UNIVERSITI SAINS MALAYSIA
Master of Business Administration

First Semester Examination
Academic Session 1995/96.

October/November 1995

AGW513 - MANAGERIAL STATISTICS

Time : [3 hours]

INSTRUCTION :
Please make sure that this examination paper consists of **TEN (10)** printed pages before you begin.

SECTION A
Answer **ALL** the questions.

1a. Explain the importance of analysis of variance in solving business decision problems.

b. 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 | | | |
	9-10am	11-12noon	2-3pm	4-5pm
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 11am - 12noon. What effect is this likely to have on your conclusions for (i) and (ii)?

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

[16 marks]

2a.   Distinguish between simple regression and multiple regression analyses.

b.   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 ($ millions) of a corporation based upon its sales ($ millions) and assets ($ millions). Data from a random sample of 25 corporations were analysed using SPSS package and results obtained are presented below.

Label	Mean	Std Dev
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

	DF	Sum of Squares	Mean Square
Regression	2	191572.02622	
Residual	22	314300.93618	

---------------------- Variables in the Equation ----------------------

Variable	B	SE B
ASSETS	.056193	.038188
SALES	-.017668	.032049
(Constant)	.631358	35.527127

Durbin-Watson Test = 2.62150

...3/-

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 $2 billions and assets of $1.5 billion.

(iv)   Determine whether there is a significant linear relationship between the profits and the two explanatory variables (sales and assets) at the 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.

[18 marks]

3a.   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?

b.   Joan, a researcher at the Malaysian Palm-oil Manufacturer's Association, is interested in determining the average consumption of edible oil per-household in Malaysia. She believes that the monthly household consumption is normally distributed with an unknown mean but a standard deviation of 1.25 kg.

(i)   If Joan takes a sample of 36 households and records the average monthly consumption, what is the probability that the sample mean is within one-half kg of the population mean?

(ii)   How large a sample must she take in order to be 98 per cent certain that the sample mean is within one-half kg of the population mean?

[18 marks]

SECTION B
Answer any THREE (3) questions.

4a.   The marketing manager of a local soft drink manufacturer claims that 20 per cent of all consumers prefer his soft-drink over any of competitor's.

(i)   If a random sample of 1600 consumers of soft drinks is selected at random from this population, within what limits would you expect X to fall, if the marketing manager's claim is valid, where X is the number in the sample who prefer the firm's soft drink?

(ii)   What would you conclude if the observed value of X was as small as 270?

b.   The weight of baggage checked-in by MSA passengers is a random variable with the mean of 20 kg and a standard deviation of 12 kg. If 100 passengers board the plane, the total baggage limit on the plane is 2300 kg. What is the approximate probability that the baggage limit will be exceeded?

c.   A TV manufacturer claims that 90% of its TV sets need no service for the first five years. A consumer protection agency thinks that this claim is too high, and so it randomly selects 81 purchasers of the TVs from five years ago and asks each of them whether or not his/her TV needed service since it was purchased. Sixty-five of them indicated that no service was necessary.

(i)   Specify the null and alternative hypotheses for the consumer protection agency.

(ii)   Test the hypotheses on the basis of the survey results and draw your conclusions.

[16 marks]

5a. A certain type of automobile battery produced by a firm is known to have an average life of 1110 days and a variance of 6400 days square. If 400 of these batteries are selected at random, what is the probability that the average life of these batteries fall between 1097 days and 1104 days? What is the minimum life of 90% of the batteries produced by the firm? Determine the quartile deviation of the battery life distribution.

b. In a game called "Taxation and Evasion", a player rolls a pair of dice. If, on any roll, the sum of the faces is 7, 11, or 12, the player gets audited. Otherwise, he/she avoids taxes. Suppose a player rolls the dice five times.

(i) What is the probability that he/she does not get audited?

(ii) What is the probability that he/she gets audited at least once?

(iii) What is the probability that he/she gets audited at most twice?

(iv) What is the standard deviation of the number of times that he/she will be audited?

[16 marks]

6a. The Federal Cooperative Organisation buys oranges from its members. The amount of juice squeezed from these oranges is approximately normally distributed with mean 70 gm and a variance of 225 gm square.

(i) What proportion of oranges will provide juice between 60 gm and 100 gm?

(ii) What proportion of oranges will provide juice less than 40 gm or more than 105 gm?

(iii) What is the amount of juice that can be squeezed if 84.13% of all oranges can be squeezed for additional juice?

(iv) 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?

b. It is desired to choose a representative sample of 500 people for a study on household savings in Penang. Comment on the following methods for obtaining the sample:

(i) Choosing 500 names at random from the telephone directory.

(ii) Picking 500 people at random from Komtar City-bus-station.

(iii) Selecting the first 500 people who visit a large supermarket at Bayan Baru.

Suggest an appropriate sampling scheme to select a sample of 500 respondents for conducting the above study.

[16 marks]

7. A firm is considering offering luncheon vouchers to its staff as an incentive to increase productivity. It conducted a survey to determine the value of the luncheon vouchers offered by other firms in the neighbourhood. In all, sixty firms responded. The monthly value of the luncheon vouchers (in RM) was found to be as follows:

32.6	26.5	37.2	35.4	38.4	29.1	36.5	37.1	28.2	29.4
41.8	36.2	34.2	52.8	29.3	38.1	37.2	26.0	37.9	28.3
33.7	32.8	24.9	26.7	39.6	36.3	27.5	36.3	34.7	27.4
34.2	46.7	37.5	28.4	29.2	28.1	34.5	35.3	36.8	39.0
42.1	34.4	42.5	31.6	34.6	24.3	24.2	37.4	33.4	34.2
34.6	33.7	36.4	29.3	41.2	46.7	46.9	32.1	44.2	32.5

(i) Produce a summary statistics with the help of a frequency distribution of the survey data.

(ii) The firm is considering giving staff luncheon vouchers of RM40.00 per month. Is this significantly higher than the amount paid by the other industries in the neighbourhood.

[16 marks]

8a.   The Personnel Manager of a large insurance company wished to evaluate the effectiveness of three different sales training programmes designed for new recruits.   Twenty-two recently recruited university graduates were randomly assigned to the three programmes;   seven each in programmes A and B and eight in programme C.   At the end of the month long training period, a standard examination was administered to the 22 participants. The scores obtained are given below:

Examination scores of the Sales-Training Programme		
A	B	C
66	72	70
74	59	71
82	62	60
75	74	81
73	78	69
97	84	76
87	67	80
		79

Using an appropriate test, would you conclude all three training programmes yield the same performance results.

b.   A leading daily newspaper studying the market's characteristics wanted to know whether the newspaper readership in the region is related to readers' educational background.   A survey questioned adults in the region on their level of education and their frequency of readership.   The results are presented in the following table.

Frequency of Readership	Level of Educational Background			
	Professional or post-graduate	Graduate	Secondary	Primary
Never	10	17	11	21
Sometimes	12	23	8	6
Dailey: English or Malay	35	38	16	7
Daily : English and Malay	28	19	6	5

At 0.10 significance level, does the frequency of newspaper readership in the region differ according to the readers' educational background?

[16 marks]

LAMPIRAN 1

$$r = \cfrac{\dfrac{1}{n}\Sigma xy - \bar{x}\bar{y}}{\sigma x \sigma y}$$

$$r_s = 1 - \cfrac{6\Sigma d^2}{n(n^2-1)}$$

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

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

$$\hat{\sigma} = \sqrt{\cfrac{\Sigma(y-\hat{y})^2}{n-k-1}}$$

$$R^2 = 1 - \cfrac{\Sigma(y-\hat{y})^2}{\Sigma(y-\bar{y})^2} \; ; \qquad \bar{R}^2 = 1 - \cfrac{\Sigma(y-\hat{y})^2/(n-k-1)}{\Sigma(y-\bar{y})^2/(n-1)}$$

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

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

$$\chi^2 = \sum_{i=0}^{k} \cfrac{(0_i-E_i)^2}{E_i} \qquad \text{or} \qquad \chi^2 = \cfrac{(|B-C|-1)^2}{B+C}$$

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

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

$$E(r) = \cfrac{2n_1n_2}{n_1+n_2} + 1$$

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

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

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

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

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

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

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

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

$$t = \frac{d\ -\ \mu_{dHO}}{s_d/\sqrt{n}}$$

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