

UNIVERSITI SAINS MALAYSIA

Peperiksaan Semester Pertama  
Sidang 1994/95

ASP300 - STATISTIK PERNIAGAAN

Oktober/November 1994

Masa: [3 jam]

ARAHAN

Sila pastikan bahawa kertas peperiksaan mengandungi ENAM BELAS muka surat yang bercetak sebelum anda memulakan peperiksaan ini.

Jawab ENAM soalan sahaja. Soalan-soalan dari Bahagian A adalah WAJIB dan jawab TIGA soalan dari Bahagian B.

Bahagian A (WAJIB)

1. Di Institut Penyelidikan Padi, 4 jenis padi berlainan ditanam untuk dikaji hasilnya. Adalah dirasakan bahawa lokasi tanaman (contohnya: cahaya matahari, angin, dsb.) mungkin mempunyai kesan terhadap hasil. Kawasan tanaman dibahagikan kepada 4 bahagian yang sama luas. Hasil padi (ratusan kg.) diberikan di dalam jadual di bawah:

Lokasi	Hasil (Jenis padi)			
	A	B	C	D
1	21.0	25.0	21.0	21.0
2	25.0	27.0	24.0	24.0
3	25.0	28.0	24.0	23.0
4	23.0	26.0	25.0	22.0

Dengan menggunakan analisis varians, uji yang berikut:

- (a) Tiada beza bererti di antara purata hasil keempat-empat jenis padi.  
(b) Tiada beza bererti di antara purata hasil di empat lokasi berlainan.

...2/-

Tulis suatu laporan ringkas kepada pengarah Institut berkenaan.

*At a Rice Research Institute, four different varieties of rice are grown so that the yields can be studied. As it is felt that the location of the plot (such as amount of sunshine, wind, etc) may also have an effect on the yield, the plots are divided into four equal strips. Rice yields (in 100 kg.) are given in the following table.*

Location	Yield (Rice variety)			
	A	B	C	D
1	21.0	25.0	21.0	21.0
2	25.0	27.0	24.0	24.0
3	25.0	28.0	24.0	23.0
4	23.0	26.0	25.0	22.0

Using the analysis of variance, test the following:

- (a) *There is no significant difference in the average yield for the four different varieties of rice.*
- (b) *There is no significant difference in the average yield produced by the different locations in the plots.*

Write a short report on your findings to the Director of the Institute.

[16 markah]

2. Dalam suatu sistem pengangkutan, seorang pengurus ingin menentukan perhubungan antara masa perjalanan (TIME), bilangan batu yang diliputi (MILES) dan bilangan serahan yang dilakukan (DELIV). Satu lagi pembolehubah (TYPE) menunjukkan jenis kenderaan, dikodkan 0 jika kenderaan jenis lori kecil dan 1 jika van digunakan juga dimasukkan juga ke dalam analisis regresi. Output komputer dan analisis ini ditunjukkan di bawah:

<u>Variable</u>	<u>Coefficient</u>	<u>Standard error</u>
Constant	0.534	1.22
Miles	0.04521	0.01600
Deliv	0.7123	0.2635
Type	0.8000	0.5392

...2/-

R-bar-squared = 78.5%

<u>Source of variation</u>	<u>Degrees of freedom</u>	<u>Sums of squares</u>	<u>Mean square</u>	<u>F-ratio</u>
Regression	3	20.5821	8.8607	
Error	6	3.4172	0.5692	
Total	9	23.9993	2.6666	

- (a) Dari analisis di atas, anggarkan persamaan regresi untuk masa perjalanan bagi lori kecil; dan masa perjalanan untuk van.
- (b) Uji tahap keertian model dan juga koefisien regresi dan terangkan maksud kedua-duanya.
- (c) Berapa lamakah masa perjalanan bagi sebuah van yang membuat 2 serahan dan jarak yang diliputi adalah 75 batu? Bagi lori kecil yang membuat 3 serahan dan jarak yang diliputi 50 batu.
- (d) Buat kesimpulan mengenai analisis ini dan beri cadangan untuk memperbaiki model ini.

*In a transportation system, the manager wishes to determine the relationship between travel time (TIME), the number of miles travelled (MILES) and the number of deliveries made (DELIV). An additional variable (TYPE) indicating the type of the vehicle, which is coded 0 if the vehicle is "pick-up" and 1 if it is a van, has also been included in the multiple regression analysis. The computer output obtained for the analysis is as follows:*

<u>Variable</u>	<u>Coefficient</u>	<u>Standard error</u>
Constant	0.534	1.22
Miles	0.04521	0.01600
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Regression	3	20.5821	8.8607	
Error	6	3.4172	0.5692	
Total	9	23.9993	2.6666	

- (a) *From the above analysis, estimate the regression equations for travel time for the vehicle "pick-up"; and regression equation for the van.*
- (b) *Test the significance of the model and also the regression coefficients and explain what they indicate.*
- (c) *What would be the travel time for a van making 2 deliveries and travelling 75 kms? And for a pick-up making 3 deliveries and travelling 50 kms?*
- (d) *Draw your conclusions about the analysis and make suggestions for improvements.*

[16 markah]

3. (a) *Cik Joanne, Pengurus Pemasaran Malaysian Insurance Sdn. Bhd., ingin membuat tinjauan mengenai bilangan besar polisi insurans yang dikeluarkan oleh syarikat itu. Syarikat ini mendapat untung tahunan yang tertabur dengan purata (min) RM310 dan sisihan piawai RM150. Keperluan ketepatan beliau menetapkan bahawa tinjauan itu mestilah cukup besar supaya ralat piawai boleh dikurangkan kepada tidak lebih dari 1.5% daripada min populasi. Berapa besarkah sampel yang perlu diambil? Dengan menggunakan saiz sampel yang didapati di atas, tentukan selang keyakinan 90% bagi min sampel.*

*Ms. Joanne, Marketing Manager of Malaysian Insurance Sdn. Bhd., wants to undertake a survey of the large number of insurance policies that her company has underwritten. Joanne's firm makes a yearly profit on each policy that is distributed with mean RM310 and standard deviation RM150. Her accuracy requirements dictate that the survey must be large enough to reduce the standard error to no more than 1.5 percent of the population mean. How large should her sample be? Using the sample size obtained earlier, determine the 90 percent confidence interval for the sample mean.*

...5/-

- (b) Sebuah sekolah pengurusan ingin membeli sebuah mesin fotokopi. Adalah dijangkakan bahawa model yang lebih canggih boleh didapati tidak lama lagi, Dekan merujuk perkara itu kepada seorang pakar bidang ini. Pakar itu mengatakan "Saya pasti model baru ini akan dikeluarkan pada hujung 10 tahun dari sekarang, tetapi adalah mustahil untuk ianya dikeluarkan dalam jangkamasa 3 tahun berikutnya. Saya akan bertaruh yang kebarangkalian untuk kejadian ini pada tahun ke-6, 7, dan 8 adalah sama dan peluang jadi-tak jadi adalah 1 ke-5 kejadian ini berlaku sebelum tahun ke-6 dan peluang bagi kejadian sebelum tahun ke-9 ialah 4 ke-5. Tambahan lagi, saya percaya kemungkinan inovasi baru berlaku dalam tahun ke-5 adalah dua kali ganda kemungkinan tahun ke-4. Akan tetapi, tiada sebab untuk saya percaya yang kemungkinan kejadian berlaku pada tahun ke-9 adalah lebih mungkin daripada tahun ke-10".

Berdasarkan maklumat di atas, Dekan Pusat Pengajian mahu anda membentuk taburan kebarangkalian bagi tempoh (tahun) model baru mesin fotokopi ini akan terdapat di pasaran.

*A management school wanted to buy a new model of photocopier. It was expected that a more advanced model is likely to be available in the near future so the Dean of the School referred the matter to an expert in the field. The expert responded "I am sure that the new model would come up by the end of 10 years from now; but it is almost impossible to have it (new advanced model) within next three years. I will bet equal chance for its happening in the sixth, seventh and eighth years and my betting odds will be 1 in 5 for its happening before the sixth year and 4 in 5 for its happening before the ninth year. Further, I believe that the new innovation is twice as likely as in the fifth year than it is in the fourth year. However, I have no reason to believe that it is any more likely in the ninth year than in the 10th year".*

*Based on the above information, the Dean of the School wants you to develop a probability distribution for the period (year) of availability of the new model of the photocopier.*

- (c) Seorang pengurus kilang ingin mengetahui sama ada kecekapan operator boleh ditingkatkan atau tidak melalui "latihan semasa kerja". Data yang berikut memberikan kadar kecekapan sebelum dan selepas "latihan semasa kerja" untuk suatu sampel seramai 15 operator yang dipilih secara rawak. Dari hasil sampel, dapatkan kesimpulan tentang kecekapan operator. Gunakan  $\alpha = 0.01$ . [Perhatian: Angka yang lebih tinggi menandakan kecekapan yang lebih tinggi].

Operator	Kadar kecekapan		Operator	Kadar kecekapan	
	Sebelum latihan	Selepas latihan		Sebelum latihan	Selepas latihan
1	51	62	9	52	70
2	55	55	10	55	68
3	60	78	11	48	58
4	58	77	12	40	53
5	43	57	13	59	50
6	47	60	14	48	61
7	58	69	15	54	74
8	59	78			

*A factory manager wishes to know whether the efficiency of operators can be improved by imparting "proper-on-the-job-training". The following data gives the efficiency ratings taken before and after the "proper-on-the-job-training" for a randomly selected sample of 15 operators. From the sample results, draw conclusions about the efficiency of the operators. Use  $\alpha = 0.01$ . [Note: A higher number indicates a higher efficiency].*

Operator	Efficiency rating		Operator	Efficiency rating	
	Before training	After training		Before training	After training
1	51	62	9	52	70
2	55	55	10	55	68
3	60	78	11	48	58
4	58	77	12	40	53
5	43	57	13	59	50
6	47	60	14	48	61
7	58	69	15	54	74
8	59	78			

[20 markah]

**Bahagian B**

Jawab TIGA soalan sahaja.

4. (a) Terangkan secara ringkas ciri-ciri taburan normal dan gariskan kepentingan taburan ini dalam analisis statistik.

*Describe briefly the characteristics of the normal distribution and outline the importance of the distribution in the statistical analysis.*

- (b) Dalam sebuah kilang mengeluarkan minuman ringan, terdapat satu proses pengetinan untuk mengisi tin. Kandungan tin-tin ini tertabur secara normal dengan min 327.5 ml dan varians 1.69 ml<sup>2</sup>. Kesemua tin ditanda sebagai mengandungi 325 ml.
- (i) Apakah peratusan pengeluaran harian yang akan mengandungi kandungan lebih dari 330 ml?
- (ii) Jika tin mengandungi kurang dari 325 ml, penyelia pengeluaran akan dihukum di bawah Akta Berat dan Ukuran. Apakah peluang ia akan dihukum? Jika proses pengeluaran adalah untuk 8,000 tin sejam, berapa banyakkah tin akan mengandungi kandungan kurang dari 325 ml?

...8/-

(iii) Apakah had-had di mana 92% daripada pengeluaran harian jatuh?

*In a factory producing soft drinks, there is a canning process to fill the cans. The contents of the cans is normally distributed with mean 327.5 ml and variance 1.69 ml square. The cans are all marked as containing 325 ml.*

(i) *What percentage of days' production will contain more than 330 ml?*

(ii) *If the cans contain less than 325 ml, the production supervisor is likely to be punished under the Weights and Measurements Act. What are his chances of being punished? If the production run is for 8,000 cans per hour, how many cans would contain less than the stated content?*

(iii) *Between what limits does 92% of the days' production fall?*

[16 markah]

5. (a) Persatuan Pengilang Malaysia sedang mengkaji perbezaan gaji operator dalam industri elektronik di Zon Dagangan Bebas di Bayan Lepas dan Zon Bebas Dagangan Prai, dan ringkasan gaji bulanan diberikan di bawah:

Gaji bulanan (RM)	Bilangan operator	
	Bayan Lepas	Prai
300 - 329	5	3
330 - 359	12	16
360 - 389	21	24
390 - 419	27	32
420 - 449	17	16
450 - 479	6	6
480 - 510	2	3

Adakah hasil di atas menunjukkan sebarang bukti perbezaan bererti dalam purata pendapatan operator di dua zon ini?

...9/-



The Association of Malaysian Manufacturers are currently studying the pay differentials of operators in electronic industry in Bayan Lepas Free Trade Zone and Prai Free Trade Zone. A sample of operators was selected from each zone and a summary of their monthly wages is given below:

Monthly wages (RM)	Number of operators	
	Bayan Lepas	Prai
300 - 329	5	3
330 - 359	12	16
360 - 389	21	24
390 - 419	27	32
420 - 449	17	16
450 - 479	6	6
480 - 510	2	3

Does the above result indicate any evidence of significant difference in the average earnings of the operators in the two zones?

- (b) Pengarah sumber manusia mengesyaki bahawa piawaian yang rendah digunakan dalam pengukuran prestasi di jabatan pemasaran berbanding jabatan operasi. Data bagi 10 pengukuran sedemikian dalam setiap jabatan diberikan di bawah. Gunakan ujian tak berparameter yang sesuai dan uji hipotesis bahawa tiada perbezaan dalam pengukuran prestasi. Gunakan  $\alpha = 0.05$ .

Kadar prestasi (maksimum = 100)

Jabatan Pemasaran	72 80 86 90 91 92 88 96 91 82
Jabatan Operasi	80 79 90 82 81 84 78 74 85 71

The director of human resources suspects that more lenient standards are being used in giving performance ratings in the marketing department than in the operations department. Data for the last 10 such ratings in each department is given below. Use an appropriate non-parametric test, and test the hypothesis that there is no difference in the performance ratings. Use  $\alpha = 0.05$ .

...10/-

*Performance ratings (maximum = 100)*

<i>Marketing Dept.</i>	72	80	86	90	91	92	88	96	91	82
<i>Operations Dept.</i>	80	79	90	82	81	84	78	74	85	71

[16 markah]

6. (a) Periksa secara kritis kebaikan dan keburukan kaedah pensampelan berkebarangkalian dan pensampelan tak berkebarangkalian.

Diinginkan memilih suatu sampel rawak seramai 500 orang yang mewakili populasi untuk suatu kajian tentang simpanan wang. Berikan komen bagi kaedah-kaedah berikut untuk mendapatkan sampel:

- (i) 500 nama secara rawak dari buku panduan telefon.
- (ii) Pilih 500 orang yang pertama yang melawat sebuah gedung pasaraya di pusat bandaraya.

Cadangkan kaedah pensampelan yang sesuai untuk kajian di atas.

*Critically examine the merits and demerits of probability sampling and non-probability sampling methods.*

*It is desired to choose a representative sample of 500 people for a study on household savings. Comment on the following methods used for obtaining the sample.*

- (i) *Choosing 500 names at random from the telephone directory.*
- (ii) *Selecting the first 500 people who visit a large supermarket in the heart of the city.*

*Suggest an appropriate sampling method to select a sample for conducting the above study.*

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- (b) Suatu proses pengacuan direka untuk mengurangkan variasi diameter keluaran. Untuk menguji proses baru, kita merumuskan hipotesis yang varians diameter keluaran bagi proses lama dan baru adalah sama. Bagi sampel  $n_1 = 8$  keluaran yang dihasilkan melalui proses baru,  $\bar{x}_1 = 25.2$  mm dan  $s_1 = 4.2$  mm. Melalui sampel  $n_2 = 10$  keluaran yang dihasilkan melalui proses lama  $\bar{x}_2 = 26$  dan  $s_2 = 4.6$  mm. Dengan menggunakan data sampel di atas, bolehkah hipotesis nol diterima pada aras keertian 5%.

*A new moulding process is designed to reduce the variability of casting diameters. To test the new process, we formulate the hypothesis that the variance of the casting diameters under the new and the old processes are alike. For a sample of  $n_1 = 8$  castings produced by the new process,  $\bar{x}_1 = 25.2$  mm and  $s_1 = 4.2$  mm. For a sample of  $n_2 = 10$  castings produced by the old process  $\bar{x}_2 = 26.5$  mm and  $s_2 = 4.6$  mm. Using the above sample data, can the null hypothesis be rejected at 5 percent level of significance?*

[16 markah]

7. (a) Food Specialities, sebuah rantai 145 pasaraya telah dibeli KFC, sebuah rantai pasaraya kebangsaan yang besar. Sebelum pembelian ini muktamad, KFC inginkan jaminan bahawa Food Specialities akan sentiasa mendapat untung. Pengurus Kewangan KFC memutuskan untuk mengkaji rekod kewangan 36 daripada pasaraya Food Specialities. Food Specialities telah mengaku bahawa keuntungan setiap pasarayanya hampir normal dengan min yang sama dan sisihan piawai RM1,200. Jika tuntutan Food Specialities benar, apakah kebarangkalian bahawa min sampel bagi 36 pasaraya terletak tidak melebihi RM200 daripada min sebenar.

*Food Specialities, a chain of 145 supermarkets, has been bought-out by KFC, a large nationwide supermarket chain. Before the deal is finalised, KFC wants to have some assurance that Food Specialities will be a consistent money maker. The Financial Controller of KFC decided to look at the financial records of 36 of the Food Specialities stores. Food Specialities have claimed that each store's profits have an approximately normal distribution with the same mean and a standard deviation of RM1,200. If Food specialities is correct in their claim, what is the probability that the sample mean for the 36 stores will fall within RM200 of the actual mean?*

...12/-

- (b) Happy Home adalah sebuah organisasi mencari pasangan yang mendakwa 50% daripada semua pasangan yang diperkenalkan akhirnya berkahwin. Kamu telah bertanya 50 kawan yang telah mengguna khidmat ini, dan 30 daripada mereka mendakwa bahawa mereka tidak mungkin berkahwin dengan orang yang Happy Home perkenalkan. Dengan andaian maklumat di atas adalah dari sampel rawak semua pelanggan Happy Home, apakah kebarangkalian 30 atau lebih individu di atas akan akhirnya berkahwin dengan orang yang diperkenalkan jika dakwaan Happy Home itu tepat?

*The Happy Home match making organisation claims that 50% of all the couples it introduces eventually marry. You have canvassed 50 friends who have used the service, and 30 of them claim that there is no chance that they will marry the person to whom Happy-Home introduced them. Assuming that the above information is from the random sample of the customers of Happy-Home, what is the probability that 30 or more of the sample individuals will not eventually marry the person to whom they were introduced, if the success rate claimed by Happy-Home is accurate?*

- (c) Pencetak kerajaan (PK) bertanggungjawab mencetak wang kertas kerajaan. PK mempunyai kekerapan ralat cetakan yang kecil, hanya 0.5 peratus daripada wang kertasnya tidak boleh diedarkan. Apakah kebarangkalian bahawa dari suatu kelompok 1,000 keping wang kertas,

- (i) semuanya boleh diedarkan?
- (ii) kurang daripada 10 tidak boleh diedarkan?

*The government press (GP) is responsible for printing the country's paper money. The GP has a small frequency of printing errors, only 0.5 percent of the bills cannot be put into circulation. What is the probability that out of a batch of 1,000 bills,*

- (i) *all can be put into circulation?*
- (ii) *less than 10 cannot be put into circulation?*

[16 markah]

...13/-

8. (a) Pengurus Malaysian Auto Lubrication Bhd. mencuba membentuk dasar memesan tin-tin minyak pelincir. Sekarang ini dia memesan 110 tin seminggu tetapi kehabisan tin berlaku sekali setiap empat minggu. Dia tahu bahawa pada puratanya, kedai mengguna 95 tin seminggu. Dia juga mengandaikan bahawa permintaan tin-tin minyak pelincir bertaburan normal.
- (i) Apakah sisihan piawai bagi taburan ini?
- (ii) Jika pengurus ingin memesan bilangan tin yang cukup supaya kebarangkalian kehabisan pada mana-mana minggu tidak melebihi 0.10, berapa banyakkah tin yang perlu dipesan setiap minggu?

*The Manager of Malaysian Auto Lubrication Bhd. is trying to revise his policy on ordering grease tins. Currently, he orders 110 tins per week but he runs out of tins 1 out of every 4 weeks. He knows that, on an average, the shop uses 95 tins per week. He is also assuming that the demand for tins is normally distributed*

- (i) *What is the standard deviation of this distribution?*
- (ii) *If the manager wants to order enough tins so that his probability of running out during any week is no greater than 0.10, how many tins should he order per week?*
- (b) Pengurus kilang mentega ingin membangunkan suatu persamaan regresi antara kos buruh (x) dan saiz kelompok (y) (yang disukat dalam kg. mentega dalam suatu kelompok) supaya perhubungan itu boleh digunakan untuk menganggar kos buruh dalam pengeluaran sesuatu saiz kelompok. Ringkasan hasil bagi 10 saiz kelompok diberikan di bawah:

$$\begin{aligned}\Sigma x &= 3,800, \Sigma y = 5,600, \Sigma x^2 = 1,526,000 \\ \Sigma y^2 &= 3,895,000, \Sigma xy = 2,358,000\end{aligned}$$

Dari hasil di atas, hitung garis regresi kuasa dua terkecil untuk menganggar kos buruh bagi sesuatu saiz kelompok. Jika pengurus memutuskan untuk mengkilangkan 750 kg. mentega pada keesokan hari, apakah kos buruh anggaran? Anggarkan pekali penentuan dan tafsirkannya.

...14/-

*A butter factory manager is trying to develop a regression equation between the labour costs (x) and the batch size (y) (measured in kgs. of butter in a batch) so that the relationship can be used for estimating the labour cost of production for a given batch size. The summary of results of last 10 batch sizes is given below:*

$$\begin{aligned}\Sigma x &= 3,800, \Sigma y = 5,600, \Sigma x^2 = 1,526,000 \\ \Sigma y^2 &= 3,895,000, \Sigma xy = 2,358,000\end{aligned}$$

*From the above results, compute a least squares regression line to estimate the labour cost for a given batch size. If the manager decides to manufacture 750 kgs of butter on the next day (batch), what would be the estimated labour cost? Estimate the coefficient of determination and interpret the same.*

[16 markah]

..15/-

$$r = \frac{\frac{1}{n}\Sigma xy - \bar{x}\bar{y}}{\sigma_x \sigma_y}, \quad r_s = 1 - \frac{6\Sigma d^2}{n(n^2-1)}$$

$$\hat{b} = \frac{\Sigma xy - n\bar{x}\bar{y}}{\Sigma x^2 - n\bar{x}^2}$$

$$\hat{a} = \bar{y} - \hat{b}\bar{x}$$

$$\hat{\sigma}^2 = \frac{\Sigma (y - \hat{y})^2}{n-2} = \frac{\Sigma y^2 - \hat{a}\Sigma y - \hat{b}\Sigma xy}{n-2}$$

$$R^2 = 1 - \frac{\Sigma (y - \hat{y})^2}{\Sigma (y - \bar{y})^2} = \frac{\hat{a}\Sigma y + \hat{b}\Sigma xy - n\bar{y}^2}{\Sigma y^2 - n\bar{y}^2}$$

$$S_b^2 = \frac{\hat{\sigma}^2}{\Sigma x^2 - n\bar{x}^2}$$

$$P = \sum_{i=0}^x \binom{n}{i} p^i q^{n-i}$$

$$\chi^2 = \sum_{i=0}^k \frac{(O_i - E_i)^2}{E_i} \quad \text{or} \quad \chi^2 = \frac{(|B-C| - 1)^2}{B + C}$$

$$D = \max \{ |F_0(x) - S_0(x)| \}$$

$$D = \frac{1.36}{\sqrt{n}}$$

$$E(r) = \frac{2n_1 n_2}{n_1 + n_2} + 1$$

$$\text{Var}(r) = \frac{2n_1n_2 (2n_1n_2 - n_1 - n_2)}{(n_1 + n_2)^2 (n_1+n_2 - 1)}$$

$$U = \frac{n_1n_2}{2} + \frac{n_1(n_1 + 1)}{2} - R_1$$

$$E(u) = \frac{n_1n_2}{2}$$

$$\text{Var}(U) = \frac{n_1n_2 (n_1 + n_2 + 1)}{12}$$

$$H = \frac{12}{n(n+1)} \sum_{i=1}^k \frac{r_i^2}{n_i} - 3(n + 1)$$

$$Z = \frac{x - E(x)}{SD(x)}$$

$$t = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$$

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sigma(\bar{x}_1 - \bar{x}_2)}$$

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