

UNIVERSITI SAINS MALAYSIA

Peperiksaan Semester Pertama
Sidang 1996/97

Oktober/November 1996

APW300 - KAEDAH STATISTIK
ASP300 - STATISTIK PERNIAGAAN

Masa: [3 jam]

ARAHAN

Sila pastikan bahawa kertas peperiksaan ini mengandungi **ENAM BELAS (16)** muka surat yang bercetak sebelum anda memulakan peperiksaan.

Jawab **ENAM (6)** soalan sahaja. Soalan-soalan daripada Bahagian A adalah **WAJIB**. Jawab **TIGA (3)** soalan daripada Bahagian B. Semua soalan **MESTI** dijawab di dalam Bahasa Malaysia. Jika pelajar memilih untuk menjawab di dalam Bahasa Inggeris, sekurang-kurangnya **SATU** soalan mesti dijawab di dalam Bahasa Malaysia **KECUALI** pelajar luar negara.

Bahagian A - WAJIB

Jawab **SEMUA** soalan

1. (a) Terangkan kepentingan analisis varians dalam menyelesaikan masalah perniagaan.
Explain the importance of analysis of variance in solving business decision problems.

- (b) Seorang pengurus kilang ingin mengetahui kesan "time of the day" ke atas produktiviti operator di kilangnya. Suatu sample 5 orang pekerja dipilih secara rawak dan bilangan pengeluaran dalam satu jam tertentu direkod dan hasilnya adalah seperti berikut:

Operator	Tempoh masa			
	9-10 pagi	11- 12 tgh	2-3 ptg	4-5 ptg
A	42	36	54	37
B	40	43	51	35
C	38	42	47	35
D	38	35	35	40
E	36	40	43	32

- (i) Adakah terdapat perbezaan yang bererti di dalam purata pengeluaran pada tempoh masa yang berlainan?
- (ii) Adakah terdapat perbezaan yang bererti dalam purata pengeluaran antara operator?

Setelah menyemak semula data pengeluaran didapati bahawa operator D mengeluarkan 53 unit (bukannya 35 unit) antara jam 11.00 pagi - 12.00 tengah hari. Apakah kesan perubahan ini kepada kesimpulan anda dalam (i) dan (ii).

- (iii) Tulis satu laporan ringkas kepada Pengurus Pengeluaran mengenai penemuan kamu dan had-hadnya?

A plant manager was interested in the effect of "time of the day" on the productivity of operators in an auto-parts factory. A sample of five workers were selected at random and the number of parts produced in a given hour was recorded with the following results:

Operator	Time period			
	9-10 am	11-12 noon	2-3 pm	4-5 pm
A	42	36	54	37
B	40	43	51	35
C	38	42	47	35
D	38	35	35	40
E	36	40	43	32

- (i) *Is there any significant difference in the average output between the time periods?*
- (ii) *Does the operator's average output differ significantly?*

On rechecking of the production data, it was found that operator D produced 53 units (instead of 35 units) between 11 a.m. - 12.00 noon. What effect is this likely to have on your conclusions for (i) and (ii)?

...3/-

(iii) Write a short report to the Works Manager regarding your findings and the limitations.

[16 markah]

2. (a) Apakah perbezaan di antara regresi mudah dan regresi berganda? Apakah masalah multikolinearan?

Distinguish between simple regression and multiple regression analysis. What is the problem of multicollinearity?

(b) Pusat Penyelidikan Ekonomi kerap membuat analisis pencapaian korporat untuk faedah ahli-ahlinya. Salah satu objektif utama ialah untuk meramal untung (RM juta) sesebuah syarikat berasaskan jualan (RM juta) dan aset (RM juta). Data dari satu sampel rawak 25 buah syarikat dianalisis menggunakan perisian SPSS dan hasil yang diperolehi adalah seperti berikut:

<u>Label</u>	<u>Mean</u>	<u>Std. Dev</u>
Profits	96.852	145.183
Assets	2614.312	2462.959
Sales	2868.708	2934.694

No. of cases = 25

Variable (s)	Entered on step number
1..	Sales
2..	Assets

Multiple R	.61538
R square	.37870
Adjusted R square	.32221
Standard error	119.52576

Analysis of variance

	<u>DF</u>	<u>Sum of squares</u>	<u>Mean square</u>
Regression	2	191572.02622	
Residual	22	314300.93618	

Variables in the equation

<u>Variable</u>	<u>B</u>	<u>SE B</u>
Assets	.056193	.038188
Sales	.017668	.032049
(Constant)	.631358	35.527127

Durbin-Watson Test = 2.162150

...4/-

Berasaskan output komputer di atas

- (i) Bentukkan persamaan regresi berganda yang bersesuaian.
- (ii) Tafsir koefisien regresi berkenaan.
- (iii) Ramalkan untung sebuah syarikat yang mempunyai jualan RM2 bilion dan aset RM1.5 bilion.
- (iv) Tentukan sama ada terdapat perhubungan linear yang bererti pada aras keertian 0.05 di antara untung dan kedua pembolehubah bebas (Jualan dan aset).
- (v) Tulis satu laporan ringkas mengenai kegunaan/had analisis ini.

The Corporate Economic Research Centre (CERT) regularly analyses the corporate performance for the benefit of its members. One of the primary objective of the analysis is to predict profits (RM millions) of a corporation based upon its sales (RM millions) and assets (RM millions). Data from a random sample of 25 corporations were analysed using SPSS package and results obtained are presented below:

<u>Label</u>	<u>Mean</u>	<u>Std. Dev</u>
Profits	96.852	145.183
Assets	2614.312	2462.959
Sales	2868.708	2934.694

No. of cases = 25

<u>Variable (s)</u>	<u>Entered on step number</u>
1..	Sales
2..	Assets

Multiple R	.61538
R square	.37870
Adjusted R square	.32221
Standard error	119.52576

Analysis of variance

	<u>DF</u>	<u>Sum of squares</u>	<u>Mean square</u>
Regression	2	191572.02622	
Residual	22	314300.93618	

...5/-

Variables in the equation

<u>Variable</u>	<u>B</u>	<u>SE B</u>
Assets	.056193	.038188
Sales	.017668	.032049
(Constant)	.631358	35.527127

Durbin-Watson Test = 2.162150

On the basis of the above computer output:

- (i) *State the relevant multiple regression equation.*
- (ii) *Interpret the regression coefficients.*
- (iii) *Predict the profit for a corporation that has sales of RM2 billions and assets of RM1.5 billion.*
- (iv) *Determine whether there is a significant linear relationship between the profits and the two explanatory variables (sales and assets) at 0.05 level of significance. How significant are the individual explanatory variables in the above relationship?*
- (v) *Write a short report on the usefulness/limitations of the analysis.*

[20 markah]

3. (a) Seorang penyunting buku teks sebuah syarikat ingin menentukan sama ada untuk mencetak sebuah buku mengenai pengurusan strategik. Buku-buku yang dicetak seperti ini mempunyai 10% kejayaan tinggi, 20% kejayaan sederhana, 40% pulang modal dan 30% rugi. Bagaimanapun, sebelum keputusan sama ada mencetak atau tidak dibuat buku itu akan dinilai terlebih dahulu. Dari rekod silam, penilaian positif diterima bagi 99% buku kejayaan tinggi, 70% bagi buku kejayaan sederhana, 40% bagi buku pulang modal dan 20% bagi buku yang rugi.
- (i) Jika buku yang dicadangkan menerima penilaian yang positif, bagaimanakah harus penyunting mengatur semula kebarangkalian pelbagai kemungkinan dengan mengambil kira maklumat di atas?
 - (ii) Apakah kadaran buku yang menerima penilaian positif?

...6/-

APW300/ASP300

The editor of a major textbook publishing company is trying to decide whether or not to publish a new strategic management book. Books published of this type indicated 10% very high successes, 20% moderate successes, 40% break-even, and 30% losers. However, before a publishing decision is made, the manuscript will be reviewed. In the past, favourable reviews were received for 99% of the very high successes, 70% of the moderate successes, 40% of the break-even books, and 20% of the losers.

- (i) If the proposed book receives a favourable review, how should the editor revise the probabilities of the various outcomes to take this information into account?*
- (ii) What proportion of books receive favourable reviews?*

[8 markah]

- (b)** **Pengurus pejabat pos sebuah kampus ingin menentukan variasi dalam permintaan harian untuk kotak surat. Dia membuat andaian bahawa permintaan mengikut taburan normal. Secara purata 100 buah kotak dibeli sehari, dan permintaan adalah kurang dari 115 bagi 90% masa.**
 - (i) Apakah sisihan piawai taburan ini?**
 - (ii) Pengurus ingin menyimpan stok yang cukup supaya kebarangkalian kehabisan stok tidak melebihi 0.05. Apakah tahap stok paling rendah yang harus disimpan?**

The manager of a campus post office is trying to quantify the variation in daily demand for mailing boxes. He has decided to assume that this demand is normally distributed. He knows that on an average 100 boxes are purchased daily, and that 90% of the time, the daily demand is below 115.

- (i) What is the standard deviation of this distribution?*
- (ii) The manager wants to stock enough mailing boxes daily so that the probability of running out of stock is no greater than 0.05. What is the lowest such stock level?*

[8 markah]

...7/-

BAHAGIAN B

Jawab **TIGA** soalan sahaja.

4. (a) Suatu kajian mengenai kerosakan satu komponen semasa pemasangan suatu produk utama menunjukkan taburan frekuensi seperti di bawah:

Bilangan kerosakan sehari (x_i)	0	1	2	3	4	5	6	7
Frekuensi direkod (f_i)	28	32	40	48	26	13	9	4

Berasaskan sampel di atas, simpulkan sama ada kerosakan mengikut taburan Poisson.

A study of daily breakage of a component during the assembly of a main product revealed the following frequency distribution:

<i>Number of breakages per day (x_i)</i>	<i>0</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>
<i>Observed frequency (f_i)</i>	<i>28</i>	<i>32</i>	<i>40</i>	<i>48</i>	<i>26</i>	<i>13</i>	<i>9</i>	<i>4</i>

On the basis of above sample data, conclude that the breakages follow a Poisson distribution.

- (b) Sebuah Organisasi Koperatif Persekutuan membeli buah oren dari ahli-ahlinya. Jumlah jus yang diperah setiap buah bertaburan normal dengan min 70 gm dan varians 225 gm².
- (i) Apakah kadaran buah oren yang akan memberikan jus di antara 60 gm dan 100 gm?
- (ii) Apakah jumlah jus setiap buah oren yang boleh diperah jika 84.13% daripada kesemua buah oren boleh diperah untuk jus tambahan?

...8/-

- (iii) Buah oren yang memberikan jus kurang dari 35 gm dianggap berkualiti rendah. Jika dua buah oren dipilih secara rawak, apakah kebarangkalian bahawa kedua-duanya adalah berkualiti rendah?

The Federal Cooperative Organisation buys oranges from its members. The amount of juice per orange squeezed from these oranges is approximately normally distributed with mean 70 gm and a variance of 225 gm².

- (i) *What proportion of oranges will provide juice between 60 gm and 100 gm?*
- (ii) *What is the amount of juice per orange that can be squeezed if 84.13% of all oranges can be squeezed for additional juice?*
- (iii) *Oranges with less than 35 gm of juice are considered to be of poor quality. If two oranges are selected at random from a lot, what is the probability that both the oranges will be of poor quality?*

[16 markah]

5. (a) Terangkan secara ringkas ciri-ciri taburan normal dan jelaskan kepentingan taburan ini dalam taabiran statistik.

Describe briefly the characteristics of the normal distribution and indicate the importance of the distribution in statistical inference.

- (b) Di sebuah kilang pengeluaran minuman ringan terdapat suatu proses mengisi tin minuman. Kandungan tin bertaburan normal dengan min 442.5 ml dan varians 1.44 ml². Tin-tin minuman ini ditandakan sebagai mengandungi 440 ml.
- (i) Apakah peratusan tin minnumam yang mengandungi lebih dari 444 ml?
- (ii) Jika syarikat didapati menjual tin minuman yang lebih rendah kandungannya, syarikat ini boleh didakwa. Dalam satu proses pengeluaran 8,000 tin minuman, berapa banyak tin yang akan mengandungi kandungan kurang daripada yang ditandakan?
- (iii) Antara had manakah 92% daripada pengeluaran akan berada?

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(iv) Apakah sisihan kuartil taburan ini?

In a factory producing soft drinks, there is a canning process to fill the cans. The content of the cans is normally distributed with mean 442.5 ml and variance of 1.44 ml². The cans are all marked as containing 440 ml.

- (i) *What percentage of the cans contain more than 444 ml?*
- (ii) *If the firm is found to have sold a can containing less than the stated content, the firm can be prosecuted. In a production run of 8,000 cans, how many cans would contain less than the stated content?*
- (iii) *Between what limits does 92% of the production fall?*
- (iv) *What is the quartile deviation of the distribution?*

[16 markah]

6. (a) FMM membuat suatu tinjauan untuk mengkaji gaji penyelia pengeluaran di kawasan perindustrian Bayan Lepas dan Prai. Data dari satu sampel penyelia pengeluaran dari Bayan Lepas dan Prai diberikan di bawah:

Gaji (RM) 1996
untuk penyelia pengeluaran di Bayan Lepas dan Prai

<u>Bayan Lepas</u>	<u>Prai</u>
1,030	1,050
1,120	1,150
980	1,030
900	1,010
1,010	910
1,120	880
1,250	850
1,000	1,010
1,020	910
1,210	830
970	920
990	1,110
	950

...10/-

Dengan menggunakan ujian hipotesis yang bersesuaian uji sama ada terdapat perbezaan yang bererti dalam purata gaji penyelia pengeluaran di kedua zon ini. Adakah apa-apa had dalam analisis ini? Terangkan.

The Federation of Manufacturers has conducted a survey to study the monthly take-home pay of production supervisors in Bayan Lepas and Prai Free Trade Zones. The table below shows data for a sample of production workers in Bayan Lepas and Prai.

*Take-home pay (RM) in 1996
for production supervisors in Bayan Lepas and Prai*

<u>Bayan Lepas</u>	<u>Prai</u>
1,030	1,050
1,120	1,150
980	1,030
900	1,010
1,010	910
1,120	880
1,250	850
1,000	1,010
1,020	910
1,210	830
970	920
990	1,110
	950

Use an appropriate hypothesis test to investigate whether there is a significant difference in the average monthly take-home pay for production supervisors in the two zones. Are there any limitations in the analysis? Explain.

- (b) Satu siri ukiran kaca kecil diperiksa untuk melihat kerosakan yang dialami semasa pengangkutan. Siri ukiran yang diterima (A) dan rosak (D) diberikan di bawah:

D,A,A,A,D,D,D,D,D,A,A,D,D,A,A,A,A,D,A,A,D,D,D,D,D

Dengan menggunakan sampel di atas uji sama ada kerosakan berlaku secara rawak.

...11/-

A sequence of small glass sculptures was inspected for shipping damage. The sequence of acceptable (A) and damaged (D) pieces was as follows:

D,A,A,A,D,D,D,D,D,A,A,D,D,A,A,A,A,D,A,A,D,D,D,D,D

Using the above sample data, test for the randomness of the damage to the shipment.

[16 markah]

7. (a) Persatuan Pengguna menjalankan satu penyiasatan mengenai ketepatan bil pelanggan yang dicetak oleh terminal "Point-of-sale" di pasaraya. Persatuan telah menerima banyak aduan dari pelanggan bahawa tawaran istimewa dan diskaun tidak direkodkan dengan betul masa pembayaran. Suatu sampel rawak 15 bil diambil dari bil-bil yang tidak tepat di sebuah pasaraya dan data diberikan di bawah:

Pelanggan	Bilangan yang direkod (RM)	Nilai barangan (RM)
Lee	37.27	34.56
Tan	47.32	48.17
Goon	85.54	81.07
Leo	13.25	13.87
Mohd.	82.89	77.65
Isaak	56.88	57.34
Lelly	24.15	24.03
Yousof	76.63	72.24
Ann	65.59	61.89
Ben	33.74	34.23
Morris	47.91	41.83
Steven	17.62	15.28
Begg	11.90	12.59
Mac	58.23	51.86
Brown	25.67	22.58

...12/-

Adakah perbezaan yang bererti antara purata jumlah yang terdapat dalam bil dengan purata jumlah nilai sebenar barangan? Adakah kecaman pelanggan bahawa mereka dikenakan bayaran yang lebih berasas?

A Consumer Association has carried out an investigation into the accuracy of customer bills issued by the electronics point-of-sales terminals in supermarkets. The association has received many complaints from consumers that special offers and reduced priced goods were not being correctly recorded at the check-outs. A survey was carried out and it was found that 10% of the customers have been incorrectly charged. A random sample of 15 bills has been taken from those found to be incorrect at a local supermarket and the details are tabulated below:

<i>Customer</i>	<i>Amount recorded on bill (RM)</i>	<i>Value of goods (RM)</i>
<i>Lee</i>	<i>37.27</i>	<i>34.56</i>
<i>Tan</i>	<i>47.32</i>	<i>48.17</i>
<i>Goon</i>	<i>85.54</i>	<i>81.07</i>
<i>Leo</i>	<i>13.25</i>	<i>13.87</i>
<i>Mohd.</i>	<i>82.89</i>	<i>77.65</i>
<i>Isaak</i>	<i>56.88</i>	<i>57.34</i>
<i>Lelly</i>	<i>24.15</i>	<i>24.03</i>
<i>Yousof</i>	<i>76.63</i>	<i>72.24</i>
<i>Ann</i>	<i>65.59</i>	<i>61.89</i>
<i>Ben</i>	<i>33.74</i>	<i>34.23</i>
<i>Morris</i>	<i>47.91</i>	<i>41.83</i>
<i>Steven</i>	<i>17.62</i>	<i>15.28</i>
<i>Begg</i>	<i>11.90</i>	<i>12.59</i>
<i>Mac</i>	<i>58.23</i>	<i>51.86</i>
<i>Brown</i>	<i>25.67</i>	<i>22.58</i>

Is there a significant difference the average amount on the bills and the average value of the goods? Is there any justification in the claim made by the customers that they were being over-charged?

- (b) Seorang pengilang alat mainan telah mengubah mesin acuan plastik lamanya kerana mesin baru didapati lebih ekonomikal. Bagaimanapun, dia mendapati dengan pengenalan mesin baru ini, produktiviti adalah lebih rendah berbanding dengan mesin lama. Pengurus telah mengumpul data untuk pengeluaran bulanan bagi 15 bulan sebelum mesin baru digunakan dan data mengenai pengeluaran bagi 11 bulan selepas mesin baru digunakan. Data diberikan dalam jadual di bawah:

Pengeluaran bulanan (dalam unit)

Mesin lama	Mesin baru	Mesin lama	Mesin baru
992	965	966	956
945	1,054	889	900
938	912	972	938
1,027	850	940	
892	796	873	
983	911	1,016	
1,014	877	897	
1,258	902		

Bolehkah pengurus membuat kesimpulan bahawa perubahan mesin telah membawa kepada pengurangan dalam pengeluaran. Gunakan ujian tak berparameter yang bersesuaian. ($\alpha = 0.05$).

A toy manufacturer changed the type of plastic moulding machine it was using in the past because the new one was found more economical. However, with the introduction of the new machine, he felt the productivity seemed to be somewhat lower than with the old machine. The manager, therefore, compiled the monthly output data for 15 months when the old machines were used and the 11 months of the production data after the new machine was introduced. The data is presented below:

Monthly output (in units)

<i>Old machines</i>	<i>New machines</i>	<i>Old machines</i>	<i>New machines</i>
992	965	966	956
945	1,054	889	900
938	912	972	938
1,027	850	940	
892	796	873	
983	911	1,016	
1,014	877	897	
1,258	902		

Can the manager conclude that the change in machines has reduced output? Use an appropriate non-parametric test. ($\alpha = 0.05$)

[16 markah]

...15/-

LAMPIRAN

$$r = \frac{\frac{1}{n} \sum xy - \bar{x}\bar{y}}{\sigma_x \sigma_y}$$

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

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

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

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

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

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

$$\chi^2 = \max (|F_o (x) - S_n (x)|)$$

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

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

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

$$n_1 n_2 + \frac{n_1 (n_1 + 1)}{2} - R_1$$

$$E(U) = \frac{n_1 n_2}{2}$$

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

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

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

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

$$t = \frac{\bar{x} - \mu}{SD(\bar{x})}$$

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

$$t = \frac{\bar{d}}{s_d / \sqrt{n}}$$

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