Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2015/2016

COURSE NAME	:	CIVIL ENGINEERING STATISTICS
COURSE CODE	:	BFC 34303
PROGRAMME	:	BFF
EXAMINATION DATE	:	JUNE / JULY 2016
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

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

Q1 The following data are the annual maximum flows in m^3/s in the Layang River at Pasir Gudang for the 50-year period from 1965 to 2014:

1980	1130	3120	2120	1700	2550	8500	3260	3960	2270
1700	1570	2830	2120	2410	2550	1980	2120	2410	2410
1420	1980	2690	3260	1840	2410	1840	3120	3290	3170
1980	4960	2120	2550	4250	1980	4670	1700	2410	4550
2690	2270	5660	5950	3400	3120	2070	1470	2410	3310

(a) Compute the mean and standard deviation.

(5 marks)

(b) Find the median, first and third quartiles.

(10 marks)

(c) Hence, draw a box-and-whiskers plot and interpret the skewness of data.

(5 marks)

Q2 (a) Events A and B are such that $P(A)=\frac{1}{3}$, $P(A \mid B)=\frac{1}{4}$ and $P(A' \cap B')=\frac{1}{6}$.

(i) Show that $P(A' \cap B)=\frac{1}{2}$.

(3 marks)

(ii) Find $P(B)$ and $P(A \cup B)$.

(4 marks)

(b) Let X be a random variable such that $X \sim B(200, 0.015)$.

(i) Calculate $P(X=r)$ for $r=0,1,2,3,4$.

(4 marks)

(ii) Find the ratio of $\frac{P(X=r)}{P(X=r+1)}$.

(4 marks)

(iii) Show that the largest value of r such that $P(X=r)<P(X=r+1)$ is 2.

(5 marks)

Q3 (a) The discrete random variable X has probability distribution $P(X = x) = k|x|$, where x takes the values of -3, -2, -1, 0, 1, 2 and 3. Find :

(i) the value of constant k.

(2 marks)

(ii) $E(X)$ and $Var(X)$.

(4 marks)

(iii) A random sample of 200 independent observations of X is taken, find the probability that the sample mean exceeds 0.12.

(4 marks)

(b) Large numbers of random samples of concrete cube with size n are taken from a normal distribution with mean 64 and standard deviation 6, and sample mean of each sample is calculated. If $P(\overline{X} > 62) = 0.8508$, estimate the value of n.

(10 marks)

Q4 (a) A company claims that the mean of calcium oxide content of a certain brand of white cement is 150 kilograms. An experiment is conducted on the calcium oxide content of 25 batch of white cement of this brand. The data (in kilograms) gives mean of 151 and standard deviation of 0.93. Test at 5% significance level if there is enough evidence to reject the company claim.

(8 marks)

(b) Two methods were used to determine the content of mercury in a water in the unit of part per billion. Ten samples were collected and each samples was divided into two equal parts. Each part was tested using the two methods. The following data was obtained.

Sample	1	2	3	4	5	6	7	8	9	10
Method X	1.82	2.01	1.14	1.88	2.45	2.22	1.98	1.03	1.96	2.07
Method Y	1.91	1.99	1.26	2.09	2.60	2.03	2.09	1.17	1.83	2.11

Use the Wilcoxon signed-rank test to compare whether there are significant differences between the two methods. Use $\alpha = 0.05$.

(12 marks)

Q5 (a) A study was conducted to investigate the relationship between hydrocarbon emissions and mileage of cars. The following data was obtained:

Hydrocarbon emission	0.27	0.28	0.28	0.29	0.31	0.33	0.34	0.34	0.31
Mileage of cars	5.13	10.12	15.06	19.95	28.90	29.79	29.88	35.01	39.88

Fit a simple linear regression model.

(10 marks)

(b) Table below shows the results of first quiz in Engineering Statistics for four different groups.

Group A	Group B	Group C	Group D
7	3	1	2
8	6	2	4
12	3	1	3
6	2	3	4
8	5	-	-

Test if there are differences in mean of results among these four groups. Use $\alpha = 0.01$.

(10 marks)

-END OF QUESTIONS-

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Lists of Formulae

$$Mode = L_{\text{mode}} + \left(\frac{d_1}{d_1 + d_2}\right)c$$

$$Median = L_{\text{m}} + \left(\frac{\frac{1}{2}n - F}{f}\right)c$$

$$Q_k = L_{Q_k} + \left(\frac{\frac{k}{4}n - F}{f}\right)c$$

$$P_k = L_{P_k} + \left(\frac{\frac{k}{100}n - F}{f}\right)c$$

$$s^2 = \frac{\sum x^2 - \frac{\left(\sum x\right)^2}{n}}{n-1} \quad \text{(ungrouped data)}$$

$$s^2 = \frac{\sum fx^2 - \frac{\left(\sum fx\right)^2}{\sum f}}{\sum f - 1} \quad \text{(grouped data)}$$

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Lists of Formulae

$$t_m = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}$$

$$U = n1 \times n2 + nx \times \frac{(nx+1)}{2} - Tx$$

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

$$\hat{\beta}_1 = \frac{S_{XY}}{S_{XX}}$$

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

$$S_{XY} = \sum xy - \frac{1}{n}\left(\sum x\right)\left(\sum y\right)$$

$$S_{XX} = \sum x^2 - \frac{1}{n}\left(\sum x\right)^2$$

$$r = \frac{n\left(\sum XY\right) - \sum X \sum Y}{\sqrt{\left[n\sum X^2 - \left(\sum X\right)^2\right]\left[n\sum Y^2 - \left(\sum Y\right)^2\right]}}$$

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Lists of Formulae

$$MSB = \frac{SSB}{k-1}$$

$$MSE = \frac{SSE}{N-k}$$

$$SST = SSE + SSB$$

$$F_C = \frac{MSB}{MSE}$$

$$SST = \sum \sum x^2 - CF$$

$$CF = \frac{\left(\sum \sum x_i\right)^2}{N}$$

$$SSB = \left(\sum_{i=1} \frac{(x_i)^2}{n_i}\right) - CF$$

$$SSE = SST - SSB$$