UNIVERSITI SAINS MALAYSIA

Peperiksaan Semester Pertama
Sidang Akademik 1997/98

September 1997

FMS 161.4 - Matematik dan Statistik untuk Farmasi

Masa: 3 jam

Kertas ini mengandungi **ENAM (6)** soalan dan 26 muka surat yang bertaip.

Jawab **LIMA (5)** soalan sahaja.

Semua soalan mesti dijawab di dalam Bahasa Malaysia.

.....2/-

I. (A) Tentukan a dan b untuk fungsi berikut:

$ax^3 + bx^2$ yang melalui titik (-1,1) dan mempunyai titik lengkok balas apabila $x = \frac{1}{3}$

(2.5 markah)

(B) Lakarkan fungsi $f(x) = x^3 - 3x + 1$

(2.5 markah)

(C) Dapatkan kamiran berikut:

(i) $\int \frac{dx}{x \log 5}$

(ii) $\int \frac{xe^x}{(x+1)^2} dx$

(iii) $\int x \log x^2 \, dx$

(iv) $\int x^3 e^{-x^2} dx$

(v) $\int x^2 (x+1)^9 dx$

(5 markah)

.....3/-

(D) Dalam menilai sesuatu laporan kajian klinikal, seseorang ahli farmasi harus berupaya menentukan sama ada keputusan kajian itu benar dan boleh diaplikasikan. Bincangkan perkara-perkara yang perlu dipertimbangkan bagi tujuan yang disebutkan di atas.

(10 markah)

II. (A) Selesaikan terbitan berikut:

(i) $f(x) = \log\sqrt{\frac{1-x}{2-x}}$

(ii) $f(x)=(x+1)^2(x-1)^5x^3$

(2 markah)

(B) Cari nilai maksimum untuk:

$y = ae^{kx} + be^{-kx}$, $a > 0, b > 0$.

(5 markah)

.....4/-

(C) Selesaikan had untuk fungsi berikut:

(i) $\lim_{x \to 0} \dfrac{e^x - 1}{x(1 + x)}$

(ii) $\lim_{x \to 1} X^{\frac{1}{x - 1}}$

(iii) $\lim_{x \to 1} \dfrac{x - a}{x^n - a^n}$

(3 markah)

(D) Senaraikan kebaikan dan keburukan kajian retrospektif dan kajian prospektif.

(10 markah)

.....5/-

III. Suatu kajian dikendalikan untuk membandingkan penyerapan drug Z dari dua sediaan yang berbeza. Enam belas subjek manusia digunakan dan dibahagikan secara rawak kepada dua kumpulan. Kumpulan 1 diberikan formulasi A dan kumpulan 2 diberikan formulasi B. Berikut ialah keputusan yang diperolehi:

Amaun yang diserap (mg)	
Formulasi A	**Formulasi B**
9.3	5.6
10.2	6.6
8.6	6.6
7.6	4.2
8.0	7.6
9.0	3.8
7.0	4.0
6.5	8.0

(A) Tentukan sama ada penyerapan drug Z dari dua formulasi itu adalah berbeza secara statistik.

(10 markah)

(B) Terangkan kelemahan-kelemahan kajian yang dikendalikan itu. Bagaimana kajian tersebut dapat diperbaiki?

(10 markah)

.....6/-

IV. (A) Jadual di bawah menunjukkan data yang didapati daripada satu kajian kohort berkaitan penggunaan pil kontraseptif dan hubungannya dengan kejadian bakteriuria.

Penggunaan Pil Kontraseptif	**Bakteriuria**		
	Ya	**Tidak**	**Total**
Ya	27	455	482
Tidak	77	1831	1908
Total	104	2286	2390

Daripada data di atas:

(i) Kira risiko relatif dan jelaskan keputusan tersebut.

(ii) Kira risiko atribut dan jelaskan keputusan tersebut.

(iii) Kira peratus risiko atribut dan jelaskan keputusan tersebut.

(10 markah)

(B) Tulis nota ringkas mengenai perkara-perkara berikut:

(i) Program Pangkalan Data.

(ii) Modem.

(iii) Internet

(iv) E-mail

(10 markah)

.....7/-

V. (A) Terangkan apa yang dimaksudkan oleh ralat "type I" dan ralat "type II". Terangkan dengan memberikan contoh yang sesuai bagaimana ralat-ralat itu boleh berlaku.

(10 markah)

(B) **Linktus Kodeina BPC**

Kodeina Fosfat	0.3% w/v
Larutan Pewarna	10 mL
Larutan Asid Benzoik	20 mL
Spirit Kloroform	20 mL
Air	20 mL
Sirap Lemon	20% v/v
Sirap sampai	1000 mL

Linktus Kodeina, Pediatrik BPC

Linktus Kodeina BPC	20% v/v
Sirap sampai	1000 mL

Dos: Sampai setahun, 5 mL; 1-5 tahun, 10 mL.

Pesakit: Anak Hamizah (4 tahun)
R_X
Linktus Kodeina, Pediatrik
Sig. 1 dos t.d.s. selama 5 hari

Tunjukkan **formula** dan kirakan **amaun sesuai (mg atau mL)** untuk preskripsi di atas.

(10 markah)

.....8/-

VI. (A) Takrif dan bincangkan tentang selang keyakinan. Berikan contoh cara selang keyakinan digunakan dalam statistik gunaan.

(5 markah)

(B) Takrif dan bincangkan tentang rantau genting. Huraikan beserta contoh tentang kepentingannya dalam ujian statistik.

(5 markah)

(C) R_X

Asid Benzoik	0.5 mmol/10 mL
Propilena Glikol	75% v/v
Air Suling q.s. ad	1L
ft. Larutan	

Sig. **Sebahagian** larutan ini dicairkan ke 500 mL dengan air akan menghasilkan suatu larutan yang mengandungi 1:10,000 asid benzoik. Gunakan sebagai diarahkan.

Kirakan isipadu (mL) untuk **sebahagian** larutan tersebut.
Berat molekul untuk asid benzoik ialah 122.

(10 markah)

.....9/-

FORMULA

1. Median (m) = $b + c \times \frac{d}{f}$

2. $u_i = Ax_i + B$

3. $\bar{x} = \frac{1}{A}(\bar{u} - B)$

4. $S_x^2 = \frac{1}{A^2} S_u^2$

5. $S_u^2 = \frac{\Sigma ui^2 fi - n\bar{u}^2}{n - 1}$

6. Trimean = $\frac{\text{kuartil atas} + (2 \times \text{median}) + \text{kuartil bawah}}{4}$

7. Ujian-t

$$t = \frac{\bar{x} - \mu_o}{S/\sqrt{n}}$$

$$s = \sqrt{\frac{x^2 - \frac{(x)^2}{n}}{n - 1}}$$

$$t = \frac{\bar{x}_1 - \bar{x}_2}{S\sqrt{1/n_1 + 1/n_2}}$$

$$s = \sqrt{\frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{n_1 + n_2 - 2}}$$

$$t = \frac{\bar{D}}{S/\sqrt{n}}$$

$$s = \sqrt{\frac{\Sigma D^2 - \frac{(\Sigma D)^2}{n}}{n - 1}}$$

TABLE X Critical values of F_{max}

p	2	3	4	5	6	7	8	9	10	11	12
2	39.0	87.5	142.	202.	266.	333.	403.	475.	550.	626.	704.
	199.	448.	729.	1036.	1362.	1705.	2063.	2432.	2813.	3204.	3605.
3	15.4	27.8	39.2	50.7	62.0	72.9	83.5	93.9	104.	114.	124.
	47.5	85.	120.	151.	184.	21(6)	24(9)	28(1)	31(0)	33(7)	36(1)
4	9.60	15.5	20.6	25.2	29.5	33.6	37.5	41.1	44.6	48.0	51.4
	23.2	37.	49.	59.	69.	79.	89.	97.	106.	113.	120.
5	7.15	10.8	13.7	16.3	18.7	20.8	22.9	24.7	26.5	28.2	29.9
	14.9	22.	28.	33.	38.	42.	46.	50.	54.	57.	60.
6	5.82	8.38	10.4	12.1	13.7	15.0	16.3	17.5	18.6	19.7	20.7
	11.1	15.5	19.1	22.	25.	27.	30.	32.	34.	36.	37.
7	4.99	6.94	8.44	9.70	10.8	11.8	12.7	13.5	14.3	15.1	15.8
	8.89	12.1	14.5	16.5	18.4	20.	22.	23.	24.	26.	27.
8	4.43	6.00	7.18	8.12	9.03	9.78	10.5	11.1	11.7	12.2	12.7
	7.50	9.9	11.7	13.2	14.5	15.8	16.9	17.9	18.9	19.8	21.
9	4.03	5.34	6.31	7.11	7.80	8.41	8.95	9.45	9.91	10.3	10.7
	6.54	8.5	9.9	11.1	12.1	13.1	13.9	14.7	15.3	16.0	16.6
10	3.72	4.85	5.67	6.34	6.92	7.42	7.87	8.28	8.66	9.01	9.34
	5.85	7.4	8.6	9.6	10.4	11.1	11.8	12.4	12.9	13.4	13.9
12	3.28	4.16	4.79	5.30	5.72	6.09	6.42	6.72	7.00	7.25	7.48
	4.91	6.1	6.9	7.6	8.2	8.7	9.1	9.5	9.9	10.2	10.6
15	2.86	3.54	4.01	4.37	4.68	4.95	5.19	5.40	5.59	5.77	5.93
	4.07	4.9	5.5	6.0	6.4	6.7	7.1	7.3	7.5	7.8	8.0
20	2.46	2.95	3.29	3.54	3.76	3.94	4.10	4.24	4.37	4.49	4.59
	3.32	3.8	4.3	4.6	4.9	5.1	5.3	5.5	5.6	5.8	5.9
30	2.07	2.40	2.61	2.78	2.91	3.02	3.12	3.21	3.29	3.36	3.39
	2.63	3.0	3.3	3.4	3.6	3.7	3.8	3.9	4.0	4.1	4.2
60	1.67	1.85	1.96	2.04	2.11	2.17	2.22	2.26	2.30	2.33	2.36
	1.96	2.2	2.3	2.4	2.4	2.5	2.5	2.6	2.6	2.7	2.7
∞	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

From H. A. David, *Biometrika*, 39, 422-4. Reprinted by permission of the Biometrika trustees.

.....11/-

8. Ujian Wilcoxon (independent samples)

$$U = n_1 n_2 + \frac{n_2(n_2 + 1)}{2} - \Sigma_R$$

$$U' = n_1 n_2 - U$$

9. Ujian Sign

$$P (s \geq k) = 1 - P (s \geq k-1)$$

10. ANOVA (1-way)

$$SS_{Total} = \Sigma X^2 - \frac{(\Sigma X)^2}{n_T}$$

$$SS_{Treatments} = \frac{(\Sigma X_A)^2}{n_A} + \frac{(\Sigma X_B)^2}{n_B} \quad ..... \quad - \frac{(\Sigma X)^2}{n_T}$$

$$SS_{Error} = SS_{Total} - SS_{Treatments}$$

$$d.f. \text{ (Total)} = (n_T - 1)$$

$$d.f. \text{ (Treatment)} = (k - 1)$$

$$d.f. \text{ (Error)} = (n_1 + n_2 ..... + n_k - k)$$

$$HSD = \frac{q\sqrt{MS_{error}}}{\sqrt{n}}$$

$$n_{nm} = \frac{2 n_1 n_2}{n_1 + n_2}$$

.....12/-

11. Ujian Kruskal-Wallis

$$H = \frac{12}{N(N+1)}\left(\frac{R_1^2}{n_1} + \frac{R_2^2}{n_2} + \ldots\ldots + \frac{R_k^2}{n_k}\right) - 3\,(N+1)$$

$$N = n_1 + n_2 + \ldots\ldots + n_k$$

$$d.f. = k - 1$$

Ujian perbandingan berganda:

$$\Delta\bar{R} = Z_{(\alpha/k\,(k-1))}\sqrt{\frac{N(N+1)}{12}\left(\frac{1}{n_i} + \frac{1}{n_j}\right)}$$

12. Ujian Friedman

$$Q = \frac{12}{n_k(k+1)}(R_1^2 + R_2^2 + \ldots\ldots + R_k^2) - 3\,n\,(k+1)$$

$$d.f. = k - 1$$

Ujian perbandingan berganda:

$$\Delta R = Z_{(\alpha/k\,(k-1))}\sqrt{\frac{b\,k\,(K+1)}{6}}$$

13. Formula Sturges

$$k = 1 + 3.3\,\log_{10} n$$

.....13/-

14. Ujian Korelasi

$$R = \frac{n \Sigma xy - \Sigma x \Sigma y}{\sqrt{n \Sigma x^2 - (\Sigma x)^2}\ \sqrt{n \Sigma y^2 - (\Sigma y)^2}}$$

15. Analisis Regresi

$$y = mx + c$$

$$m = \frac{\Sigma xy - \frac{\Sigma x \Sigma y}{n}}{\Sigma x^2 - \frac{(\Sigma x)^2}{n}}$$

$$c = \frac{\Sigma y - m(\Sigma x)}{n}$$

$$SS_E = \Sigma y^2 - m \Sigma xy - \frac{(\Sigma y)^2}{n} + \frac{m \Sigma x \Sigma y}{n}$$

$$S_{yx} = \sqrt{\frac{SS_E}{n-2}}$$

16. $$\chi^2 = \frac{N(AD - BC)^2}{(A+B)(C+D)(A+C)(B+D)}$$

17. $$99\%\ CI\ \mu = \bar{X} \pm \left(t \times \frac{s}{\sqrt{n}} \right)$$

18. $$99\%\ CI\ \mu = \bar{X} \pm \left(z \times \frac{s}{\sqrt{n}} \right)$$

19. $$Z = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}}$$

20. $$\chi^2 = \Sigma \frac{(O-E)^2}{E}$$

.....14/-

TABLE IV Normal curve areas

Z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
0.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990
3.1	.49903									
3.2	.49931									
3.3	.49952									
3.4	.49966									
3.5	.49977									
3.6	.49984									
3.7	.49989									
3.8	.49993									
3.9	.49995									
4.0	.50000									

.....15/-

TABLE III Critical values of *t*

For any given df, the table shows the values of t corresponding to various levels of probability. Obtained t is significant at a given level if it is equal to or greater than the value shown in the table.

	Level of significance for one-tailed test					
	.10	.05	.025	.01	.005	.0005
	Level of significance for two-tailed test					
df	.20	.10	.05	.02	.01	.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	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

From R. A. Fisher and F. Yates, *Statistical Tables for Biological, Agricultural and Medical Research*, published by Longman Group Ltd., London (previously published by Oliver and Boyd Ltd., Edinburgh) and by permission of the authors and publishers.

TABLE IX Critical values of U

n_1	n_2	0.10	0.05	0.025	0.01	0.005	0.001
3	2	6	-	-	-	-	-
	3	8	9	-	-	-	-
4	2	8	-	-	-	-	-
	3	11	12	-	-	-	-
	4	13	15	16	-	-	-
5	2	9	10	-	-	-	-
	3	13	14	15	-	-	-
	4	16	18	19	20	-	-
	5	20	21	23	24	25	-
6	2	11	12	-	-	-	-
6	3	15	16	17	-	-	-
	4	19	21	22	23	24	-
	5	23	25	27	28	29	-
	6	27	29	31	33	34	-
7	2	13	14	-	-	-	-
7	3	17	19	20	21	-	-
	4	22	24	25	27	28	-
	5	27	29	30	32	34	-
	6	31	34	36	38	39	42
	7	36	38	41	43	45	48
8	2	14	15	16	-	-	-
	3	19	21	22	24	-	-
	4	25	27	28	30	31	-
	5	30	32	34	36	38	40
	6	35	38	40	42	44	47
8	7	40	43	46	49	50	54
	8	45	49	51	55	57	60
9	1	9	-	-	-	-	-
	2	16	17	18	-	-	-
	3	22	23	25	26	27	-
9	4	27	30	32	33	35	-
	5	33	36	38	40	42	44
	6	39	42	44	47	49	52
	7	45	48	51	54	56	60
	8	50	54	57	61	63	67
9	9	56	60	64	67	70	74
10	1	10	-	-	-	-	-
	2	17	19	20	-	-	-
	3	24	26	27	29	30	-
	4	30	33	35	37	38	40
10	5	37	39	42	44	46	49
	6	43	46	49	52	54	57
	7	49	53	56	59	61	65
	8	56	60	63	67	69	74
	9	62	66	70	74	77	82
10	10	68	73	77	81	84	90
11	1	11	-	-	-	-	-
	2	19	21	22	-	-	-
	3	26	28	30	32	33	-
	4	33	36	38	40	42	44
11	5	40	43	46	48	50	53
	6	47	50	53	57	59	62
	7	54	58	61	65	67	71
	8	61	65	69	73	75	80
	9	68	72	76	81	83	89
11	10	74	79	84	88	92	98
	11	81	87	91	96	100	106
12	1	12	-	-	-	-	-
	2	20	22	23	-	-	-
	3	28	31	32	34	35	-
12	4	36	39	41	43	45	48
	5	43	47	49	52	54	58
	6	51	55	58	61	63	68
	7	58	63	66	70	72	77
	8	66	70	74	79	81	87
12	9	73	78	82	87	90	96
	10	81	86	91	96	99	106
	11	88	94	99	104	108	115
	12	95	102	107	113	117	124
13	1	13	-	-	-	-	-
13	2	22	24	25	26	-	-
	3	30	33	35	37	38	-
	4	39	42	44	47	49	51
	5	47	50	53	56	58	62
	6	55	59	62	66	68	73
13	7	63	67	71	75	78	83
	8	71	76	80	84	87	93
	9	79	84	89	94	97	103
	10	87	93	97	103	106	113
	11	95	101	106	112	116	123

TABLE IX (*continued*)

n_1	n_2	0.10	0.05	0.025	0.01	0.005	0.001	n_1	n_2	0.10	0.05	0.025	0.01	0.005	0.001
13	12	103	109	115	121	125	133	16	10	106	112	118	124	129	137
	13	111	118	124	130	135	143		11	115	122	129	135	140	149
14	1	14	-	-	-	-	-		12	125	132	139	146	151	161
	2	24	25	27	28	-	-		13	134	143	149	157	163	173
	3	32	35	37	40	41	-		14	144	153	160	168	174	185
14	4	41	45	47	50	52	55	16	15	154	163	170	179	185	197
	5	50	54	57	60	63	67		16	163	173	181	190	196	208
	6	59	63	67	71	73	78	17	1	17	-	-	-	-	-
	7	67	72	76	81	83	89		2	28	31	32	34	-	-
	8	76	81	86	90	94	100		3	39	42	45	47	49	51
14	9	85	90	95	100	104	111	17	4	50	53	57	60	62	66
	10	93	99	104	110	114	121		5	60	65	68	72	75	80
	11	102	108	114	120	124	132		6	71	76	80	84	87	93
	12	110	117	123	130	134	143		7	81	86	91	96	100	106
	13	119	126	132	139	144	153		8	91	97	102	108	112	119
14	14	127	135	141	149	154	164	17	9	101	108	114	120	124	132
15	1	15	-	-	-	-	-		10	112	119	125	132	136	145
	2	25	27	29	30	-	-		11	122	130	136	143	148	158
	3	35	38	40	42	43	-		12	132	140	147	155	160	170
	4	44	48	50	53	55	59		13	142	151	158	166	172	183
15	5	53	57	61	64	67	71	17	14	153	161	169	178	184	195
	6	63	67	71	75	78	83		15	163	172	180	189	195	208
	7	72	77	81	86	89	95		16	173	183	191	201	207	220
	8	81	87	91	96	100	106		17	183	193	202	212	219	232
	9	90	96	101	107	111	118	18	1	18	-	-	-	-	-
15	10	99	106	111	117	121	129		2	30	32	34	36	-	-
	11	108	115	121	128	132	141		3	41	45	47	50	52	54
	12	117	125	131	138	143	152		4	52	56	60	63	66	69
	13	127	134	141	148	153	163		5	63	68	72	76	79	84
	14	136	144	151	159	164	174		6	74	80	84	89	92	98
15	15	145	153	161	169	174	185	18	7	85	91	96	102	105	112
16	1	16	-	-	-	-	-		8	96	103	108	114	118	126
	2	27	29	31	32	-	-		9	107	114	120	126	131	139
	3	37	40	42	45	46	-		10	118	125	132	139	143	153
	4	47	50	53	57	59	62		11	129	137	143	151	156	166
16	5	57	61	65	68	71	75	18	12	139	148	155	163	169	179
	6	67	71	75	80	83	88		13	150	159	167	175	181	192
	7	76	82	86	91	94	101		14	161	170	178	187	194	206
	8	86	92	97	102	106	113		15	172	182	190	200	206	219
	9	96	102	107	113	117	125		16	182	193	202	212	218	232

TABLE IX *(continued)*

n_1	n_2	0.10	0.05	0.025	0.01	0.005	0.001
18	17	193	204	213	224	231	245
	18	204	215	225	236	243	258
19	1	18	19	-	-	-	-
	2	31	34	36	37	38	-
	3	43	47	50	53	54	57
19	4	55	59	63	67	69	73
	5	67	72	76	80	83	88
	6	78	84	89	94	97	103
	7	90	96	101	107	111	118
	8	101	108	114	120	124	132
19	9	113	120	126	133	138	146
	10	124	132	138	146	151	161
	11	136	144	151	159	164	175
	12	147	156	163	172	177	188
	13	158	167	175	184	190	202
19	14	169	179	188	197	203	216
	15	181	191	200	210	216	230
	16	192	203	212	222	230	244
	17	203	214	224	235	242	257
	18	214	226	236	248	255	271
19	19	226	238	248	260	268	284
20	1	19	20	-	-	-	-
	2	33	36	38	39	40	-
	3	45	49	52	55	57	60
	4	58	62	66	70	72	77
20	5	70	75	80	84	87	93
	6	82	88	93	98	102	108
	7	94	101	106	112	116	124
	8	106	113	119	126	130	139
	9	118	126	132	140	144	154
20	10	130	138	145	153	158	168
	11	142	151	158	167	172	183
	12	154	163	171	180	186	198
	13	166	176	184	193	200	212
	14	178	188	197	207	213	226
20	15	190	200	210	220	227	241
	16	201	213	222	233	241	255
	17	213	225	235	247	254	270
	18	225	237	248	260	268	284
	19	237	250	261	273	281	298
	20	249	262	273	286	295	312

From D. B. Owen, *Handbook of Statistical Tables*. Reading, MA: Addison-Wesley, 1962. Reprinted by permission.

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TABLE XIII Table of q (0.05 level)

d.f. \ k	2	3	4	5	6	7	8	9	10	11
5	3.64	4.60	5.22	5.67	6.03	6.33	6.58	6.80	6.99	7.17
6	3.46	4.34	4.90	5.30	5.63	5.90	6.12	6.32	6.49	6.65
7	3.34	4.16	4.68	5.06	5.36	5.61	5.82	6.00	6.16	6.30
8	3.26	4.04	4.53	4.89	5.17	5.40	5.60	5.77	5.92	6.05
9	3.20	3.95	4.41	4.76	5.02	5.24	5.43	5.59	5.74	5.87
10	3.15	3.88	4.33	4.65	4.91	5.12	5.30	5.46	5.60	5.72
11	3.11	3.82	4.26	4.57	4.82	5.03	5.20	5.35	5.49	5.61
12	3.08	3.77	4.20	4.51	4.75	4.95	5.12	5.27	5.39	5.51
13	3.06	3.73	4.15	4.45	4.69	4.88	5.05	5.19	5.32	5.43
14	3.03	3.70	4.11	4.41	4.64	4.83	4.99	5.13	5.25	5.36
15	3.01	3.67	4.08	4.37	4.59	4.78	4.94	5.08	5.20	5.31
16	3.00	3.65	4.05	4.33	4.56	4.74	4.90	5.03	5.15	5.26
17	2.98	3.63	4.02	4.30	4.52	4.71	4.86	4.99	5.11	5.21
18	2.97	3.61	4.00	4.28	4.49	4.67	4.82	4.96	5.07	5.17
19	2.96	3.59	3.98	4.25	4.47	4.65	4.79	4.92	5.04	5.14
20	2.95	3.58	3.96	4.23	4.45	4.62	4.77	4.90	5.01	5.11
24	2.92	3.53	3.90	4.17	4.37	4.54	4.68	4.81	4.92	5.01
30	2.89	3.49	3.85	4.10	4.30	4.46	4.60	4.72	4.82	4.92
40	2.86	3.44	3.79	4.04	4.23	4.39	4.52	4.63	4.73	4.82
60	2.83	3.40	3.74	3.98	4.16	4.31	4.44	4.55	4.65	4.73
120	2.80	3.36	3.68	3.92	4.10	4.24	4.36	4.47	4.56	4.64
∞	2.77	3.31	3.63	3.86	4.03	4.17	4.29	4.39	4.47	4.55

From H.L. Harker in *Annals of Mathematical Statistics*, 31 (1960): 1122-1147. Reprinted by permission of the publishers, The Institute of Mathematical Statistics.

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TABLE V Chi square

Column headings indicate probability of chance deviation between O and E.

D.F. \ P	0.25	0.10	0.05	0.025	0.01	0.005
1.	1.323	2.706	3.841	5.024	6.635	7.879
2.	2.773	4.605	5.991	7.378	9.210	10.597
3.	4.108	6.251	7.815	9.348	11.345	12.838
4.	5.385	7.779	9.488	11.143	13.277	14.860
5.	6.626	9.236	11.071	12.833	15.086	16.750
6.	7.841	10.645	12.592	14.449	16.812	18.548
7.	9.037	12.017	14.067	16.013	18.475	20.278
8.	10.219	13.362	15.507	17.535	20.090	21.955
9.	11.389	14.684	16.919	19.023	21.666	23.589
10.	12.549	15.987	18.307	20.483	23.209	25.188
11.	13.701	17.275	19.675	21.920	24.725	26.757
12.	14.845	18.549	21.026	23.337	26.217	28.299
13.	15.984	19.812	22.362	24.736	27.688	29.819
14.	17.117	21.064	23.685	26.119	29.141	31.319
15.	18.245	22.307	24.996	27.488	30.578	32.801

Adapted from table of χ^2 appearing in *Handbook of Statistical Tables* by D. B. Owen, Addison-Wesley, 1962, p. 50. Reprinted by permission of the U.S. Atomic Energy Commission.

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The obtained F is significant at a given level if it is equal to or greater than the value shown in the table.
0.05 (light row) and 0.01 (dark row) points for the distribution of F

Degrees of freedom for lesser mean square	Degrees of freedom for greater mean square																							
	1	2	3	4	5	6	7	8	9	10	11	12	14	16	20	24	30	40	50	75	100	200	500	∞
1	161	200	216	225	230	234	237	239	241	242	243	244	245	246	248	249	250	251	252	253	253	254	254	254
	4052	4999	5403	5625	5764	5859	5928	5981	6022	6056	6082	6106	6142	6169	6208	6234	6258	6286	6302	6323	6334	6352	6361	6366
2	18.51	19.00	19.16	19.25	19.30	19.33	19.36	19.37	19.38	19.39	19.40	19.41	19.42	19.43	19.44	19.45	19.46	19.47	19.47	19.48	19.49	19.49	19.50	19.50
	98.49	99.01	99.17	99.25	99.30	99.33	99.34	99.36	99.38	99.40	99.41	99.42	99.43	99.44	99.45	99.46	99.47	99.48	99.48	99.49	99.49	99.49	99.50	99.50
3	10.13	9.55	9.28	9.12	9.01	8.94	8.88	8.84	8.81	8.78	8.76	8.74	8.71	8.69	8.66	8.64	8.62	8.60	8.58	8.57	8.56	8.54	8.54	8.53
	34.12	30.81	29.46	28.71	28.24	27.91	27.67	27.49	27.34	27.23	27.13	27.05	26.92	26.83	26.69	26.60	26.50	26.41	26.30	26.27	26.23	26.18	26.14	26.12
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96	5.93	5.91	5.87	5.84	5.80	5.77	5.74	5.71	5.70	5.68	5.66	5.65	5.64	5.63
	21.20	18.00	16.69	15.98	15.52	15.21	14.98	14.80	14.66	14.54	14.45	14.37	14.24	14.15	14.02	13.93	13.83	13.74	13.69	13.61	13.57	13.52	13.48	13.46
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.78	4.74	4.70	4.68	4.64	4.60	4.56	4.53	4.50	4.46	4.44	4.42	4.40	4.38	4.37	4.36
	16.26	13.27	12.06	11.39	10.97	10.67	10.45	10.27	10.15	10.05	9.96	9.89	9.77	9.68	9.55	9.47	9.38	9.29	9.24	9.17	9.13	9.07	9.04	9.02
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06	4.03	4.00	3.96	3.92	3.87	3.84	3.81	3.77	3.75	3.72	3.71	3.69	3.68	3.67
	13.74	10.92	9.78	9.15	8.75	8.47	8.26	8.10	7.98	7.87	7.79	7.72	7.60	7.52	7.39	7.31	7.23	7.14	7.09	7.02	6.99	6.94	6.90	6.88
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.63	3.60	3.57	3.52	3.49	3.44	3.41	3.38	3.34	3.32	3.29	3.28	3.25	3.24	3.23
	12.25	9.55	8.45	7.85	7.46	7.19	7.00	6.84	6.71	6.62	6.54	6.47	6.35	6.27	6.15	6.07	5.98	5.90	5.85	5.78	5.75	5.70	5.67	5.65
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.34	3.31	3.28	3.23	3.20	3.15	3.12	3.08	3.05	3.03	3.00	2.98	2.96	2.94	2.93
	11.26	8.65	7.59	7.01	6.63	6.37	6.19	6.03	5.91	5.82	5.74	5.67	5.56	5.48	5.36	5.28	5.20	5.11	5.06	5.00	4.96	4.91	4.88	4.86
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.13	3.10	3.07	3.02	2.98	2.93	2.90	2.86	2.82	2.80	2.77	2.76	2.73	2.72	2.71
	10.56	8.02	6.99	6.42	6.06	5.80	5.62	5.47	5.35	5.26	5.18	5.11	5.00	4.92	4.80	4.73	4.64	4.56	4.51	4.45	4.41	4.36	4.33	4.31
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.97	2.94	2.91	2.86	2.82	2.77	2.74	2.70	2.67	2.64	2.61	2.59	2.56	2.55	2.54
	10.04	7.56	6.55	5.99	5.64	5.39	5.21	5.06	4.95	4.85	4.78	4.71	4.60	4.52	4.41	4.33	4.25	4.17	4.12	4.05	4.01	3.96	3.93	3.91
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.86	2.82	2.79	2.74	2.70	2.65	2.61	2.57	2.53	2.50	2.47	2.45	2.42	2.41	2.40
	9.65	7.20	6.22	5.67	5.32	5.07	4.88	4.74	4.63	4.54	4.46	4.40	4.29	4.21	4.10	4.02	3.94	3.86	3.80	3.74	3.70	3.66	3.62	3.60
12	4.75	3.88	3.49	3.26	3.11	3.00	2.92	2.85	2.80	2.76	2.72	2.69	2.64	2.60	2.54	2.50	2.46	2.42	2.40	2.36	2.35	2.32	2.31	2.30
	9.33	6.93	5.95	5.41	5.06	4.82	4.65	4.50	4.39	4.30	4.22	4.16	4.05	3.98	3.86	3.78	3.70	3.61	3.56	3.49	3.46	3.41	3.38	3.36
13	4.67	3.80	3.41	3.18	3.02	2.92	2.84	2.77	2.72	2.67	2.63	2.60	2.55	2.51	2.46	2.42	2.38	2.34	2.32	2.28	2.26	2.24	2.22	2.21
	9.07	6.70	5.74	5.20	4.86	4.62	4.44	4.30	4.19	4.10	4.02	3.96	3.85	3.78	3.67	3.59	3.51	3.42	3.37	3.30	3.27	3.21	3.18	3.16
14	4.60	3.74	3.34	3.11	2.96	2.85	2.77	2.70	2.65	2.60	2.56	2.53	2.48	2.44	2.39	2.35	2.31	2.27	2.24	2.21	2.19	2.16	2.14	2.13
	8.86	6.51	5.56	5.03	4.69	4.46	4.28	4.14	4.03	3.94	3.86	3.80	3.70	3.62	3.51	3.43	3.34	3.26	3.21	3.14	3.11	3.06	3.02	3.00
15	4.54	3.68	3.29	3.06	2.90	2.79	2.70	2.64	2.59	2.55	2.51	2.48	2.43	2.39	2.33	2.29	2.25	2.21	2.18	2.15	2.12	2.10	2.08	2.07
	8.68	6.36	5.42	4.89	4.56	4.32	4.14	4.00	3.89	3.80	3.73	3.67	3.56	3.48	3.36	3.29	3.20	3.12	3.07	3.00	2.97	2.92	2.89	2.87

TABLE VII (*continued*)

0.05 (light row) and 0.01 (dark row) points for the distribution of F

Degrees of freedom for lesser mean square	Degrees of freedom for greater mean square																							
	1	2	3	4	5	6	7	8	9	10	11	12	14	16	20	24	30	40	50	75	100	200	500	∞
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49	2.45	2.42	2.37	2.33	2.28	2.24	2.20	2.16	2.13	2.09	2.07	2.04	2.02	2.01
	8.53	6.23	5.29	4.77	4.44	4.20	4.03	3.89	3.78	3.69	3.61	3.55	3.45	3.37	3.25	3.18	3.10	3.01	2.96	2.89	2.86	2.80	2.77	2.75
17	4.45	3.59	3.20	2.96	2.81	2.70	2.62	2.55	2.50	2.45	2.41	2.38	2.33	2.29	2.23	2.19	2.15	2.11	2.08	2.04	2.02	1.99	1.97	1.96
	8.40	6.11	5.18	4.67	4.34	4.10	3.93	3.79	3.68	3.59	3.52	3.45	3.35	3.27	3.16	3.08	3.00	2.92	2.86	2.79	2.76	2.70	2.67	2.65
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41	2.37	2.34	2.29	2.25	2.19	2.15	2.11	2.07	2.04	2.00	1.98	1.95	1.93	1.92
	8.28	6.01	5.09	4.58	4.25	4.01	3.85	3.71	3.60	3.51	3.44	3.37	3.27	3.19	3.07	3.00	2.91	2.83	2.78	2.71	2.68	2.62	2.59	2.57
19	4.38	3.52	3.13	2.90	2.74	2.63	2.55	2.48	2.43	2.38	2.34	2.31	2.26	2.21	2.15	2.11	2.07	2.02	2.00	1.96	1.94	1.91	1.90	1.88
	8.18	5.93	5.01	4.50	4.17	3.94	3.77	3.63	3.52	3.43	3.36	3.30	3.19	3.12	3.00	2.92	2.84	2.76	2.70	2.63	2.60	2.54	2.51	2.49
20	4.35	3.49	3.10	2.87	2.71	2.60	2.52	2.45	2.40	2.35	2.31	2.28	2.23	2.18	2.12	2.08	2.04	1.99	1.96	1.92	1.90	1.87	1.85	1.84
	8.10	5.85	4.94	4.43	4.10	3.87	3.71	3.56	3.45	3.37	3.30	3.23	3.13	3.05	2.94	2.86	2.77	2.69	2.63	2.56	2.53	2.47	2.44	2.42
21	4.32	3.47	3.07	2.84	2.68	2.57	2.49	2.42	2.37	2.32	2.28	2.25	2.20	2.15	2.09	2.05	2.00	1.96	1.93	1.80	1.87	1.84	1.82	1.81
	8.02	5.78	4.87	4.37	4.04	3.81	3.65	3.51	3.40	3.31	3.24	3.17	3.07	2.99	2.88	2.80	2.72	2.63	2.58	2.51	2.47	2.42	2.38	2.36
22	4.30	3.44	3.05	2.82	2.66	2.55	2.47	2.40	2.35	2.30	2.26	2.23	2.18	2.13	2.07	2.03	1.98	1.93	1.91	1.87	1.84	1.81	1.80	1.78
	7.94	5.72	4.82	4.31	3.99	3.76	3.59	3.45	3.35	3.26	3.18	3.12	3.02	2.94	2.83	2.75	2.67	2.58	2.53	2.46	2.42	2.37	2.33	2.31
23	4.28	3.42	3.03	2.80	2.64	2.53	2.45	2.38	2.32	2.28	2.24	2.20	2.14	2.10	2.04	2.00	1.96	1.91	1.88	1.84	1.82	1.79	1.77	1.76
	7.88	5.66	4.76	4.26	3.94	3.71	3.54	3.41	3.30	3.21	3.14	3.07	2.97	2.89	2.78	2.70	2.62	2.53	2.48	2.41	2.37	2.32	2.28	2.26
24	4.26	3.40	3.01	2.78	2.62	2.51	2.43	2.36	2.30	2.26	2.22	2.18	2.13	2.09	2.02	1.98	1.94	1.89	1.86	1.82	1.80	1.76	1.74	1.73
	7.82	5.61	4.72	4.22	3.90	3.67	3.50	3.36	3.25	3.17	3.09	3.03	2.93	2.85	2.74	2.66	2.58	2.49	2.44	2.36	2.33	2.27	2.23	2.21
25	4.24	3.38	2.99	2.76	2.60	2.49	2.41	2.34	2.28	2.24	2.20	2.16	2.11	2.06	2.00	1.96	1.92	1.87	1.84	1.80	1.77	1.74	1.72	1.71
	7.77	5.57	4.68	4.18	3.86	3.63	3.46	3.32	3.21	3.13	3.05	2.99	2.89	2.81	2.70	2.62	2.54	2.45	2.40	2.32	2.29	2.23	2.19	2.17
26	4.22	3.37	2.89	2.74	2.59	2.47	2.39	2.32	2.27	2.22	2.18	2.15	2.10	2.05	1.99	1.95	1.90	1.85	1.82	1.78	1.76	1.72	1.70	1.69
	7.72	5.53	4.64	4.14	3.82	3.59	3.42	3.29	3.17	3.09	3.02	2.96	2.86	2.77	2.66	2.58	2.50	2.41	2.36	2.28	2.25	2.19	2.15	2.13
27	4.21	3.35	2.96	2.73	2.57	2.46	2.37	2.30	2.25	2.20	2.16	2.13	2.08	2.03	1.97	1.93	1.88	1.84	1.80	1.76	1.74	1.71	1.68	1.67
	7.68	5.49	4.60	4.11	3.79	3.56	3.39	3.26	3.14	3.06	2.98	2.93	2.83	2.74	2.63	2.55	2.47	2.38	2.33	2.25	2.21	2.16	2.12	2.10
28	4.20	3.34	2.95	2.71	2.56	2.44	2.36	2.29	3.24	2.19	2.15	2.12	2.06	2.02	1.96	1.91	1.87	1.81	1.78	1.75	1.72	1.69	1.67	1.65
	7.64	5.45	4.57	4.07	3.76	3.53	3.36	3.23	3.11	3.03	2.95	2.90	2.80	2.71	2.60	2.52	2.44	2.35	2.30	2.22	2.18	2.13	2.09	2.06
29	4.18	3.33	2.93	2.70	2.54	2.43	2.35	2.28	2.22	2.18	2.14	2.10	2.05	2.00	1.94	1.90	1.85	1.80	1.77	1.73	1.71	1.68	1.65	1.64
	7.60	5.52	4.54	4.04	3.73	3.50	3.32	3.20	3.08	3.00	2.92	2.87	2.77	2.68	2.57	2.49	2.41	2.32	2.27	2.19	2.15	2.10	2.06	2.03
30	4.17	3.32	2.92	2.69	2.53	2.42	2.34	2.27	2.21	2.16	2.12	2.09	2.04	1.99	1.93	1.89	1.84	1.79	1.76	1.72	1.69	1.66	1.64	1.62
	7.56	5.39	4.51	4.02	3.70	3.47	3.30	3.17	3.06	2.98	2.90	2.84	2.74	2.66	2.55	2.47	2.38	2.29	2.24	2.16	2.13	2.07	2.03	2.01

TABLE VII (*continued*)

0.05 (light row) and 0.01 (dark row) points for the distribution of F

Degrees of freedom for lesser mean square	Degrees of freedom for greater mean square																							
	1	2	3	4	5	6	7	8	9	10	11	12	14	16	20	24	30	40	50	75	100	200	500	∞
32	4.15	3.30	2.90	2.67	2.51	2.40	2.32	2.25	2.19	2.14	2.10	2.07	2.02	1.97	1.91	1.86	1.82	1.76	1.74	1.69	1.67	1.64	1.61	1.59
	7.50	5.34	4.46	3.97	3.66	3.42	3.25	3.12	3.01	2.94	2.86	2.80	2.70	2.62	2.51	2.42	2.34	2.25	2.20	2.12	2.08	2.02	1.98	1.96
34	4.13	3.28	2.88	2.65	2.49	2.38	2.30	2.23	2.17	2.12	2.08	2.05	2.00	1.95	1.89	1.84	1.80	1.74	1.71	1.67	1.64	1.61	1.59	1.57
	7.44	5.29	4.42	3.93	3.61	3.38	3.21	3.08	2.97	2.89	2.82	2.76	2.66	2.58	2.47	2.38	2.30	2.21	2.15	2.08	2.04	1.98	1.94	1.91
36	4.11	3.26	2.86	2.63	2.48	2.36	2.28	2.21	2.15	2.10	2.06	2.03	1.89	1.93	1.87	1.82	1.78	1.72	1.69	1.65	1.62	1.59	1.56	1.55
	7.39	5.25	4.38	3.89	3.58	3.35	3.18	3.04	2.94	2.86	2.78	2.72	2.62	2.54	2.43	2.35	2.26	2.17	2.12	2.04	2.00	1.94	1.90	1.87
38	4.10	3.25	2.85	2.62	2.46	2.35	2.26	2.19	2.14	2.09	2.05	2.02	1.96	1.92	1.85	1.80	1.76	1.71	1.67	1.63	1.60	1.57	1.54	1.53
	7.35	5.21	4.34	3.86	3.54	3.32	3.15	3.02	2.91	2.82	2.75	2.69	2.59	2.51	2.40	2.32	2.22	2.14	2.08	2.00	1.97	1.90	1.86	1.84
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.07	2.04	2.00	1.95	1.90	1.84	1.79	1.74	1.69	1.66	1.61	1.59	1.55	1.53	1.51
	7.31	5.18	4.31	3.83	3.51	3.29	3.12	2.99	2.88	2.80	2.73	2.66	2.56	2.49	2.37	2.29	2.20	2.11	2.05	1.97	1.94	1.88	1.84	1.81
42	4.07	3.22	2.83	2.59	2.44	2.32	2.24	2.17	2.11	2.06	2.02	1.90	1.94	1.89	1.82	1.78	1.73	1.68	1.64	1.60	1.57	1.54	1.51	1.49
	7.27	5.15	4.29	3.80	3.49	3.26	3.10	2.96	2.86	2.77	2.70	2.64	2.54	2.46	2.35	2.26	2.17	2.08	2.02	1.94	1.91	1.85	1.80	1.78
44	4.06	3.21	2.82	2.58	2.43	2.31	2.23	2.16	2.10	2.05	2.01	1.98	1.92	1.88	1.81	1.76	1.72	1.66	1.63	1.58	1.56	1.52	1.50	1.48
	7.24	5.12	4.26	3.78	3.46	3.24	3.07	2.94	2.84	2.75	2.68	2.62	2.52	2.44	2.32	2.24	2.15	2.06	2.09	1.92	1.88	1.82	1.78	1.75
46	4.05	3.20	2.81	2.57	2.42	2.30	2.22	2.14	2.09	2.04	2.00	1.97	1.91	1.87	1.80	1.75	1.71	1.65	1.62	1.57	1.54	1.51	1.48	1.46
	7.21	5.10	4.24	3.76	3.44	3.22	3.05	2.92	2.82	2.73	2.66	2.60	2.50	2.42	2.30	2.22	2.13	2.04	1.98	1.90	1.86	1.80	1.76	1.72
48	4.04	3.19	2.80	2.56	2.41	2.30	2.21	2.14	2.08	2.03	1.99	1.96	1.90	1.86	1.79	1.74	1.70	1.64	1.61	1.56	1.53	1.50	1.47	1.45
	7.19	5.08	4.22	3.74	3.42	3.20	3.04	2.90	2.80	2.71	2.64	2.58	2.48	2.40	2.28	2.20	2.11	2.02	1.96	1.88	1.84	1.78	1.73	1.70
50	4.03	3.18	2.79	2.56	2.40	2.29	2.20	2.13	2.07	2.02	1.98	1.95	1.90	1.85	1.78	1.74	1.69	1.63	1.60	1.55	1.52	1.48	1.46	1.44
	7.17	5.06	4.20	3.72	3.41	3.18	3.02	2.88	2.78	2.70	2.62	2.56	2.46	2.39	2.26	2.18	2.10	2.00	1.94	1.86	1.82	1.76	1.71	1.68
55	4.02	3.17	2.78	2.54	2.38	2.27	2.18	2.11	2.05	2.00	1.97	1.93	1.88	1.83	1.76	1.72	1.67	1.61	1.58	1.52	1.50	1.46	1.43	1.41
	7.12	5.01	4.16	3.68	3.37	3.15	2.98	2.85	2.75	2.66	2.59	2.53	2.43	2.35	2.23	2.15	2.06	1.96	1.90	1.82	1.78	1.71	1.66	1.64
60	4.00	3.15	2.76	2.52	2.37	2.25	2.17	2.10	2.04	1.99	1.95	1.92	1.86	1.81	1.75	1.70	1.65	1.59	1.56	1.50	1.48	1.44	1.41	1.39
	7.08	4.98	4.13	3.65	3.34	3.12	2.95	2.82	2.72	2.63	2.56	2.50	2.40	2.32	2.20	2.12	2.03	1.93	1.87	1.79	1.74	1.68	1.63	1.60
65	3.99	3.14	2.75	2.51	2.36	2.24	2.15	2.08	2.02	1.98	1.94	1.90	1.85	1.80	1.73	1.68	1.63	1.57	1.54	1.49	1.46	1.42	1.39	1.37
	7.04	4.95	4.10	3.62	3.31	3.09	2.93	2.79	2.70	2.61	2.54	2.47	2.37	2.30	2.18	2.09	2.00	1.90	1.84	1.76	1.71	1.64	1.60	1.56
70	3.98	3.13	2.74	2.50	2.35	2.32	2.14	2.07	2.01	1.97	1.93	1.89	1.84	1.79	1.72	1.67	1.62	1.56	1.53	1.47	1.45	1.40	1.37	1.35
	7.01	4.92	4.08	3.60	3.29	3.07	2.91	2.77	2.67	2.59	2.51	2.45	2.35	2.28	2.15	2.07	1.98	1.88	1.82	1.74	1.69	1.62	1.56	1.53
80	3.96	3.11	2.72	2.48	2.33	2.21	2.12	2.05	1.99	1.95	1.91	1.88	1.82	1.77	1.70	1.65	1.60	1.54	1.51	1.45	1.42	1.38	1.35	1.32
	6.96	4.88	4.04	3.56	3.25	3.04	2.87	2.74	2.64	2.55	2.48	2.41	2.32	2.24	2.11	2.03	1.94	1.84	1.78	1.70	1.65	1.57	1.52	1.49

TABLE VII (*continued*)

0.05 (light row) and 0.01 (dark row) points for the distribution of F

Degrees of freedom for lesser mean square	Degrees of freedom for greater mean square																						
	1	2	3	4	5	6	7	8	9	10	11	12	14	16	20	24	30	40	50	75	100	200	500	∞
100	3.94	3.09	2.70	2.46	2.30	2.19	2.10	2.03	1.97	1.92	1.88	1.85	1.79	1.75	1.68	1.63	1.57	1.51	1.48	1.42	1.39	1.34	1.30	1.28
	6.90	4.82	3.98	3.51	3.20	2.99	2.82	2.69	2.59	2.51	2.43	2.36	2.26	2.19	2.06	1.98	1.89	1.79	1.73	1.64	1.59	1.51	1.46	1.43
125	3.92	3.07	2.68	2.44	2.29	2.17	2.08	2.01	1.95	1.90	1.86	1.83	1.77	1.72	1.65	1.60	1.55	1.49	1.45	1.39	1.36	1.31	1.27	1.25
	6.84	4.78	3.94	3.47	3.17	2.95	2.79	2.65	2.56	2.47	2.40	2.33	2.23	2.15	2.03	1.94	1.85	1.75	1.68	1.59	1.54	1.46	1.40	1.37
150	3.91	3.06	2.67	2.43	2.27	2.16	2.07	2.00	1.94	1.89	1.85	1.82	1.76	1.71	1.64	1.59	1.54	1.47	1.44	1.37	1.34	1.29	1.25	1.22
	6.81	4.75	3.91	3.44	3.13	2.92	2.76	2.62	2.53	2.44	2.37	2.30	2.20	2.12	2.00	1.91	1.83	1.72	1.66	1.56	1.51	1.43	1.37	1.33
200	3.89	3.04	2.65	2.41	2.26	2.14	2.05	1.98	1.92	1.87	1.83	1.80	1.74	1.69	1.62	1.57	1.52	1.45	1.42	1.35	1.32	1.26	1.22	1.19
	6.76	4.71	3.38	3.41	3.11	2.90	2.73	2.60	2.50	2.41	2.34	2.28	1.17	2.09	1.97	1.88	1.79	1.69	1.62	1.53	1.48	1.39	1.33	1.28
400	3.86	3.02	2.62	2.39	2.23	2.12	2.03	1.96	1.90	1.85	1.81	1.78	1.72	1.67	1.60	1.54	1.49	1.42	1.38	1.32	1.28	1.22	1.16	1.13
	6.70	4.66	3.83	3.36	3.06	2.85	2.69	2.55	2.46	2.37	2.29	2.23	2.12	2.04	1.92	1.84	1.74	1.64	1.57	1.47	1.42	1.32	1.24	1.19
1000	3.85	3.00	2.61	2.38	2.22	2.10	2.02	1.95	1.89	1.84	1.80	1.76	1.70	1.65	1.58	1.53	1.47	1.41	1.36	1.30	1.26	1.19	1.13	1.08
	6.66	4.62	3.80	3.34	3.04	2.82	2.66	2.53	2.43	2.34	2.26	2.20	2.09	2.01	1.89	1.81	1.71	1.61	1.54	1.44	1.38	1.28	1.19	1.11
∞	3.84	2.99	2.60	2.37	2.21	2.09	2.01	1.94	1.88	1.83	1.79	1.75	1.69	1.64	1.57	1.52	1.46	1.40	1.35	1.28	1.24	1.17	1.11	1.00
	6.64	4.60	3.78	3.32	3.02	2.80	2.64	2.51	2.41	2.32	2.24	2.18	2.07	1.99	1.87	1.79	1.69	1.59	1.52	1.41	1.36	1.25	1.15	1.00

TABLE FOR WILCOXON SIGNED RANK TEST

n	c	P (W ≥ c)	n	c	P (W ≥ c)	n	c	P (W ≥ c)	n	c	P (W ≥ c)
1	1	.500	8	32	.012	12	58	.010	16	88	.011
2	3	.250		28	.027		50	.026		76	.025
3	6	.125		24	.055		44	.046		64	.052
4	10	.062		20	.096		34	.102		52	.096
	8	.125									
			9	39	.010	13	65	.011	17	97	.010
5	15	.031		33	.027		57	.024		83	.025
	13	.062		29	.049		49	.047		71	.049
	11	.094		23	.102		39	.095		55	.103
6	21	.016	10	45	.010	14	73	.010	18	105	.010
	19	.031		39	.024		63	.025		91	.024
	17	.047		33	.053		53	.052		77	.049
	13	.109		27	.097		43	.097		61	.098
7	28	.096	11	52	.009	15	80	.011	19	114	.010
	24	.023		44	.027		70	.024		96	.025
	20	.055		38	.051		60	.047		82	.052
	16	.109		30	.013		46	.104		66	.098
									20	124	.010
										106	.024
										90	.049
										70	.101

.....26/-

THE CORRELATION COEFFICIENT

Values of the correlation Coefficient for Different Levels of Significance (2 tail)

d.f.	.1	.05	.02	.01	.001
1.	.98769	.99692	.999507	.999877	.9999988
2.	.90000	.95000	.98000	.990000	.99900
3.	.8054	.8783	.93433	.9587	.99116
4.	.7293	.8114	.8822	.91720	.97406
5.	.6694	.7545	.8329	.8745	.95074
6.	.6215	.7067	.7887	.8343	.92493
7.	.5822	.6664	.7498	.7977	.8982
8.	.5494	.6319	.7155	.7646	.8721
9.	.5214	.6021	.6851	.7348	.8471
10.	.4973	.5760	.6581	.7079	.8233
11.	.4762	.5529	.6339	.6835	.8010
12.	.4575	.5324	.6120	.6614	.7800
13.	.4409	.5139	.5923	.6411	.7603
14.	.4259	.4973	.5742	.6226	.7420
15.	.4124	.4821	.5577	.6055	.7246

d.f. = degrees of freedom

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