UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2017/2018

COURSE NAME	:	STATISTICS
COURSE CODE	:	BIT 11603
PROGRAMME CODE	:	BIT
EXAMINATION DATE	:	JUNE/JULY 2018
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

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

Q1 A network provider investigates the load of its network. The number of concurrent users is recorded at fifty locations as in **Table Q1**.

Table Q1

15200	25100	14200	16300	17800
20100	12200	14800	17200	18800
18500	17100	15100	18500	17500
15200	17500	16100	16200	16100
18500	19200	21900	16900	15200
17800	23700	13900	17200	17500
22700	15500	20000	20500	15200
15800	22000	11200	13400	18800
15200	21700	18900	20800	21500
20800	21200	20500	18200	15200

(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 intervals about the population mean (μ).

(6 marks)

(c) Based on answer from **Q1(b)**, is the width of 95% confidence interval larger than the width of 90% confidence interval? Explain your answer.

(3marks)

(d) Construct a 90% confidence interval for $n = 85$.

(2 marks)

(e) Comparing your answers from **Q1(b)** and **Q1(d)**, how does the sample size, n, affect the confidence interval?

(3 marks)

Q2 (a) A system consists of five database-servers 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, $p = 0.8$. Calculate the probability of a transaction that unsuccessfully update databases from the system.

(10 marks)

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

$$f(x)=\begin{cases}\frac{1}{18}(x^2-2x), & -3<x<3\\ 0 & otherwise\end{cases}$$

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

(5 marks)

(ii) Calculate $E(X)$ and $Std.dev\ (X)$.

(5 marks)

Q3 (a) Explain Central Limit Theorem applied in sampling distribution.

(6 marks)

(b) The height for student population at universities in Malaysia is normally distributed with a mean of 170 cm and standard deviation of 15 cm. A random sample of 40 students was taken in a certain university. Calculate the probability that the mean height of the sample is less than 175 cm.

(6 marks)

(c) From a random sample of 50 graduating students at a university, the mean CGPA is 2.95 with standard deviation 0.35.

(i) Calculate the point estimate of the CGPA

(2 marks)

(ii) Construct a 90% confidence interval for the mean CGPA for all graduating students at that university.

(6 marks)

Q4 (a) Make the following test of hyphotesis.

(i) **Table Q4(a)** provides data on battery lives for laptops with a CD writer (sample *X*) and without a CD writer (sample *Y*). Does CD writer consume extra energy, and therefore, does it reduce the battery life on a laptop?

Table Q4(a)

Sample X	Sample Y
$n_x = 12$	$n_y = 16$
$\bar{x} = 4.8$	$\bar{y} = 5.2$
$s_x = 1.6$	$s_y = 1.4$

(6 marks)

(ii) $H_0 : \mu = 40$, $H_1 : \mu < 40$, $n = 75$, $\bar{x} = 38.5$, $\sigma = 7.2$, $\alpha = 0.01$.

(4 marks)

(b) An experiment was conducted to compare three different computer keyboard designs with respect to their effect on repetitive stress injuries (rsi). 15 businesses of comparable size participated in a study to compare three keyboard designs. 5 of 15 businesses were randomly selected and their computers were equipped with design 1. 5 of the remaining 10 were selected and equipped with design 2, and the remaining 5 used design 3. After one year, the number of repetitive stress injuries (rsi) were recorded for each company. The results are shown in **Table Q4(b)**.

Table Q4(b)

No. Exp.	Design 1	Design 2	Design 3
1	10	24	17
2	10	22	17
3	8	24	15
4	10	24	19
5	12	26	17

Test a claim that repetitive stress injuries (rsi) affects the keyboard design at $\alpha = 0.05$ significance level.

(10 marks)

Q5 In **Table Q5**, the data represent investments (in thousands of Ringgit Malaysia), in the development of new software by some computer companies over 10-years period.

Table Q5

Year, X	Investment, X	Year, X	Investment, Y
2003	17	2008	40
2004	25	2009	41
2005	32	2010	43
2006	30	2011	45
2007	34	2012	47

(a) Based on the data in **Table Q5**, obtain the regression line of the year and investment in the development of new software.

(6 marks)

(b) If we randomly select a yearly investment is 2012, predict the investment in the new software development and calculate its error.

(4 marks)

(c) Test at 1% significance level whether the slope of the regression line for year investment 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

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

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

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

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

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

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

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

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

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

$$T=\frac{\hat{\beta}_1-\beta_c}{\sqrt{MSE/S_{xx}}},SSE=S_{yy}-\hat{\beta}_1S_{xy},\ MSE=\frac{SSE}{n-k}$$

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

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

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

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

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

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