UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2008/2009

SUBJECT	:	STATISTICS FOR MANAGEMENT (REAL ESTATE)
CODE	:	BSM 1822
COURSE	:	1 BPD / 2 BPD
DATE	:	APRIL 2009
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTION	:	ANSWER ALL QUESTIONS IN **PART A** AND **TWO (2)** QUESTIONS IN **PART B**

THIS EXAMINATION PAPER CONSISTS OF 7 PAGES

PART A

Q1 Ahmad wishes to buy a car and she read a newspaper to find the price of the used car for a local compact car. The data of the age (in years) and the prices (RM in thousand) are shown in **Table Q1** such as below.

Table Q1 : The price per age

Age (x)	1	2	3	4	5	6
Price (y)	32.4	31.3	29.2	28.6	27.9	26.5

(a) Sketch a scatter plot for the data.

(2 marks)

(b) Use the method of least squares to estimate the regression line. Interpret the results.

(8 marks)

(c) Test the slope, $\beta_1 \neq -1$ at 1% level of significance.

(8 marks)

(d) Estimate the car price when the car are 20 years old.

(2 marks)

Q2 (a) State the definitions of Type I and Type II error.

(2 marks)

(b) A company management claims that the average maintenance cost in this year for MFI industries will be more than RM3500 per month. The standard deviation of the population is RM470. A random sample of 100 MFI industries has an average maintenance cost of RM3650 per month. At significant level of 1%, test the company management claim that maintenance cost in this year will be increased.

(8 marks)

(c) There are two Mac Donald outlets that run their business in Alor Setar. The top management wishes to compare the delivery service that the two outlets had done. Their time of delivery (in minute) was recorded and measured as in **Table Q2(c)**.

Table Q2(c) : Mac Donald Data

	Outlet 1	Outlet 2
Sample size	14	24
Sample mean	85	74
Sample standard deviation	12	9

Test the claim that the mean of delivery time between outlet 1 is different from mean of delivery time outlet 2 by using 0.1 level of significance.

(10 marks)

Q3 (a) The quality control manager at a television factory needs to estimate the mean life of a large shipment of television. The process standard deviation is known to be 100 hours and assumes that the shipment contains a total of 200 televisions.

(i) Determine the sample size needed to estimate the average life within 20 hours with 99% confidence level.

(ii) Find the 98% confidence interval of the population mean life of television in this shipment if a random sample of 27 televisions selected from the shipment indicates a sample average life of 290 hours.

(7 marks)

(b) (i) A group of research student with 14 academic staffs and 17 administration staffs involve in a study to find mean of attendance time in January 2009. The mean time of attendance recorded by academic staff was 9.2 and the standard deviation was 1.3. While, the mean time of attendance recorded by administration staff was 7.9 and the standard deviation was 1.5. Construct a 95% confidence interval for the difference between means time of attendance record by academic staff to administration staff. Assume that the population variances are equal but unknown.

(ii) **Table Q3(b)(ii)** shows the price of laptop (in RM) from a selected samples of computer shop.

Table Q3(b)(ii) : Price of laptop

1599	1699	1799	1899	1999	2099	2299	2499	2699

Find the 98% confidence interval for the variance of the laptop price. Assume that the population is normally distributed.

(13 marks)

PART B

Q4 (a) The probability distribution function for the random variables, X is given in **Table Q4(a)**.

Table Q4(a) : Probability Distribution Function

x	-3	6	9
$P(X=x)$	k	$\frac{1}{2}$	$\frac{1}{3}$

Find
(i) the value of k.
(ii) the cumulative probability distribution, $F(X)$.
(iii) the values of $E(X)$ and $E(X^2)$. By using these values, evaluate $E[X+2]^2$.
(iv) the value of $Var(4X+1)$.

(15 marks)

(b) The length of time, X in seconds has probability density function such as below.

$$f(x)=\begin{cases}\frac{1}{5}e^{-x/5} & , \quad 0 \le x < \infty \\ 0 & , \quad \textit{otherwise}\end{cases}$$

(i) Show that $f(x)$ is a probability density function.
(ii) Find the value of $P(-1 \le X < 2)$.

(5 marks)

Q5 (a) A trading company has ten computers that it uses to trade on the Kuala Lumpur Stock Exchange (KLSE). The probability of a computer failing in a day is 0.08 and the computer fail independently. What is the probability that
(i) six out of ten computers fail in a day ?
(ii) three out of ten computers do not fail in a day ?

(6 marks)

(b) The number of flaws in a plastic panels used in the interior of automobiles has a mean of 2.2 flaws per square meter of the plastic panel.
(i) What is the probability that there are less than twenty surface flaws in ten square meter of plastic panel ?
(ii) Calculate the mean and variance for the flaws in hundred square meters of plastic panel.

(8 marks)

(c) A mass contains 10000 atoms of a radioactive substance. The probability that a given atom will decay in a one-minute time period is 0.0002. Let X represent the number of atoms that decay in one minute. Compute the probability that at most two atoms decay in one minute for each of these masses by using suitable approximation.

(6 marks)

Q6 (a) The compressive strength of concrete is normally distributed with mean 2500 psi and standard deviation is 50 psi. Find the probability that a random sample of five specimens will have a sample mean diameter that

(i) falls between 2499 psi and 2510 psi.

(ii) not more than 2550 psi.

(13 marks)

(b) The elasticity of a polymer is affected by the concentration of a reactant. If low concentration is used, the true mean elasticity is fifty six and when high concentration is used the mean elasticity is sixty. The standard deviation of elasticity is four, regardless of concentration. If two random samples of size sixteen are taken, find the probability that mean high concentration is higher than mean low concentration.

(7 marks)

Q7 (a) A small town has one fire engine and one ambulance available for emergencies. The probability that the fire engine is available when needed is 0.76 and the probability that the ambulance is available when called is 0.96. In the event of an injury resulting from a burning building, find the probability that both the ambulance and the fire engine will be available.

(4 marks)

(b) The moon is in the Seventh House at the same time that Jupiter aligns with Mars 5% of the time, whereas Jupiter aligns with Mars 25% of the time. It is also found that, 75% of the time, either Jupiter aligns with Mars or the Moon is in the Seventh House, or both. Find the probability that the time is the Moon in the Seventh House?

(5 marks)

(c) In a small town, two lawn companies fertilize lawns during the summer. Tri-State Lawn Service has 72% of the market. Thirty percent of the lawns fertilized by Tri State could be rated as very healthy one month after service. Greenchem has the other 28% of the market. Twenty percent of the lawns fertilized by Greenchem could be rates as very healthy one month after service. A lawn that has been treated with fertilizer by one of these companies within the last month is selected randomly. If the lawn is rated as very healthy, what are the posterior probabilities that Tri-State of Greenchem treated the lawn ?

(6 marks)

(d) Suppose a voter poll is taken in three states. In state A, 50% of voters support the liberal candidate, in state B, 60% of the voters support the liberal candidate, and in state C, 35% of the voters support the liberal candidate. From the total population of the three states, 40% live in state A, 25% live in state B and 35% live in state C. Given that a voter supports the liberal candidate, what is the probability that he lives in state B ?

(5 marks)

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Formulae

Probability :

$P(\bar{A}) = 1 - P(A)$, $P(A \cup B) = P(A) + P(B) - P(A \cap B)$, $P(A) = \dfrac{n(A)}{n(S)}$, $0 \le P(A) \le 1$,

$\sum P(A) = 1$, ${}^nC_r = \binom{n}{r} = \dfrac{n!}{r!(n-r)!}$, $P(A \cup B) = P(A) + P(B) - P(A \cap B)$,

$P(A \cup B) = P(A) + P(B)$, $P(B \mid A) = \dfrac{P(B \cap A)}{P(A)}$, $P(B_k|A) = \dfrac{P(B_k) \times P(A|B_i)}{\sum_{i=1}^{n} P(B_i) \times P(A|B_i)}$, $k = 1, 2, ..., n$..

Random Variable :

$\sum_{i=-\infty}^{\infty} P(x_i) = 1$, $E(X) = \sum_{\forall x} x \cdot P(x)$, $E(X^2) = \sum_{\forall x} x^2 \cdot P(x)$, $\int_{-\infty}^{\infty} f(x)\,dx = 1$, $E(X) = \int_{-\infty}^{\infty} x \cdot P(x)\,dx$,

$Var(X) = E(X^2) - [E(X)]^2$.

Special Probability Distributions :

$P(x = r) = {}^nC_r \cdot p^r \cdot q^{n-r}, r = 0, 1, \ldots, n$, $X \sim B(n, p)$, $P(X = r) = \dfrac{e^{-\mu} \cdot \mu^r}{r!}$, $r = 0, 1, \ldots, \infty$,

$X \sim P_0(\mu)$, $Z = \dfrac{X - \mu}{\sigma}$, $Z \sim N(0,1)$, $X \sim N(\mu, \sigma^2)$.

Sampling Distributions :

$\bar{X} \sim N(\mu, \sigma^2/n)$, $Z = \dfrac{\bar{X} - \mu}{\sigma/\sqrt{n}} \sim N(0,1)$, $T = \dfrac{\bar{x} - \mu}{s/\sqrt{n}}$, $\bar{X}_1 - \bar{X}_2 \sim N\left(\mu_1 - \mu_2, \dfrac{\sigma_1^2}{n_1} + \dfrac{\sigma_2^2}{n_2}\right)$.

Estimations :

$n = \left(\dfrac{Z_{\alpha/2} \cdot \sigma}{E}\right)^2$, $\left(\bar{x}_1 - \bar{x}_2\right) - Z_{\alpha/2}\sqrt{\dfrac{\sigma_1^2}{n_1} + \dfrac{\sigma_2^2}{n_2}} < \mu_1 - \mu_2 < \left(\bar{x}_1 - \bar{x}_2\right) + Z_{\alpha/2}\sqrt{\dfrac{\sigma_1^2}{n_1} + \dfrac{\sigma_2^2}{n_2}}$,

$\left(\bar{x}_1 - \bar{x}_2\right) - Z_{\alpha/2}\sqrt{\dfrac{s_1^2}{n_1} + \dfrac{s_2^2}{n_2}} < \mu_1 - \mu_2 < \left(\bar{x}_1 - \bar{x}_2\right) + Z_{\alpha/2}\sqrt{\dfrac{s_1^2}{n_1} + \dfrac{s_2^2}{n_2}}$,

$\left(\bar{x}_1 - \bar{x}_2\right) - t_{\alpha/2,v} \cdot S_p\sqrt{\dfrac{1}{n_1} + \dfrac{1}{n_2}} < \mu_1 - \mu_2 < \left(\bar{x}_1 - \bar{x}_2\right) + t_{\alpha/2,v} \cdot S_p\sqrt{\dfrac{1}{n_1} + \dfrac{1}{n_2}}$

where Pooled estimate of variance, $S_p^2 = \dfrac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}$ with $v = n_1 + n_2 - 2$,

$\left(\bar{x}_1 - \bar{x}_2\right) - t_{\alpha/2,v}\sqrt{\dfrac{1}{n}\left(s_1^2 + s_2^2\right)} < \mu_1 - \mu_2 < \left(\bar{x}_1 - \bar{x}_2\right) + t_{\alpha/2,v}\sqrt{\dfrac{1}{n}\left(s_1^2 + s_2^2\right)}$ with $v = 2(n-1)$,

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$$\left(\bar{x}_1-\bar{x}_2\right)-t_{\alpha/2,v}\sqrt{\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}}<\mu_1-\mu_2<\left(\bar{x}_1-\bar{x}_2\right)+t_{\alpha/2,v}\sqrt{\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}} \text{ with } v=\frac{\left(\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}\right)^2}{\frac{\left(\frac{s_1^2}{n_1}\right)^2}{n_1-1}+\frac{\left(\frac{s_2^2}{n_2}\right)^2}{n_2-1}},$$

$$\frac{(n-1)\cdot s^2}{\chi^2_{\alpha/2,v}}<\sigma^2<\frac{(n-1)\cdot s^2}{\chi^2_{1-\alpha/2,v}} \text{ with } v=n-1,$$

$$\frac{s_1^2}{s_2^2}\cdot\frac{1}{f_{\alpha/2}(v_1,v_2)}<\frac{\sigma_1^2}{\sigma_2^2}<\frac{s_1^2}{s_2^2}\cdot f_{\alpha/2}(v_2,v_1) \text{ with } v_1=n_1-1 \text{ and } v_2=n_2-1.$$

Hypothesis Testings :

$$Z=\frac{(\bar{X}_1-\bar{X}_2)-(\mu_1-\mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1}+\frac{\sigma_2^2}{n_2}}},\quad T=\frac{(\bar{X}_1-\bar{X}_2)-(\mu_1-\mu_2)}{S_p\cdot\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}} \text{ with } v=n_1+n_2-2,$$

$$Z=\frac{(\bar{X}_1-\bar{X}_2)-(\mu_1-\mu_2)}{\sqrt{\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}}},\quad T=\frac{(\bar{X}_1-\bar{X}_2)-(\mu_1-\mu_2)}{\sqrt{\frac{1}{n}\left(s_1^2+s_2^2\right)}},\quad T=\frac{(\bar{X}_1-\bar{X}_2)-(\mu_1-\mu_2)}{\sqrt{\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}}} \text{ with}$$

$$v=\frac{\left(\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}\right)^2}{\frac{\left(\frac{s_1^2}{n_1}\right)^2}{n_1-1}+\frac{\left(\frac{s_2^2}{n_2}\right)^2}{n_2-1}}.$$

Simple Linear Regressions :

$$S_{xy}=\sum x_i y_i-\frac{\sum x_i\cdot\sum y_i}{n},\quad S_{xx}=\sum x_i^{\,2}-\frac{\left(\sum x_i\right)^2}{n},\quad S_{yy}=\sum y_i^{\,2}-\frac{\left(\sum y_i\right)^2}{n},\quad \bar{x}=\frac{\sum x}{n},\quad \bar{y}=\frac{\sum y}{n},$$

$$\hat{\beta}_1=\frac{S_{xy}}{S_{xx}},\quad \hat{\beta}_0=\bar{y}-\hat{\beta}_1\bar{x},\quad \hat{y}=\hat{\beta}_0+\hat{\beta}_1 x,\quad r=\frac{S_{xy}}{\sqrt{S_{xx}\cdot S_{yy}}},\quad SSE=S_{yy}-\hat{\beta}_1 S_{xy},\quad MSE=\frac{SSE}{n-2},$$

$$T=\frac{\hat{\beta}_1-\beta_1^*}{\sqrt{\frac{MSE}{S_{xx}}}}\sim t_{n-2},\quad T=\frac{\hat{\beta}_0-\beta_0^*}{\sqrt{MSE\left(\frac{1}{n}+\frac{\bar{x}^2}{S_{xx}}\right)}}\sim t_{n-2}.$$