 12	4 12	4 12	4 12	4 12	5 12	5 12	5 12
6		3 11	3 12	3 12	4 13	4 13	4 13	4 13	5 14	5 14	5 14	5 14	5 14	5 14	6 14	6 14
7			3 13	4 13	4 14	5 14	5 14	5 14	5 15	5 15	6 15	6 16	6 16	6 16	6 16	6 16
8				4 14	5 14	5 15	5 15	6 16	6 16	6 16	6 16	6 17	7 17	7 17	7 17	7 17
9					5 15	5 16	6 16	6 16	6 17	7 17	7 18	7 18	7 18	7 18	7 18	7 18
10						6 16	6 17	7 17	7 18	7 18	7 18	8 19	8 19	8 19	8 20	9 20
11							7 17	7 18	7 19	8 19	8 19	8 20	9 20	9 20	9 21	9 21
12								7 19	8 19	8 20	8 20	9 21	9 21	9 21	10 22	10 22
13									8 20	9 20	9 21	9 21	10 22	10 22	10 23	10 23
14										9 21	9 22	10 22	10 23	10 23	11 23	11 24
15											10 22	10 23	11 23	11 24	11 24	12 25
16												11 23	11 24	11 25	12 25	12 25
17													11 25	12 25	12 26	13 26
18														12 26	13 26	13 27
19															13 27	13 27
20																14 28

Distribution function of U i.e. $P(U \leq U_0) = p_0$, $n_1 \leq n_2$ and $3 \leq n_2 \leq 10$

The probabilities associated with the values as small as observed value of U in the Mann-Whitney test.

$n_2 = 3$

	n_1		
U_0	1	2	3
0	.25	.10	.05
1	.50	.20	.10
2		.40	.20
3		.60	.35
4			.50

$n_2 = 4$

	n_1			
U_0	1	2	3	4
0	.2000	.0667	.0286	.0143
1	.4000	.1333	.0571	.0286
2	.6000	.2667	.1143	.0571
3		.4000	.2000	.1000
4		.6000	.3143	.1714
5			.4286	.2429
6			.5714	.3429
7				.4429
8				.5571

$n_2 = 5$

	n_1				
U_0	1	2	3	4	5
0	.1667	.0476	.0179	.0079	.0040
1	.3333	.0952	.0357	.0159	.0079
2	.5000	.1905	.0714	.0317	.0159
3		.2857	.1250	.0556	.0278
4		.4286	.1964	.0952	.0476
5		.5714	.2857	.1429	.0754
6			.3929	.2063	.1111
7			.5000	.2778	.1548
8				.3651	.2103
9				.4524	.2738
10				.5476	.3452
11					.4206
12					.5000

$n_2 = 6$

	n_1					
U_0	1	2	3	4	5	6
0	.1429	.0357	.0119	.0048	.0022	.0011
1	.2857	.0714	.0238	.0095	.0043	.0022
2	.4286	.1429	.0476	.0190	.0087	.0043
3	.5714	.2143	.0833	.0333	.0152	.0076
4		.3214	.1310	.0571	.0260	.0130
5		.4286	.1905	.0857	.0411	.0206
6		.5714	.2738	.1286	.0628	.0325
7			.3571	.1762	.0887	.0465
8			.4524	.2381	.1234	.0660
9			.5476	.3048	.1645	.0898
10				.3810	.2143	.1201
11				.4571	.2684	.1548
12				.5429	.3312	.1970
13					.3961	.2424
14					.4654	.2944
15					.5346	.3496
16						.4091
17						.4686
18						.5314

$n_2 = 7$

	n_1						
U_0	1	2	3	4	5	6	7
0	.1250	.0278	.0083	.0030	.0013	.0006	.0003
1	.2500	.0556	.0167	.0061	.0025	.0012	.0006
2	.3750	.1111	.0333	.0121	.0051	.0023	.0012
3	.5000	.1667	.0583	.0212	.0088	.0041	.0020
4		.2500	.0917	.0364	.0152	.0070	.0035
5		.3333	.1333	.0545	.0240	.0111	.0055
6		.4444	.1917	.0818	.0366	.0175	.0087
7		.5556	.2583	.1152	.0530	.0256	.0131
8			.3333	.1576	.0745	.0367	.0189
9			.4167	.2061	.1010	.0507	.0265
10			.5000	.2636	.1338	.0688	.0364
11				.3242	.1717	.0903	.0487
12				.3939	.2159	.1171	.0641
13				.4636	.2652	.1474	.0825
14				.5364	.3194	.1830	.1043
15					.3775	.2226	.1297
16					.4381	.2669	.1588
17					.5000	.3141	.1914
18						.3654	.2279
19						.4178	.2675
20						.4726	.3100
21						.5274	.3552
22							.4024
23							.4508
24							.5000

$n_2 = 8$

	n_1							
U_0	1	2	3	4	5	6	7	8
0	.1111	.0222	.0061	.0020	.0008	.0003	.0002	.0001
1.	.2222	.0444	.0121	.0040	.0016	.0007	.0003	.0002
2.	.3333	.0889	.0242	.0081	.0031	.0013	.0006	.0003
3.	.4444	.1333	.0424	.0141	.0054	.0023	.0011	.0005
4.	.5556	.2000	.0667	.0242	.0093	.0040	.0019	.0009
5.		.2667	.0970	.0364	.0148	.0063	.0030	.0015
6.		.3556	.1394	.0545	.0225	.0100	.0047	.0023
7.		.4444	.1879	.0768	.0326	.0147	.0070	.0035
8.		.5556	.2485	.1071	.0466	.0213	.0103	.0052
9.			.3152	.1414	.0637	.0296	.0145	.0074
10.			.3879	.1838	.0855	.0406	.0200	.0103
11.			.4606	.2303	.1111	.0539	.0270	.0141
12.			.5394	.2848	.1422	.0709	.0361	.0190
13.				.3414	.1772	.0906	.0469	.0249
14.				.4040	.2176	.1142	.0603	.0325
15.				.4667	.2618	.1412	.0760	.0415
16.				.5333	.3108	.1725	.0946	.0524
17.					.3621	.2068	.1159	.0652
18.					.4165	.2454	.1405	.0803
19.					.4716	.2864	.1678	.0974
20.					.5284	.3310	.1984	.1172
21.						.3773	.2317	.1393
22.						.4259	.2679	.1641
23.						.4749	.3063	.1911
24.						.5251	.3472	.2209
25.							.3894	.2527
26.							.4333	.2869
27.							.4775	.3227
28.							.5225	.3605
29.								.3992
30.								.4392
31.								.4796
32.								.5204

$n_2 = 9$

	n_1								
U_0	1	2	3	4	5	6	7	8	9
0	.1000	.0182	.0045	.0014	.0005	.0002	.0001	.0000	.0000
1.	.2000	.0364	.0091	.0028	.0010	.0004	.0002	.0001	.0000
2.	.3000	.0727	.0182	.0056	.0020	.0008	.0003	.0002	.0001
3.	.4000	.1091	.0318	.0098	.0035	.0014	.0006	.0003	.0001
4.	.5000	.1636	.0500	.0168	.0060	.0024	.0010	.0005	.0002
5.		.2182	.0727	.0252	.0095	.0038	.0017	.0008	.0004
6.		.2909	.1045	.0378	.0145	.0060	.0026	.0012	.0006
7.		.3636	.1409	.0531	.0210	.0088	.0039	.0019	.0009
8.		.4545	.1864	.0741	.0300	.0128	.0058	.0028	.0014
9.		.5455	.2409	.0993	.0415	.0180	.0082	.0039	.0020

10.			.3000	.1301	.0559	.0248	.0115	.0056	.0028
11.			.3636	.1650	.0734	.0332	.0156	.0076	.0039
12.			.4318	.2070	.0949	.0440	.0209	.0103	.0053
13.			.5000	.2517	.1199	.0567	.0274	.0137	.0071
14.				.3021	.1489	.0723	.0356	.0180	.0094
15.				.3552	.1818	.0905	.0454	.0232	.0122
16.				.4126	.2188	.1119	.0571	.0296	.0157
17.				.4699	.2592	.1361	.0708	.0372	.0200
18.				.5301	.3032	.1638	.0869	.0464	.0252
19.					.3497	.1942	.1052	.0570	.0313
20.					.3986	.2280	.1261	.0694	.0385
21.					.4491	.2643	.1496	.0836	.0470
22.					.5000	.3035	.1755	.0998	.0567
23.						.3445	.2039	.1179	.0680
24.						.3878	.2349	.1383	.0807
25.						.4320	.2680	.1606	.0951
26.						.4773	.3032	.1852	.1112
27.						.5227	.3403	.2117	.1290
28.							.3788	.2404	.1487
29.							.4185	.2707	.1701
30.							.4591	.3029	.1933
31.							.5000	.3365	.2181
32.								.3715	.2447
33.								.4074	.2729
34.								.4442	.3024
35.								.4813	.3332
36.								.5187	.3652
37.									.3981
38.									.4317
39.									.4657
40.									.5000

$n_2 = 10$

	n_1									
U_0	1	2	3	4	5	6	7	8	9	10
0	.0909	.0152	.0035	.0010	.0003	.0001	.0001	.0000	.0000	.0000
1.	.1818	.0303	.0070	.0020	.0007	.0002	.0001	.0000	.0000	.0000
2.	.2727	.0606	.0140	.0040	.0013	.0005	.0002	.0001	.0000	.0000
3.	.3636	.0909	.0245	.0070	.0023	.0009	.0004	.0002	.0001	.0000
4.	.4545	.1364	.0385	.0120	.0040	.0015	.0006	.0003	.0001	.0001
5.	.5455	.1818	.0559	.0180	.0063	.0024	.0010	.0004	.0002	.0001
6.		.2424	.0804	.0270	.0097	.0037	.0015	.0007	.0003	.0002
7.		.3030	.1084	.0380	.0140	.0055	.0023	.0010	.0005	.0002
8.		.3788	.1434	.0529	.0200	.0080	.0034	.0015	.0007	.0004
9.		.4545	.1853	.0709	.0276	.0112	.0048	.0022	.0011	.0005
10.		.5455	..2343	.0939	.0376	.0156	.0068	.0031	.0015	.0008
11.			.2867	.1199	.0496	.0210	.0093	.0043	.0021	.0010

12.			.3462	.1518	.0646	.0280	.0125	.0058	.0028	.0014
13.			.4056	.1868	.0823	.0363	.0165	.0078	.0038	.0019
14.			.4685	.2268	.1032	.0467	.0215	.0103	.0051	.0026
15.			.5315	.2697	.1272	.0589	.0277	.0133	0.066	.0034
16.				.3177	.1548	.0736	.0351	.0171	.0086	.0045
17.				.3666	.1855	.0903	.0439	.0217	.0110	.0057
18.				.4196	.2198	.1099	.0544	.0273	.0140	.0073
19.				.4725	.2567	.1317	.0665	.0338	.0175	.0093
20.				.5275	.2970	.1566	.0806	.0416	.0217	.0116
21.					.3393	.1838	.0966	.0506	.0267	.0144
22.					.3839	.2139	.1148	.0610	.0326	.0177
23.					.4296	.2461	.1349	.0729	.0394	.0216
24.					.4765	.2811	.1574	.0864	.0474	.0262
25.					.5235	.3177	.1819	.1015	.0564	.0315
26.						.3564	.2087	.1185	.0667	.0376
27.						.3962	.2374	.1371	.0782	.0446
28.						.4374	.2681	.1577	.0912	.0526
29.						.4789	.3004	.1800	.1055	.0615
30.						.5211	.3345	.2041	.1214	.0716
31.							.3698	.2299	.1388	.0827
32.							.4063	.2574	.1577	.0952
33.							.4434	.2863	.1781	.1088
34.							.4811	.3167	.2001	.1237
35.							.5189	.3482	.2235	.1399
36.								.3809	.2483	.1575
37.								.4143	.2745	.1763
38.								.4484	.3019	.1965
39.								.4827	.3304	.2179
40.								.5173	.3598	.2406
41.									.3901	.2644
42.									.4211	.2894
43.									.4524	.3153
44.									.4841	.3421
45.									.5159	.3697
46.										.3980
47.										.4267
48.										.4559
49.										.4853
50.										.5147

Critical value of U in the Mann-Whitney Test

a. Critical values of U for a one-tailed test at 0.025 or for a two-tailed test at 0.05

n_1 / n_2	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1																				
2								0	0	0	0	1	1	1	1	1	2	2	2	2
3					0	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8
4				0	1	2	3	4	4	5	6	7	8	9	10	11	11	12	13	13
5			0	1	2	3	5	6	7	8	9	11	12	13	14	15	17	18	19	20
6			1	2	3	5	6	8	10	11	13	14	16	17	19	21	22	24	25	27
7			1	3	5	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34
8		0	2	4	6	8	10	13	15	17	19	22	24	26	29	31	34	36	38	41
9		0	2	4	7	10	12	15	17	20	23	26	28	31	34	37	39	42	45	48
10		0	3	5	8	11	14	17	20	23	26	29	33	36	39	42	45	48	52	55
11		0	3	6	9	13	16	19	23	26	30	33	37	40	44	47	51	55	58	62
12		1	4	7	11	14	18	22	26	29	33	37	41	45	49	53	57	61	65	69
13		1	4	8	12	16	20	24	28	33	37	41	45	50	54	59	63	67	72	76
14		1	5	9	13	17	22	26	31	36	40	45	50	55	59	64	67	74	78	83
15		1	5	10	14	19	24	29	34	39	44	49	54	59	64	70	75	80	85	90
16		1	6	11	15	21	26	31	37	42	47	53	59	64	70	75	81	86	92	98
17		2	6	11	17	22	28	34	39	45	51	57	63	67	75	81	87	93	99	105
18		2	7	12	18	24	30	36	42	48	55	61	67	74	80	86	93	99	106	112
19		2	7	13	19	25	32	38	45	52	58	65	72	78	85	92	99	106	113	119
20		2	8	13	20	27	34	41	48	55	62	69	76	83	90	98	103	112	119	127

b. Critical values of U for a one-tailed test at 0.05 or for a two-tailed test at 0.10

n_1 / n_2	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1																			0	0
2					0	0	0	1	1	1	1	2	2	2	3	3	3	4	4	4
3			0	0	1	2	2	3	3	4	5	5	6	7	7	8	9	9	10	11
4			0	1	2	3	4	5	6	7	8	9	10	11	12	14	15	16	17	18
5		0	1	2	4	5	6	8	9	11	12	13	15	16	18	19	20	22	23	25
6		0	2	3	5	7	8	10	12	14	16	17	19	21	23	25	26	28	30	32
7		0	2	4	6	8	11	13	15	17	19	21	24	26	28	30	33	35	37	39
8		1	3	5	8	10	13	15	18	20	23	26	28	31	33	36	39	41	44	47
9		1	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54
10		1	4	7	11	14	17	20	24	27	31	34	37	41	44	48	51	55	58	62
11		1	5	8	12	16	19	23	27	31	34	38	42	46	50	54	57	61	65	69
12		2	5	9	13	17	21	26	30	34	38	42	47	51	55	60	64	68	72	77
13		2	6	10	15	19	24	28	33	37	42	47	51	56	61	65	70	75	80	84
14		2	7	11	16	21	26	31	36	41	46	51	56	61	66	71	77	82	87	92
15		3	7	12	18	23	28	33	39	44	50	55	61	66	72	77	83	88	94	100
16		3	8	14	19	25	30	36	42	48	54	60	65	71	77	83	89	95	101	107
17		3	9	15	20	26	33	39	45	51	57	64	70	77	83	89	96	102	109	115
18		4	9	16	22	28	35	41	48	55	61	68	75	82	88	95	102	109	116	123
19	0	4	10	17	23	30	37	44	51	58	65	72	80	87	94	101	109	116	123	130
20	0	4	11	18	25	32	39	47	54	62	69	77	84	92	100	107	115	123	130	138

Probabilities associated with values as large as observed values of Kruskul-Wallis H Statistic. i.e. $p_o = P(H > H^*)$ where $H^* = H_{cal.}$

Sample sizes			H	p	Sample sizes			H	p
n_1	n_2	n_3			n_1	n_2	n_3		
2	1	1	2.7000	.500	4	3	2	6.4444	.008
								6.3000	.011
2	2	2	3.6000	.200				5.4444	.046
								5.4000	.051
2	2	2	4.5714	.067				4.5111	.098
			3.7143	.200				4.4444	.102
3	1	1	3.2000	.300	4	3	3	6.7455	.010
								6.7455	.010
3	2	1	4.2857	.100				6.7091	.013
			3.8571	.100				5.7909	.046
3	2	2	5.3572	.029				4.7091	.092
			4.7143	.048				4.7000	.101
			4.5000	.067					
			4.4643	.105	4	4	1	6.6667	.010
								6.1667	.022
3	3	1	5.1429	.043				4.9667	.048
			4.5714	.100				4.8667	.054
			4.0000	.129				4.1667	.082
3	3	2	6.2500	.011				4.0667	.102
			5.3611	.032	4	4	2	7.0364	.006
			5.1389	.061				6.8727	.011
			4.5556	.100				5.4545	.046
			4.2500	.121				5.2364	.052
3	3	3	7.2000	.004				4.5545	.098
			6.4889	.011				4.4455	.103
			5.6889	.029	4	4	3	7.1439	.010
			5.6000	.050				7.1364	.011
			5.0667	.086				5.5985	.049
			4.6222	.100				5.5758	.051
4	1	1	3.5714	.200				4.5455	.099
4	2	1	4.8214	.057				4.4773	.102
			4.5000	.076	4	4	4	7.6538	.008
			4.0179	.114				7.5385	.011
4	2	2	6.0000	.014				5.6923	.049
			5.3333	.033				5.6538	.054
			5.1250	.052				4.6539	.097
			4.4583	.100				4.5001	.104
			4.1667	.105	5	1	1	3.8571	.143
4	3	1	5.8333	.021	5	2	1	5.2500	.036
			5.2083	.050				5.0000	.048
			5.0000	.057				4.4500	.071
			4.0556	.093				4.2000	.095

			3.8889	.129				4.0500	.119
5	2	2	6.5333	.008	5	4	4	7.7604	.009
			6.1333	.013				7.7440	.011
			5.1600	.034				5.6571	.049
			5.0400	.056				5.6176	.050
			4.3733	.090				4.6187	.100
			4.2933	.122				4.5527	.102
5	3	1	6.4000	.012	5	5	1	7.3091	.009
			4.9600	.048				6.8364	.011
			4.8711	.052				5.1273	.046
			4.0178	.095				4.9091	.53
			3.8400	.123				4.1091	.086
5	3	2	6.9091	.009				4.0364	.105
			6.8281	.010	5	5	2	7.3385	.010
			5.2509	.049				7.2692	.010
			5.1055	.052				5.3385	.047
			4.6509	.091				5.2464	.051
			4.4945	.101				4.6231	.097
5	3	3	7.0788	.009				4.5077	.100
			6.9818	.011	5	5	3	7.5780	.010
			5.6485	.049				7.5429	.010
			5.5152	.051				5.7055	.046
			4.5333	.097				5.6264	.051
			4.4121	.109				4.5451	.100
5	4	1	6.9545	.008				4.5363	.102
			6.8400	.011	5	5	4	7.8229	.010
			4.9855	.044				7.7914	.010
			4.8600	.056				5.6657	.049
			3.9873	.098				5.6429	.050
			3.9600	.102				4.5229	.099
5	4	2	7.2045	.009				4.5200	.101
			7.1182	.010	5	5	5	8.0000	.009
			5.2727	.049				7.9800	.010
			5.2682	.050				5.7800	.049
			4.5409	.098				5.6600	.051
			4.5182	.101				4.5600	.100
5	4	3	7.4449	.010				4.5000	.102
			7.3949	.011					
			5.6564	.049					
			5.6308	.050					
			4.5487	.099					
			4.5231	.103					

Probabilities associated with values as small as observed values of x in the binomial distribution with parameter n and p = ½

$$\text{i.e. } p_0 = P(X \le x) = \sum_{x=0}^{x=k} \binom{n}{x} \left(\frac{1}{2}\right)^n ; k = 0, 1, 2, \ldots (n-1).$$

n \ x	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	5	*														
2	250	500	*													
3	125	500	875	*												
4	063	313	688	938	*											
5	031	188	500	812	969	*										
6	016	109	344	656	891	984	*									
7	008	062	227	500	773	938	992	*								
8	004	035	145	363	637	855	965	996	*							
9	002	020	090	254	500	746	910	980	998	*						
10	001	011	055	172	377	623	828	945	989	999	*					
11		006	033	113	274	500	726	887	967	994	*	*				
12		003	019	073	194	387	613	806	927	981	997	*	*			
13		002	011	046	133	291	500	709	867	954	989	998	*	*		
14		001	006	029	090	212	395	605	788	910	971	994	999	*	*	
15			004	018	059	151	304	500	696	849	941	982	996	*	*	*
16			002	011	038	105	227	402	598	773	895	962	989	998	*	*
17			001	006	025	072	166	315	500	685	834	928	975	994	999	*
18			001	004	015	048	119	240	407	593	760	881	952	985	996	999
19				002	010	032	084	180	324	500	676	820	916	968	990	998
20				001	006	021	058	132	252	412	588	748	868	942	979	994
21				001	004	013	039	095	192	332	500	668	808	905	961	987
22					002	008	026	067	143	262	416	584	738	857	933	974
23					001	005	017	047	105	202	339	500	661	798	895	953
24					001	003	011	032	076	154	271	419	581	729	846	924
25						002	007	022	054	115	212	345	500	655	788	885

Note: To save space decimal points are omitted in the p's.

** = 1 or approximately 1.0*