UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2023/2024

COURSE NAME	:	STATISTICS FOR REAL ESTATE MANAGEMENT
COURSE CODE	:	BPE 15102
PROGRAMME CODE	:	BPD
EXAMINATION DATE	:	JULY 2024
DURATION	:	2 HOURS
INSTRUCTION	:	1. ANSWER **ALL** QUESTIONS 2. THIS FINAL EXAMINATION IS CONDUCTED VIA ☐ Open book ☒ Closed book 3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

Q1 (a) A home security system is designed to have a 99% reliability rate. Suppose that nine homes equipped with this system experience an attempted burglary.

Calculate the probability that at least one of the alarms is triggered.

(5 marks)

(b) In a food processing and packaging plant, an average of two packaging machine breakdowns per week.

Find the probability that there are no machine breakdowns in a week.

(5 marks)

Q2 The line width for semiconductor manufacturing is assumed to be normally distributed with a mean of 0.5 micrometer and standard deviation of 0.05 micrometer.

(a) Find the probability that a line width is greater than 0.62 micrometer?

(5 marks)

(b) Calculate the probability that a line width is between 0.47 and 0.63 micrometer?

(10 marks)

Q3 The data of chlorine residual in a swimming pool at various times after it has been treated with chemicals is shows in **Table Q3**.

Table Q3: The data of chlorine residual in a swimming pool at various time.

Number of hours, X	Chlorine residuals, Y (parts per million)
2	1.8
4	1.5
6	1.4
8	1.1
10	1.1
12	0.9

(a) Sketch a scatter plot for the data in **Table Q3**.

(4 marks)

(b) Find the estimated regression line by using the least square method.

(8 marks)

(c) Predict the chlorine residuals in a swimming pool at 24 hours.

(2 marks)

(d) Compute
(i) coefficient of correlation, r

(2 marks)

(ii) coefficient of determination, r^2.

(4 marks)

Q4 (a) PVC pipe is manufactured with mean diameter is 3.2 cm and standard deviation is 1.6 cm. The distribution of diameter is normal.

Find the probability that a random sample of 64 pipes will have a sample mean diameter that is less than three centimeters.

(8 marks)

(b) A company manufactures two types of cables, Brand A and Brand B, that have mean breaking strengths of 4000 kg and 4500 kg and standard deviations of 300 kg and 200 kg, respectively. 100 cables of Brand A and 50 cables of Brand B are tested.

Find the probability that the mean breaking strengths of Brand B will be at least 600 kg more than Brand A?

(12 marks)

(c) In the production of airbag inflators for automative safety systems, a company is interested in estimating the true mean of the inflator. Measurements on 20 inflators yielded an average value 2.02 cm and standard deviation of 0.05.

Construct 98% confidence interval of the true mean.

(10 marks)

(d) A restaurant owner wishes to find the 99% confidence interval of the true mean cost of a dry fish. A previous study showed that the standard deviation of the price was RM0.12.

Calculate the sample if she wishes to be accurate within RM0.10?

(5 marks)

Q5 (a) What is null hypothesis and alternative hypothesis?

(2 marks)

(b) Explain briefly what is meant by the significance level of a test.

(3 marks)

(c) The average annual cost of car insurance in 2023 for residents of Kuala Lumpur was RM891, while for residents of Pulau Pinang was RM789. If given that the sample size of both states is 14 with standard deviation of sample, 3 and 6 respectively.

Test at 0.01 level of significance whether the mean annual cost of car insurance Kuala Lumpur is greater than the mean annual cost of car insurance Pulau Pinang.

(15 marks)

-END OF QUESTIONS-

APPENDIX

STATISTICS FOR REAL ESTATE MANAGEMENT FORMULA SHEET

Special Probability Distributions

Binomial

$P(X=x)={}^{n}C_{x}.p^{x}.q^{n-x}$ Mean, $\mu = np$ Variance, $\sigma^2 = npq$

Poisson

$$P(X=x)=\frac{e^{-\mu}.\mu^{x}}{x!}$$

Normal

$$P(X>k)=P\left(Z>\frac{k-\mu}{\sigma}\right)$$

Sampling Distribution

Z – value for single mean

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

Probability related to single Mean

$$P(\bar{x}>r)=P\left(Z>\frac{r-\mu}{\sigma/\sqrt{n}}\right)$$

Let,

$$\mu_{\bar{x}_1-\bar{x}_2}=\mu_1-\mu_2 \quad and \quad \sigma_{\bar{x}_1-\bar{x}_2}=\sqrt{\frac{\sigma_1^{\,2}}{n_1}+\frac{\sigma_2^{\,2}}{n_2}}$$

Z – value for Two Mean

$$Z=\frac{(\bar{x}_1-\bar{x}_2)-\mu_{\bar{x}_1-\bar{x}_2}}{\sigma_{\bar{x}_1-\bar{x}_2}}$$

Probability related to two Mean

$$P(\bar{x}_1-\bar{x}_2>r)=P\left(Z>\frac{r-\mu_{\bar{x}_1-\bar{x}_2}}{\sigma_{\bar{x}_1-\bar{x}_2}}\right)$$

Estimation

Confidence interval for single mean

Large sample: $n \geq 30$ $\Rightarrow$ σ is known: $\left(\bar{x} - z_{\alpha/2}\left(\sigma / \sqrt{n}\right) < \mu < \bar{x} + z_{\alpha/2}\left(\sigma / \sqrt{n}\right)\right)$

$\Rightarrow$ σ is unknown: $\left(\bar{x} - z_{\alpha/2}\left(s / \sqrt{n}\right) < \mu < \bar{x} + z_{\alpha/2}\left(s / \sqrt{n}\right)\right)$

Small sample: $n < 30$ $\Rightarrow$ σ is known: $\left(\bar{x} - z_{\alpha/2}\left(\sigma / \sqrt{n}\right) < \mu < \bar{x} + z_{\alpha/2}\left(\sigma / \sqrt{n}\right)\right)$

$\Rightarrow$ σ is unknown: $\left(\bar{x} - t_{\alpha/2}\left(s / \sqrt{n}\right) < \mu < \bar{x} + t_{\alpha/2}\left(s / \sqrt{n}\right)\right)$

Hypothesis Testing

Testing of hypothesis on a difference between two means

Variances	Samples size	Statistical test
Unknown (Equal)	$n_1, n_2 < 30$	$T_{Test} = \dfrac{\left(\bar{x}_1 - \bar{x}_2\right) - \left(\mu_1 - \mu_2\right)}{S_p \cdot \sqrt{\dfrac{1}{n_1} + \dfrac{1}{n_2}}}$ $v = n_1 + n_2 - 2$ where $S_p = \sqrt{\dfrac{\left(n_1 - 1\right)s_1^2 + \left(n_1 - 1\right)s_2^2}{n_1 + n_2 - 2}}$
Unknown (Not equal)	$n_1 = n_2 < 30$	$T_{Test} = \dfrac{\left(\bar{x}_1 - \bar{x}_2\right) - \left(\mu_1 - \mu_2\right)}{\sqrt{\dfrac{1}{n}\left(s_1^2 + s_2^2\right)}}$ $v = 2\left(n - 1\right)$
Unknown (Not equal)	$n_1, n_2 < 30$	$T_{Test} = \dfrac{\left(\bar{x}_1 - \bar{x}_2\right) - \left(\mu_1 - \mu_2\right)}{\sqrt{\dfrac{s_1^2}{n_1} + \dfrac{s_2^2}{n_2}}}$ $v = \dfrac{\left(\dfrac{s_1^2}{n_1} + \dfrac{s_2^2}{n_2}\right)^2}{\dfrac{\left(\dfrac{s_1^2}{n_1}\right)^2}{n_1 - 1} + \dfrac{\left(\dfrac{s_2^2}{n_2}\right)^2}{n_2 - 1}}$

Simple Linear Regressions

Let

$$S_{xy} = \sum_{i=1}^{n} x_i y_i - \frac{1}{n}\left(\sum_{i=1}^{n} x_i\right)\left(\sum_{i=1}^{n} y_i\right), \quad S_{xx} = \sum_{i=1}^{n} x_i^2 - \frac{1}{n}\left(\sum_{i=1}^{n} x_i\right)^2 \quad \text{and}$$

$$S_{yy} = \sum_{i=1}^{n} y_i^2 - \frac{1}{n}\left(\sum_{i=1}^{n} y_i\right)^2$$

Simple linear regression model

$\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 x$

where

$$\hat{\beta}_1 = \frac{S_{xy}}{S_{xx}}$$

$$\hat{\beta}_0 = \bar{y} - \hat{\beta}_1 \bar{x}$$

Coefficient of Determination

$$r^2 = \frac{\left(S_{xy}\right)^2}{S_{xx} \cdot S_{yy}}$$

Coefficient of Pearson Correlation

$$r = \frac{S_{xy}}{\sqrt{S_{xx} \cdot S_{yy}}}$$