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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2011/2012

COURSE NAME	:	STATISTICS FOR REAL ESTATE MANAGEMENT
COURSE CODE	:	BWM 10902 / BSM1822
PROGRAMME	:	1 BPD 2 BPD
EXAMINATION DATE	:	JUNE 2012
DURATION	:	2 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS.

THIS EXAMINATION PAPER CONSISTS OF **SIX (6)** PAGES

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Q1 (a) The increased number of small commuter planes in major airports has heightened concern over air safety. An eastern airport has recorded a monthly average of five near-misses on landings and takeoffs in the past five years. Assume that it follows a Poisson distribution.

(i) Find the probability that during a given month there are no near-misses on landings and takeoffs at the airport.

(4 marks)

(ii) Find the probability that during a given month there are five near-misses.

(3 marks)

(iii)Find the probability that there are at least five near-misses during particular months.

(2 marks)

(iv)Find the probability that there are between three and five near-misses during particular months.

(3 marks)

(b) The life of certain automobile tire is normally distributed with mean 35 000 miles and variance 25 000 000 miles.

(i) What is the probability of such tire last between 30 000 and 40 000 miles?

(5 marks)

(ii) What is the probability of such tire last over 40 000 miles?

(4 marks)

(iii)What is the probability of such tire last at most 60 000 miles?

(4 marks)

Q2 (a) Suppose that the college faculty with the rank of professor at 2-year institutions earn an average of \$ 54 000 per year with standard deviation of \$ 4000. In an attempt to verify this salary level, a random sample of 60 professors was selected from a personnel database for all 2-year institutions in the United State.

(i) What is the sampling distribution of sample mean?

(5 marks)

(ii) Calculate the probability that the sample mean is greater than \$ 55 000.

(4 marks)

(iii)If random sample of 70 professors was selected, what is the probability that the sample mean will be at most \$ 52 900.

(7 marks)

(b) A study was designed to estimate the difference in diastolic blood pressure readings between men and women. The mean and standard deviation for sixteen men are 77.37 and 8.35, while for thirteen women are 71.08 and 9.22 respectively. Assume that the readings are normally distributed, find probability that the different between diastolic blood pressure readings from women is two more than men.

(9 marks)

Q3 (a) The polychlorinated biphenyl (PCB) concentration of a fish caught in Lake Michigan was measured by a technique that is known to result in an error of measurement that is normally distributed with standard deviation of 0.08 part per million. If the result of 10 independent measurements of this fish are:

11.2, 12.4, 10.8, 11.6, 12.5, 10.1, 11.0, 12.2, 12.4, 10.6

Find a 95 percent confidence interval for the average of the PCB level of the fish.

(9 marks)

(b) **Table Q3** below shows the results of a mouse-infection experiment in which 14 mice in Group A and 11 mice in Group B received the same challenge dose of bacteria and were then observed daily.

Table Q3: The Result of a Mouse-infection Experiment in Group A and Group B

Mouse Group	**Day of death (post-infection) of individual mouse**
A	2, 2, 3, 3, 3, 3, 4, 4, 5, 6, 7, 7, 8, 9
B	1, 1, 2, 2, 2, 2, 3, 3, 3, 4, 5

If the population variances of both group are not equal, find the 99% confidence interval for the difference between the average days of 2 groups of mice that infected by the dose of bacteria.

(14 marks)

Q4 (a) To determine the effectiveness of a new method of teaching reading to young children, a group of 20 non-reading children were randomly divided into two groups of 10 each. The first group was taught by a standard and the second group by an experimental method. At the end of school term, a reading examination was given to each of the students, with the following summary statistics resulting as in **Table Q4**.

Table Q4: Reading Examination Result for Standard and Experimental Method

Standard Method	**Experimental Method**
Average score = 65.6 Standard deviation = 5.4	Average score = 70.4 Standard deviation = 4.8

(i) Are the above data strong enough to prove, at the 5% percent level of significance, that the experimental method results in a higher mean test score? Assume that the population variances are not equal.

(8 marks)

(ii) Use a 10% level of significance to test the difference of ratio variances for the two difference method.

(8 marks)

(b) An area manager in a department store wants to study the relationship between the number of workers on duty and the value of merchandise lost to shoplifters. To do so, she assigned a different number of clerks for each of 10 weeks. The result were as follows (**Table Q5**):

Table Q5: The Data for the Number of Worker on Duty and the Value of Merchandise Lost to Shoplifters.

Week	Number of workers(X)	Loss (Y)
1	9	420
2	11	350
3	12	360
4	13	300
5	15	225
6	18	200
7	16	230
8	14	280
9	12	315
10	10	410

(i) Assuming a linear relationship, use the least squares method to find the simple linear regression model and interpret the meaning of β_1.

(9 marks)

(ii) What is the approximate number of loss if the number of workers is 30?

(2 marks)

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Formulae

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 :

$n=\left(\dfrac{Z_{\alpha/2}\cdot\sigma}{E}\right)^2$, $\bar{x}\pm z_{\alpha/2}(\sigma/\sqrt{n})$, $\bar{x}\pm z_{\alpha/2}(s/\sqrt{n})$, $\bar{x}\pm t_{\alpha/2,v}\left(\dfrac{s}{\sqrt{n}}\right)$

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

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

$$\left(\bar{x}_1-\bar{x}_2\right)-t_{\alpha/2,v}\cdot S_p\sqrt{\frac{2}{n}}<\mu_1-\mu_2<\left(\bar{x}_1-\bar{x}_2\right)+t_{\alpha/2,v}\cdot S_p\sqrt{\frac{2}{n}};v=2n-2$$

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

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 $v=n_1+n_2-2$,

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

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

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

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

Hypothesis Testing :

$$Z_{Test}=\frac{\bar{x}-\mu}{\sigma/\sqrt{n}},\quad Z_{Test}=\frac{\bar{x}-\mu}{s/\sqrt{n}},\quad T_{Test}=\frac{\bar{x}-\mu}{s/\sqrt{n}}$$

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

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

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

$$F=\frac{s_1^2}{s_2^2},\quad \text{with } \frac{1}{f_{\alpha/2}(v_2,v_1)} \quad \text{and} \quad f_{\alpha/2}(v_1,v_2)$$

Simple Linear Regressions :

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

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

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