
UNIVERSITI SAINS MALAYSIA

Peperiksaan Semester Pertama
Sidang Akademik 2003/04

September/Oktober 2003

IUK 106E – STATISTIK UNTUK TEKNOLOGIS

Masa: 3 jam

Sila pastikan bahawa kertas peperiksaan ini mengandungi SEBELAS mukasurat (termasuk 5 keping Lampiran) yang bercetak sebelum anda memulakan peperiksaan ini.

Jawab **SEMUA** soalan. Semua soalan boleh dijawab dalam Bahasa Malaysia atau Bahasa Inggeris.

...2/-

1. (a) Bagi jadual kekerapan berikut:

For the following frequency table:

Systolic Blood
Pressure of Men Frequency

Tekanan darah
Sistolik lelaki *Kekerapan*

90-99	1
100-109	4
110-119	17
120-129	12
130-139	5
140-149	0
150-159	1

Cari

Find

- i) Kelebaran kelas

Class width

- ii) Titik-titik pertengahan kelas

Class midpoints

- iii) Sempadan-sempanan kelas

Class boundaries

- iv) Taburan kekerapan relatif

Relative frequency distribution

(60 markah)

...3/-

- (b) Sample empat jenis bijirin berbeza menunjukkan nombor kalori berikut bagi sajian yang dicadangkan bagi setiap jenama. Pada $\alpha = 0.05$, adakah terdapat perbezaan pada nombor kalori bagi jenama berlainan?

Samples of four different Cereals show the following number of calories for the suggested servings of each brand. At $\alpha = 0.05$, is there a difference in the number of calories for the different brands?

<u>Brand A</u> <u>Jenama A</u>	<u>Brand B</u> <u>Jenama B</u>	<u>Brand C</u> <u>Jenama C</u>	<u>Brand D</u> <u>Jenama D</u>
112	110	109	106
120	118	116	122
135	123	125	130
125	128	130	117
108	102	128	116
121	101	132	114

(40 markah)

2. (a) Gunakan data dalam jadual berikut.
Jika 1 dari 100 subjek dipilih secara rawak, cari kebarangkalian mendapat seseorang yang telah bercakap benar atau telah mendapati ujian poligraf menunjukkan kebenaran telah dinyatakan.

Use the data in following table.

If 1 of the 100 subjects is randomly selected, find the probability of getting someone who told the truth or had the polygraph test indicate that the truth was being told.

	Poligraf menunjukkan kebenaran <i>Polygraph indicated Truth</i>	Poligraf menunjukkan penipuan <i>Polygraph indicated Lie</i>
Subjek betul-betul betul bercakap benar <i>Subject actually Told the truth</i>	65	15
Subjek sebenarnya bercakap bohong <i>Subject actually Told a lie</i>	3	17

(50 markah)

...4/-

- (b) Dengan satu kaedah pensampelan penyetujuan, satu sampel barang dipilih secara rawak tanpa penggantian dan keseluruhan kelompok ditolak sekiranya terdapat sekurangnya satu kecacatan. Syarikat Niko Electronics baru mengeluarkan 2500 keping cakera padat, dan 2% adalah cacat. Sekiranya 4 daripada cakera padat dipilih dan diuji, apakah kebarangkalian kesemua kelompok akan tertolak?

With one method of acceptance sampling, a sample of items randomly selected without replacement and the entire batch is rejected if there is at least one defect. The Niko Electronics Company has just manufactured 2500 CD's, and 2% are defective. If 4 of the CD's are selected and tested, what is the probability that the entire batch will be rejected?

(50 markah)

3. (a) Apabila manusia merokok, nikotin yang mereka serap ditukarkan kepada kotinin, yang boleh diukur. Satu sample 40 perokok mempunyai min paras kotinin sebanyak 172.5 unit.

Dengan mengandaikan σ^2 diketahui sebagai 14280.25, carikan estimat selang jarak sela keyakinan 90% bagi min paras kontinin bagi semua perokok.

When people smoke, the nicotine they absorb is converted to cotinine, which can be measured. A sample of 40 smokers has a mean continine level of 172.5. Assuming that σ^2 is known to be 14280.25, find a 90% confidence interval estimate of the mean continine level of all smokers.

(50 markah)

...5/-

- (b) Satu tinjauan keatas 436 pekerja menunjukkan 192 daripadanya menyatakan pemantauan mel-e pekerja adalah benar-benar tidak beretika. Apabila 121 ketua peringkat kanan ditinjau, 40 menyatakan bahawa pemantauan mel-e pekerja adalah benar-benar/sungguh-sungguh tidak beretika. Gunakan paras signifikan 0.05 untuk menguji dakwaan bahawa bagi yang menyatakan pemantauan mel-e adalah benar-benar tidak beretika, perkadaran pekerja adalah lebih besar daripada perkadaran ketua.

A survey of 436 workers showed that 192 of them said that it was seriously unethical to monitor employee e-mail. When 121 senior-level bosses were surveyed, 40 said that it was seriously unethical to monitor employee e-mail. Use 0.05 significance level to test the claim that for those saying that monitorin e-mail is seriously unethical, the proportion of employee is greater than the proportion of bosses.

(50 markah)

4. (a) *Bagi data berikut*

For the following data

$$\bar{x} = 2.5 \quad \sum x = 10 \quad \sum y = 20 \quad \sum x^2 = 36 \quad \sum y^2 = 120 \quad \sum xy = 48$$

Cari

Find

- i) Pekali korelasi linear

The linear correlation coefficient

- ii) Persamaan garisan regresi

The equation of the regression line

(50 markah)

...6/-

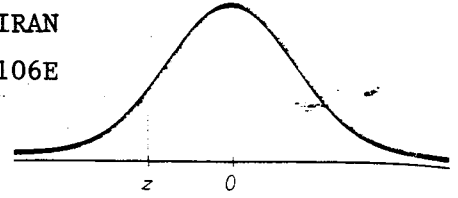
- (b) Sepuluh sample, setiap satunya terdiri dari lima baterai automobil, diuji kekuatannya. Min dan purata bagi sample-sampel tersebut diberikan di bawah. Konstruk dan analisisakan carta-carta \bar{x} dan R bagi data tersebut.

Ten samples, each consisting of five automobile batteries, are tested for strength. The mean and averages of the samples are given here. Construct and analyze \bar{x} chart and R chart for the data.

Sample	1	2	3	4	5	6	7	8	9	10
Mean	12.2	12.5	12.3	11.9	11.8	11.2	12.1	12	12.2	11.8
R	2.1	1.3	1.5	2.1	1.2	1.1	1.3	1.3	1.8	2

(50 markah)

...7/-



NEGATIVE z Scores

TABLE A-2 Standard Normal (z) Distribution: Cumulative Area from the LEFT

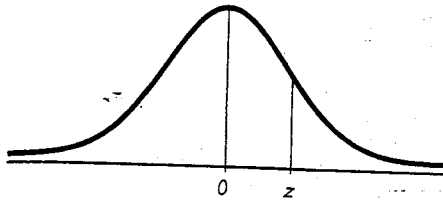
z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
-3.50 and lower	.0001									
-3.4	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0002
-3.3	.0005	.0005	.0005	.0004	.0004	.0004	.0004	.0004	.0004	.0003
-3.2	.0007	.0007	.0006	.0006	.0006	.0006	.0006	.0005	.0005	.0005
-3.1	.0010	.0009	.0009	.0009	.0008	.0008	.0008	.0008	.0007	.0007
-3.0	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010
-2.9	.0019	.0018	.0018	.0017	.0016	.0016	.0015	.0015	.0014	.0014
-2.8	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
-2.7	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0028	.0027	.0026
-2.6	.0047	.0045	.0044	.0043	.0041	.0040	.0039	.0038	.0037	.0036
-2.5	.0062	.0060	.0059	.0057	.0055	.0054	.0052	.0051	.0049	.0048
-2.4	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
-2.3	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
-2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
-2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
-2.0	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
-1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
-1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
-1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
-1.6	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
-1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
-1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681
-1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
-1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
-1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
-1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
-0.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
-0.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
-0.7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
-0.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
-0.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
-0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
-0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
-0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
-0.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
-0.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641

NOTE: For values of z below -3.49, use 0.0001 for the area.

*Use these common values that result from interpolation:

z score	Area
-1.645	0.0500
-2.575	0.0050

...8/=



POSITIVE z Scores

TABLE A-2 (continued) Cumulative Area from the LEFT

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
3.50 and up	.9999									

NOTE: For values of z above 3.49, use 0.9999 for the area.
 *Use these common values that result from interpolation:

z score	Area
1.645	0.9500
2.575	0.9950

Common Critical Values

Confidence Level	Critical Value
0.90	1.645
0.95	1.96
0.99	2.575

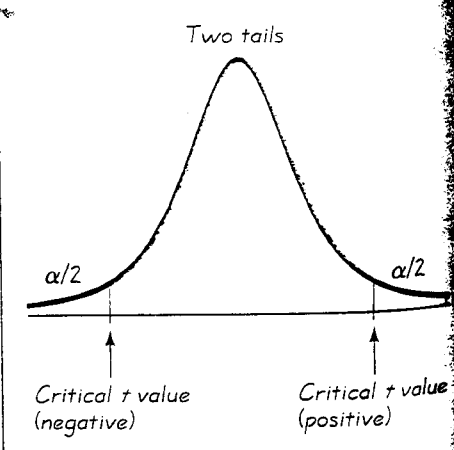
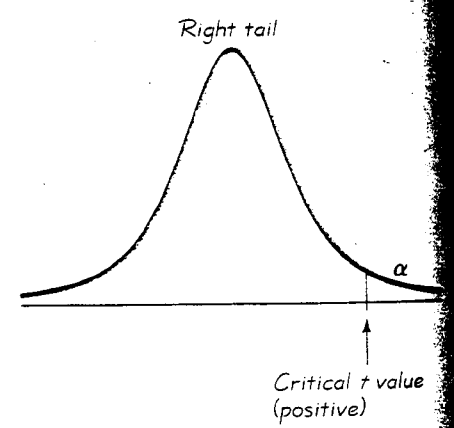
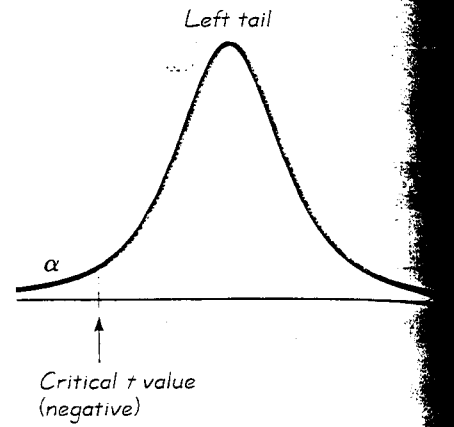
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Table 0 Factors for Computing Control Limits

Number of observations in sample, n	\bar{X} chart	R chart	
	Factors for control limits	Factors for control limits	
	A_2	D_3	D_4
2	1.880	0	3.267
3	1.023	0	2.575
4	0.729	0	2.282
5	0.577	0	2.115
6	0.483	0	2.004
7	0.419	0.076	1.924
8	0.373	0.136	1.864
9	0.337	0.184	1.816
10	0.308	0.223	1.777
11	0.285	0.256	1.744
12	0.266	0.284	1.716
13	0.249	0.308	1.692
14	0.235	0.329	1.671
15	0.223	0.348	1.652
16	0.212	0.364	1.636
17	0.203	0.379	1.621
18	0.194	0.392	1.608
19	0.187	0.404	1.596
20	0.180	0.414	1.586
21	0.173	0.425	1.575
22	0.167	0.434	1.566
23	0.162	0.443	1.557
24	0.157	0.452	1.548
25	0.153	0.459	1.541

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TABLE A-3		<i>t</i> Distribution: Critical <i>t</i> Values				
		Area in One Tail				
		0.005	0.01	0.025	0.05	0.10
Degrees of Freedom		Area in Two Tails				
		0.01	0.02	0.05	0.10	0.20
1		63.657	31.821	12.706	6.314	3.078
2		9.925	6.965	4.303	2.920	1.886
3		5.841	4.541	3.182	2.353	1.638
4		4.604	3.747	2.776	2.132	1.533
5		4.032	3.365	2.571	2.015	1.476
6		3.707	3.143	2.447	1.943	1.440
7		3.499	2.998	2.365	1.895	1.415
8		3.355	2.896	2.306	1.860	1.397
9		3.250	2.821	2.262	1.833	1.383
10		3.169	2.764	2.228	1.812	1.372
11		3.106	2.718	2.201	1.796	1.363
12		3.055	2.681	2.179	1.782	1.356
13		3.012	2.650	2.160	1.771	1.350
14		2.977	2.624	2.145	1.761	1.345
15		2.947	2.602	2.131	1.753	1.341
16		2.921	2.583	2.120	1.746	1.337
17		2.898	2.567	2.110	1.740	1.333
18		2.878	2.552	2.101	1.734	1.330
19		2.861	2.539	2.093	1.729	1.328
20		2.845	2.528	2.086	1.725	1.325
21		2.831	2.518	2.080	1.721	1.323
22		2.819	2.508	2.074	1.717	1.321
23		2.807	2.500	2.069	1.714	1.319
24		2.797	2.492	2.064	1.711	1.318
25		2.787	2.485	2.060	1.708	1.316
26		2.779	2.479	2.056	1.706	1.315
27		2.771	2.473	2.052	1.703	1.314
28		2.763	2.467	2.048	1.701	1.313
29		2.756	2.462	2.045	1.699	1.311
30		2.750	2.457	2.042	1.697	1.310
31		2.744	2.453	2.040	1.696	1.309
32		2.738	2.449	2.037	1.694	1.309
34		2.728	2.441	2.032	1.691	1.307
36		2.719	2.434	2.028	1.688	1.306
38		2.712	2.429	2.024	1.686	1.304
40		2.704	2.423	2.021	1.684	1.303
45		2.690	2.412	2.014	1.679	1.301
50		2.678	2.403	2.009	1.676	1.299
55		2.668	2.396	2.004	1.673	1.297
60		2.660	2.390	2.000	1.671	1.296
65		2.654	2.385	1.997	1.669	1.295
70		2.648	2.381	1.994	1.667	1.294
75		2.643	2.377	1.992	1.665	1.293
80		2.639	2.374	1.990	1.664	1.292
90		2.632	2.368	1.987	1.662	1.291
100		2.626	2.364	1.984	1.660	1.290
200		2.601	2.345	1.972	1.653	1.286
300		2.592	2.339	1.968	1.650	1.284
400		2.588	2.336	1.966	1.649	1.284
500		2.586	2.334	1.965	1.648	1.283
750		2.582	2.331	1.963	1.647	1.283
1000		2.581	2.330	1.962	1.646	1.282
2000		2.578	2.328	1.961	1.646	1.282
Large		2.576	2.326	1.960	1.645	1.282



...11/-

TABLE A-4 Chi-Square (χ^2) Distribution

Degrees of Freedom	Area to the Right of the Critical Value									
	0.995	0.99	0.975	0.95	0.90	0.10	0.05	0.025	0.01	0.005
1	—	—	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	11.071	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	28.299
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	14.042	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	43.194	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	14.257	16.047	17.708	19.768	39.087	42.557	45.722	49.588	52.336
30	13.787	14.954	16.791	18.493	20.599	40.256	43.773	46.979	50.892	53.672
40	20.707	22.164	24.433	26.509	29.051	51.805	55.758	59.342	63.691	66.766
50	27.991	29.707	32.357	34.764	37.689	63.167	67.505	71.420	76.154	79.490
60	35.534	37.485	40.482	43.188	46.459	74.397	79.082	83.298	88.379	91.952
70	43.275	45.442	48.758	51.739	55.329	85.527	90.531	95.023	100.425	104.215
80	51.172	53.540	57.153	60.391	64.278	96.578	101.879	106.629	112.329	116.321
90	59.196	61.754	65.647	69.126	73.291	107.565	113.145	118.136	124.116	128.299
100	67.328	70.065	74.222	77.929	82.358	118.498	124.342	129.561	135.807	140.169

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Degrees of Freedom

- $n - 1$ for confidence intervals or hypothesis tests with a standard deviation or variance
- $k - 1$ for multinomial experiments or goodness-of-fit with k categories
- $(r - 1)(c - 1)$ for contingency tables with r rows and c columns
- $k - 1$ for Kruskal-Wallis test with k samples

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