UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESI 2015/2016

COURSE NAME	:	CIVIL ENGINEERING STATISTICS
COURSE CODE	:	BFC 34303
PROGRAMME	:	BACHELOR OF CIVIL ENGINEERING WITH HONOURS
EXAMINATION DATE	:	DECEMBER 2015/JANUARY 2016
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **EIGHT (8)** PAGES

Q1   (a)   From the following stem-and-leaf diagram, calculate the mean and find the values of the median, first and third quartiles. Hence, construct the box-and-whiskers plot and comment on the data distribution.

Stem	Leaf
9	0 1
10	7
11	1 5 8
12	3 3 7 9
13	4
14	9
15	
16	8

Key: 12 | 9 means 129

(10 marks)

(b)   Given that $P(C \cap D) = \dfrac{1}{4}$, $P(C|D) = \dfrac{1}{3}$ and $P(D|C) = \dfrac{3}{5}$, find

(i) $P(C)$

(2 marks)

(ii) $P(D)$

(2 marks)

(iii) $P(C|D')$

(3 marks)

(iv) $P(C'|D')$

(3 marks)

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Q2   (a)   The probability density function is given as :

$$f(t)=\begin{cases} \dfrac{t^2}{m} & , \quad -1<t<2 \\ 0 & , \quad otherwise \end{cases}$$

and m is a constant. Find

(i)   The value of m.

(ii)   The cumulative distribution function, F (t).

(iii)   P $(-1<t<1)$.

(14 marks)

(b)   The number of accidents that occur on a construction site has a Poisson distribution, where the mean number of accidents is 1.2 each month.

(i)   Find the probability that 2 accidents occur in a month.

(ii)   If the Department of Worker's Safety state that the number of accidents must not exceed three per month, what is the probability the construction site will defy the rule in any month?

(6 marks)

Q3   A research was done to determine the wind speed distribution in Batu Pahat. The following monthly wind speed data (measured in m/s) was obtained.

15.42	12.85	10.28	13.36	15.42	20.56	16.28	25.70	15.42	9.25
10.28	9.25	8.22	11.31	14.91	16.45	13.36	15.42	13.36	12.85
11.31	11.31	12.85	11.82	14.39	15.42	16.96	21.59	15.42	15.42
12.85	12.85	11.82	14.39	12.34	24.67	12.85	20.05	27.24	22.62

(a)   Find a 90% confidence interval for the true mean wind speed in Batu Pahat.

(10 marks)

(b)   Can you conclude that the mean of wind speed in Batu Pahat is less than $12\,m/s$? Use $\alpha=0.10$.

(10 marks)

Q4   (a)   The effectiveness of advertising for two machine (Brand X and Brand Y) was compared. Market research was carried out with the participants being shown adverts for his two machine which they can rated on the overall likelihood of them buying the product (out of 10, with 10 being "definitely going to buy the product").

Brand X		Brand Y	
Participant	Rating	Participant	Rating
1	3	1	9
2	4	2	7
3	1	3	5
4	6	4	10
5	2	5	6
6	5	6	8

$U = 2$

Test if there is any significance difference ($\alpha = 0.01$) between the rating given to each brand in terms of the likelihood of buying the product.

(8 marks)

(b)   Two methods were used to determine the content of phosphates in a water. Twelve 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 A	54.7	58.5	66.8	46.1	52.3	74.3	92.5	40.2	87.3	74.8
Method B	55.0	55.7	62.9	45.5	51.1	75.4	89.6	38.4	86.8	72.5

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

(12 marks)

$W = 8$

Q5 (a) The following table shows the results of the length ($y\ cm$) of a metal rod measured at different temperature ($x\ °C$).

Temperature, $x°C$	105	111	115	121	126	130
Length, $y\ cm$	20.01	20.08	20.18	20.22	20.44	20.51

   (i) Find the sample correlation coefficient. Explain what this value means in the context of the problem.

   (8 marks)

   (ii) Find the least square regression line to predict length from temperature. Interpret the regression coefficients in the context of the problem.

   (3 marks)

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

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

Can we conclude that there are differences in mean of results among this three groups? Use $\alpha = 0.01$.

   (9 marks)

-END OF QUESTIONS-

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Lists of Formulae

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

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

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

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

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

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

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

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

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

$$SST = SSE + SSB$$

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

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

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

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

$$SSE = SST - SSB$$