

UNIVERSITI SAINS MALAYSIA

Peperiksaan Semester Tambahan
Sidang 1987/88

FMT 202 Statistik

Tarikh: 24 Jun 1988

Masa: 9.00 pagi - 11.00 pagi
(2 jam)

Kertas ini mengandungi ENAM soalan.

Jawab LIMA (5) soalan sahaja.

Semua soalan mesti dijawab dalam Bahasa Malaysia.

...2/-

1. Dengan kaedah transformasi linear, carikan purata, kevarianan dan sisihan piawai untuk data yang berikut.

Kelas	Frekuensi
18 - 32	10
33 - 37	15
38 - 42	40
43 - 47	65
48 - 52	35
53 - 67	20

(20 markah)

...3/-

2. Jadual yang berikut menunjukkan Taburan Peratus Kumulatif untuk 500 peninjauan.

Sempadan kelas	Peratus kumulatif
0 - 6	0
6 - 16	13
16 - 26	35
26 - 41	56
41 - 56	72
56 - 76	90
76 - 101	100

Sediakan

- (i) Taburan frekuensi kumulatif
- (ii) Taburan peratus frekuensi kumulatif
- (iii) Poligon frekuensi tersebut
- (iv) Berapa banyak peninjauan yang terdapat di dalam kelas 41 - 56?

(20 markah)

...4/-

3. Suatu kajian telah dikendalikan untuk membandingkan dua formulasi A dan B dari segi penyerapan ramuan aktifnya. Dua-belas (12) subjek manusia dibahagikan kepada dua kumpulan I dan II. Kumpulan I diberikan formulasi A dan kumpulan II diberikan B. Berikut ialah data yang diperolehi:

Amaun yang diserap (mg)	
Formulasi A	Formulasi B
55.0	70.5
53.0	65.5
63.0	60.0
60.0	59.0
54.5	60.5
57.5	58.5

- (A) Pilihlah (dengan memberikan alasan-alasan) suatu ujian statistik yang sesuai untuk menganalisis data tersebut.
(11 markah)
- (B) Apakah kelemahan-kelemahan rekabentuk ujian yang digunakan di atas itu? Terangkan juga bagaimana rekabentuk ujian tersebut dapat diperbaiki.
(5 markah)
- (C) Apakah yang dimaksudkan dengan type I dan type II error?
(4 markah)

...5/-

4. (A) Anda dikehendaki membandingkan dua kaedah analisis yang digunakan untuk menganalisis suatu drug x di dalam plasma. Bincangkan langkah-langkah serta suatu ujian statistik yang sesuai untuk mengendalikan perbandingan itu.

(10 markah)

- (B) Suatu kajian dikendalikan untuk menentukan perhubungan berat-badan dengan tekanan darah diastolik. Dua-puluh subjek manusia dipilih secara rawak untuk kajian ini dan berikut adalah data yang diperolehi.

Subjek	berat badan (lb)	tekanan diastolik (mmHg)	Subjek	berat badan (lb)	tekanan darah (mmHg)
1	140	75	11	110	70
2	150	80	12	120	72
3	170	85	13	130	75
4	180	88	14	135	75
5	130	74	15	140	78
6	160	80	16	200	90
7	155	78	17	195	91
8	195	90	18	185	90
9	200	93	19	160	85
10	210	95	20	170	85

Pilihkan suatu ujian statistik yang sesuai untuk menganalisis data tersebut.

(10 markah)

5. Anda ditugaskan untuk mengawal mutu penyalutan 10,000 tablet eritromisin oleh dua orang ahli farmasi. Salutan tablet yang unggul ialah 0.05 mm dengan kevarianan 0.05. Cik Y menyiapkan 7,000 biji tablet dengan nilai salutan purata 0.04 mm manakala Cik X hanya menyiapkan 3,000 biji tablet dengan salutan purata 0.06 mm.

Tentukan:

- (A) Julat salutan tablet untuk Cik Y dan X pada sempadan keyakinan 99%.
- (B) Jika tablet daripada Cik Y dan Cik X boleh digunakan pada peringkat kesignifikanan 99%.

(20 markah)

6. Nilai kepekatan enzim CPK pesakit jantung daripada 3 buah wad di Hospital Besar Pulau Pinang ialah seperti berikut:

<u>Wad A</u>	<u>Wad B</u>	<u>Wad C</u>
$\bar{x} = 37.7$ unit	$\bar{x} = 29.9$ unit	$\bar{x} = 40.8$ unit
$n = 34$	$n = 45$	$n = 148$

- (A) Susunkan kepekatan enzim tersebut berdasarkan nilai yang tertinggi jika nilai populasi ialah 36.9 unit dengan $\sigma = 24$.
- (B) Nilai CPK daripada wad manakah yang tidak boleh digunakan jika diujikan pada peringkat kesignifikanan 95%?
- (C) Nilai CPK daripada wad manakah yang boleh diterima pada peringkat kesignifikanan 90%?
- (D) Tandakan serta lukiskan kedudukan setiap nilai enzim tersebut di dalam graf yang sesuai.

(20 markah)

FORMULA

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

$$2. u_i = Ax_i + B$$

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

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

$$5. S_u^2 = \frac{\sum u_i^2 f_i - n\bar{u}^2}{n - 1}$$

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

7. Ujian-t

$$t = \frac{\bar{x} - \mu_0}{S/\sqrt{n}}$$

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

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

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

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

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

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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

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

10. ANOVA (1-way)

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

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

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

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

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

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

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

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

...9/-

11. Ujian Kruskal-Wallis

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

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

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

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

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

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

Ujian perbandingan berganda:

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

13. Formula Sturges

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

...10/-

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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

$$y = mx + c$$

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

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

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

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

-ooOoo-

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.

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

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 X Critical values of F_{\max}

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

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.

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									

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	.95873	.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