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Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2015/2016

COURSE NAME	:	STATISTICS
COURSE CODE	:	BIC 10603
PROGRAMME CODE	:	BIS / BIP / BIW / BIM
EXAMINATION DATE	:	JUNE / JULY 2016
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

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

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Q1 (a) The realibility of a system is the probability that a system is consistently perfoms according to its specifications. The reliability of a series system consisting of n independent components is given by

$$R_S = \prod_{i=1}^{n} R_{i,}$$

and the realibility of a parallel system consisting of n independent components is given by

$$R_S = \prod_{i=1}^{n}(1 - R_i).$$

where R_i is the realibility of the i^{th} component and $\prod_{i=1}^{n} x_i = x_1 \times x_2 \times \cdots \times x_n$. Consider a system consists of series and parallel CPUs (A, B, C, D, E, F) with realibility as shown in **Figure Q1(a)**.

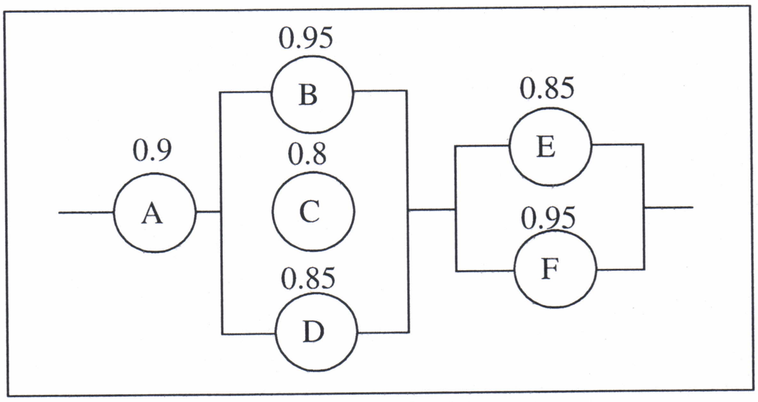

Figure Q1(a)

Find the realibility of the system.

(10 marks)

(b) Let X be a continous random variable with the function below,

$$f(x) = \begin{cases} 12(x^2 - x^3), 0 < x < 1 \\ 0, \qquad otherwise \end{cases}.$$

(i) Show that $f(x)$ satisfy with the probability density function.

(5 marks)

(ii) Find the mean and variance of X.

(5 marks)

Q2 (a) A system consists of seven databases that to be accessed by user's transaction. A transaction can successfully update databases when the transaction obtain majority locked from those databases. Assume that the probability of obtaining lock from each database is, $p = 0.7$. Find the probability of a transaction that can successfully update databases from the system.

(10 marks)

(b) A server on average has to do five read-locks per hour. For any given hour, find the probability that will do the following:

(i) At most five read-locks.

(5 marks)

(ii) At least six read-locks.

(5 marks)

Q3 Suppose we want to purchase a used three-years-old Proton Gen 2. We would like to estimate the population mean price of a used three-years-old Proton Gen 2. We estimate the population mean by obtaining a random sample of 15 used three-year-old Proton Gen 2 listed in **Table 1**.

Table 1: The market price of 15 used three-year-old Proton Gen 2

RM35 000	RM43 108	RM33 995	RM32 750	RM33 998
RM43 500	RM33 995	RM32 750	RM39 950	RM36 900
RM35 995	RM39 998	RM37 995	RM37 995	RM43 785

(a) Calculate the point estimate of the population mean (μ) and the Margin of Error (ME).

(6 marks)

(b) Construct a 90% and 95% confidence interval about the population mean (μ).

(6 marks)

(c) Based on answers from **Q3(b)**, is the width of 95% confidence interval larger than the width of 90% confidence interval? Explain your answer.

(3 marks)

(d) Construct a 90% confidence interval for $n = 45$.

(2 marks)

(e) Comparing your answers from **Q3(b)** and **Q3(d)**, how does the sample size, n, affect the confidence interval?

(3 marks)

Q4 (a) Make the following test of hyphotesis.

(i) $H_0 : \mu = 83$, $H_1 : \mu \neq 83$, $n = 35$, $\bar{x} = 80.5$, $\sigma = 15$, $\alpha = 0.10$.

(5 marks)

(ii) $H_0 : \mu = 42$, $H_1 : \mu < 42$, $n = 75$, $\bar{x} = 40.5$, $\sigma = 7.4$, $\alpha = 0.01$.

(5marks)

(b) Random sample 8 observations, $11.0, 10.7, 9.4, 7.8, 11.3, 9.1, 10.2, 10.5$ are taken to determine if there is evidence that the concentration of an average certain material less than 11ppm. Test the claim by using $\alpha = 0.025$.

(10 marks)

Q5 A sample of seven household income from a small town and collect information of their incomes and food expenditure for the last month. The information obtained is given in **Table 2** (both in hundreds of Ringgit Malaysia).

Table 2: Income, food and utility expenditure of seven household

Income (RM)	55	83	38	61	33	49	67
Food & Utility Expenditure (RM)	14	24	13	16	9	15	17

(a) Based on the data in **Table 2**, obtain the least squares line of the food and utility expenditure on the household income. Use income as an independent variable.

(6 marks)

(b) Predict the food and utility expenditure if we randomly select a monthly income is RM 6,100 and calculate the error of prediction.

(4 marks)

(c) Test at 1% significance level whether the slop of the regression line for the incomes and food utility expenditures of seven household is positive.

(6 marks)

(d) Calculate the coefficient of determination (R^2) and comment on your answer.

(4 marks)

- END OF QUESTION –

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Formula

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

$$r=\frac{S_{xy}}{\sqrt{S_{xx}S_{yy}}},\quad \hat{\beta}_1=\frac{S_{xy}}{S_{xx}},\quad \hat{\beta}_0=\bar{y}-\hat{\beta}_1\bar{x}$$

$$Z=\frac{\bar{x}-\mu}{\sigma/\sqrt{n}},\quad Z=\frac{\bar{x}-\mu}{s/\sqrt{n}},\quad T=\frac{\bar{x}-\mu}{s/\sqrt{n}}$$

$$\bar{x}-z_{\alpha/2}\left(\frac{\sigma}{\sqrt{n}}\right)<\mu<\bar{x}+z_{\alpha/2}\left(\frac{\sigma}{\sqrt{n}}\right)$$

$$\bar{x}-z_{\alpha/2}\left(\frac{s}{\sqrt{n}}\right)<\mu<\bar{x}+z_{\alpha/2}\left(\frac{s}{\sqrt{n}}\right)$$

$$\bar{x}-t_{\alpha/2,\,v}\left(\frac{s}{\sqrt{n}}\right)<\mu<\bar{x}+t_{\alpha/2,\,v}\left(\frac{s}{\sqrt{n}}\right),\quad v=n-1$$

$$S_p^2=\frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2}\ \text{and}\ v=n_1+n_2-2\quad v=2(n-1)$$

$$\chi^2=\sum_{i=1}^{k}\frac{(O_i-E_i)^2}{E_i},\quad \chi^2=\sum_{i=1}^{r}\sum_{j=1}^{c}\frac{(O_{ij}-E_{ij})^2}{E_{ij}},\quad MSTR=\frac{SSTR}{k-1},\quad MSE=\frac{MSTR}{N-k}$$

$$\text{SST}=\sum X^2-(\sum X)^2/N,\quad \text{SSTR}=\sum T_i^2/n_i-(\sum X)^2/N,\quad \text{SSE}=\text{SST}-\text{SSTR}$$

$$T=\frac{\hat{\beta}_1-\beta_c}{\sqrt{MSE/S_{xx}}},\quad SSE=S_{yy}-\hat{\beta}_1 S_{xy},\quad MSE=\frac{SSE}{n-k}$$

$$\chi^2=\frac{(n-1).s^2}{\sigma^2{}_0},\quad F=\frac{s_1^2}{s_2^2}$$

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

$$\sum_{i=-\infty}^{\infty} p(x_i) = 1,\ E(X) = \sum_{\forall x} xp(x),\ Var(X) = E(X^2) - [E(X)]^2,$$

$$P(X = r) = {}^nC_r \cdot p^r \cdot (1-p)^{n-r} \quad r = 0, 1, \ldots, n \quad P(X = r) = \frac{e^{-\mu} \cdot \mu^r}{r!} \quad r = 0, 1, \ldots, \infty$$

$$X \sim N(\mu, \sigma^2),\ Z \sim N(0, 1) \text{ and } Z = \frac{X - \mu}{\sigma},$$

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