UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESI 2010/2011

COURSE NAME	:	STATISTICS FOR REAL ESTATE MANAGEMENT
COURSE CODE	:	BWM 10902/ BSM 1822
PROGRAMME	:	BACHELOR'S DEGREE IN REAL ESTATE MANAGEMENT (WITH HONOURS)
EXAMINATION DATE	:	APRIL/ MAY 2011
DURATION	:	2 HOURS AND 30 MINUTES
INSTRUCTION	:	ANSWER ALL QUESTIONS IN **PART A** AND **TWO (2)** QUESTIONS IN **PART B**

THIS EXAMINATION PAPER CONSISTS OF EIGHT (8) PAGES

PART A [60 MARKS]

Q1 A large public utility company wants to compare the consumption of electricity during the certain season for single-family houses in two different towns. For each household sampled, the monthly electric bill is recorded as shown in **Table Q1**.

Table Q1: Summary of the monthly electric bill

	Town 1	Town 2
Sample mean	RM115.00	RM98.00
Sample standard deviation	RM30.00	RM18.00
Sample size	25	21

Using a level of significance of 0.01.

(a) Determine the sampling distribution of the monthly electric bill in Town 1 and Town 2.

(2 marks)

(b) Is there any evidence that the mean bill in Town 2 is above RM80.00?

(6 marks)

(c) Is there any evidence that the variance bill in Town 1 is below RM32.00?

(6 marks)

(d) Is there any evidence of a difference between the variances of bills in Town 1 and Town 2?

(8 marks)

(e) Is there any evidence that the mean monthly bill is higher in Town 1 than in Town 2?

(8 marks)

Q2 The director of graduate studies at a large college of business would like to predict the grade point index (GPI) of students in an MBA program based on the Graduate Management Aptitudes Test (GMAT) score. A sample of 10 students who had completed 2 years in the program are selected. The results as shown in **Table Q2.**

Table Q2: GMAT score and GPI

Students	GMAT score	GPI
1	6.88	3.72
2	6.47	3.44
3	6.52	3.21
4	6.08	3.29
5	6.80	3.91
6	6.17	3.28
7	5.57	3.02
8	5.99	3.13
9	6.16	3.45
10	5.94	3.33

(a) Determine which are the independent and dependent variables.

(2 marks)

(b) Plot a scatter diagram between GMAT score and GPI.

(2 marks)

(c) Assuming a linear relationship between GMAT score and GPI, use the least – squares method to compute the regression coefficients β_0 and β_1.

(8 marks)

(d) Interpret the meaning of the slope in this problem.

(2 marks)

(e) Use the prediction line developed in (c) to predict the GPI for a student with GMAT score of 6.00.

(2 marks)

(f) Determine the coefficient of determination r^2 and interpret its meaning in this problem.

(4 marks)

(g) At significance level, $\alpha = 0.05$, test if there is a significance relationship between GMAT score and GPI. What is your conclusion?

(10 marks)

PART B [40 MARKS]

Q3 **(a)** A game is played between two players ***A*** and ***B***. They take turns to withdraw a marble from a bag randomly without replacement. The first person to get a red marble wins. It is agreed that ***A*** shall begin first.

(i) If there are 5 marbles, one red and the others are of some other colors, what is the probability that ***A*** wins? Is the game fair?

(5 marks)

(ii) If there are 6 marbles, one red and the others are of some other colors, what is the probability that ***A*** wins? Is the game fair?

(5 marks)

(b) A, B and C are three events in a sampling space where $P(A) = 0.4$, $P(B) = 0.7$ and $P(C) = 0.2$

(i) Can the events A and B be exclusive? Why?

(5 marks)

(ii) Let D is another event. Given D and A as well as D and C are exclusive, $P(A \text{ U } C) = 0.55$, what is the maximum probability of D?

(5 marks)

Q4 Mr Hamid is trying to set up a portfolio that consists of a corporate bond fund and a common stock fund. The following information in **Table Q4** about the annual return (per RM1,000) of each of these investments under different economic conditions is available along with the probability that each of these economics conditions will occur.

Table Q4: Annual return (per RM1,000) of each of these investments under different economic conditions

Probability	State of economy	Corporate Bond Fund (RM)	Common Stock Fund (RM)
0.10	Recession	-30	-150
0.15	Stagnation	50	-20
0.35	Slow growth	90	120
0.30	Moderate growth	100	160
0.10	High growth	110	250

(a) Compute the expected return for the corporate bond fund and for the common stock fund.

(8 marks)

(b) Compute the standard deviation for the corporate bond fund and for the common stock fund.

(8 marks)

(c) Would you invest in the corporate bond fund or the common stock fund? Explain.

(4 marks)

Q5 An industrial sewing machine uses ball bearings that are targeted to have a diameter of 0.75 inch. The lower and upper specification limits under which the ball bearing can operate are 0.74 inch and 0.76 inch, respectively. Past experience has indicated that the actual diameter of the ball bearings is approximately normal distributed with a mean of 0.753 inch and standard deviation of 0.004 inch. What is the probability that a ball bearing is

(a) between the target and the actual mean?

(5 marks)

(b) between the lower specification limit and the target?

(5 marks)

(c) above the upper specification limit?

(5 marks)

(d) 95% of the diameters are greater than what value?

(5 marks)

Q6 The amount of time a bank teller spends with each customer has a population mean, $\mu = 3.10$ minutes and standard deviation, $\sigma = 0.40$ minutes. If we select a random sample of 16 customers,

(a) what is the probability that the mean time spent per customer is at least 3.00 minutes?

(4 marks)

(b) what is the probability the sample mean is between 3.00 and 3.30 minutes?

(4 marks)

(c) there is an 95% chance that the sample mean is below how many minutes?
(5 marks)

(d) If you select a random sample of 64 customers, what is the probability that the mean time spent per customer is at least 3.00 minutes?
(5 marks)

(e) Explain the difference in the results of (a) and (d).
(2 marks)

Q7 One of the major measures of the quality of service provided by any organization is the speed with which it responds to customer complaints. A large family-held department store selling furniture and flooring including carpeting had undergone a major expansion in the past several years. In particular, the flooring department had extended from 2 installation crews to an installation supervisor, a measurer, and 15 installation crews. Last year there were 16 complaints concerning carpeting installation. Information in **Table Q7** represents the number of days between the receipt of the complaint and the resolution of the complaint.

Table Q7: Number of days between the receipt of the complaint and the resolution of the complaint

11	19	27	12
12	5	29	35
13	10	28	26
33	35	52	22

(a) Estimate the average number of days between the receipt of the complaint and the resolution of the complaint.
(4 marks)

(b) Estimate the variance number of days between the receipt of the complaint and the resolution of the complaint.
(4 marks)

(c) Construct a 95% confidence interval estimate of the average number of days between the receipt of the complaint and the resolution of the complaint.
(6 marks)

(d) Construct a 95% confidence interval estimate of the variance number of days between the receipt of the complaint and the resolution of the complaint.
(6 marks)

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Formulae

Random variables:

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

$E(X) = \int_{-\infty}^{\infty} x \cdot P(x)\,dx$, $E(X^2) = \int_{-\infty}^{\infty} x^2 \cdot P(x)\,dx$, $Var(X) = E(X^2) - [E(X)]^2$.

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 $v = 2(n-1)$,

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

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Formulae

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

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

Hypothesis Testings :

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

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

$$v = \frac{\left(\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}\right)^2}{\frac{\left(\frac{s_1^2}{n_1}\right)^2}{n_1-1}+\frac{\left(\frac{s_2^2}{n_2}\right)^2}{n_2-1}}.\ ;\ S_p^2 = \frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2}\ ;\ \chi^2 = \frac{(n-1)s^2}{\sigma^2}$$

Simple Linear Regressions :

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

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

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