Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2017/2018

COURSE NAME	:	STATISTICS
COURSE CODE	:	BIC 10603
PROGRAMME CODE	:	BIS / BIP / BIW / BIM
EXAMINATION DATE	:	JUNE / JULY 2018
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS.

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

Q1 (a) The following data contain the amount of 80 daily emission (in tons) of sulphur oxides from an industrial plant:

15.8	26.4	17.3	11.2	23.9	24.8	18.7	13.9	9.0	13.2
22.7	9.8	6.2	14.7	17.5	26.1	12.8	28.6	17.6	23.7
26.8	22.7	18.0	20.5	11.0	20.9	15.5	19.4	16.7	10.7
19.1	15.2	22.9	26.6	20.4	21.4	19.2	21.6	16.9	19.0
18.5	23.0	24.6	20.1	16.2	18.0	7.7	13.5	23.5	14.5
14.4	29.6	19.4	17.0	20.8	24.3	22.5	24.6	18.4	18.1
8.3	21.9	12.3	22.3	13.3	11.8	19.3	20.0	25.7	31.8
25.9	10.5	15.9	27.5	18.1	17.9	9.4	24.1	20.1	28.5

(i) Arrange the data into a frequency distribution table by taking 5 as the lower limit of the first class and 4 is the class width.

(7 marks)

(ii) Histogram is the most common form of graphical presentation for a frequency distribution. Based on your frequency distribution table in **Q1(a)(i)**, convert the table into graphical presentation using histogram.

(3 marks)

(b) A random variable *X* has the cumulative distribution function (cdf):

$$F(x) = \begin{cases} d, & x \leq -1 \\ a + bx - \frac{1}{4}x^3, & -1 < x < 1 \\ c, & x \geq 1 \end{cases}$$

for some constant a, b, c, d.

Compute the values of a, b, c, d for which *X* has a probability density function, $f(x)$.

(10 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 obtains majority lock from those databases. Assume that the probability of obtaining lock from each database is, $p = 0.7$. Determine the probability of a transaction that can successfully update databases from the system.

(10 marks)

(b) On average, a server has to do five read-locks per hour. For a given hour, calculate the probability that the server will do the following:

(i) At most three read-locks.

(5 marks)

(ii) At least four read-locks.

(5 marks)

Q3 (a) A group of crisp packets has a mean weight of 5.02 grams and a standard deviation of 0.30 grams. A random sample of 100 crisp packets are chosen from the group.

(i) Compute the probability that an average weight of crisp packets chosen is between 4.96 and 5.00 grams.

(8 marks)

(ii) Find the probability that an average weight of crisp packets chosen is more than 5.10 grams.

(4 marks)

(b) Compressive strength of a concrete is normally distributed with standard deviation 2.18039×10^5 pascal. A sample of 16 specimens has been randomly selected which gives the mean of 2.49978×10^7 pascal. Construct a 95% confidence interval on the mean compressive strength using a suitable formulae to fit the given condition.

(8 marks)

Q4 (a) In a manufacturing plant, plastic sheathing is specified to be at least two mils thick by one of the many quality measures. Set up the null and alternative hypothesis for a quality monitoring system that ensures the desired level of quality.

(4 marks)

(b) An ice cream company claimed that its product contain on average 500 calories per pint.

(i) Test the claim if 24 pint containers were analysed, giving the mean is 507 calories and a standard deviation of 21 calories at 1% level of significance.

(8 marks)

(ii) Test the claim if 42 pint containers were analysed, giving the mean is 509 calories and a variance of 18 calories at 1% level of significance.

(8 marks)

Q5 A selection of four 'Kelah' fish from Pahang river was obtained in order to investigate the nature of its habitat. Each Kelah was measured its length and weight. Let the first variable be the length and the second variable as the weight of the kelah. **Table 1** shows the measurement of the Kelah fish.

Table 1: The measurement of 'Kelah' fish

Length (cm)	42	52	48	58
Weight (kg)	4	5	4	3

(a) Construct a scatter plot of the data. Then show the data in a data array.

(4 marks)

(b) Calculate the sample mean $\bar{x}_1$ and $\bar{x}_2$, the sample variances S_{11} and S_{22}, and the sample covariance S_{12}.

(11 marks)

(c) Compute the sample correlation coefficient r_{12} and interpret the result.

(5 marks)

- END OF QUESTION –

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Formula

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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