Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2017/2018

COURSE NAME	:	CIVIL ENGINEERING STATISTICS
COURSE CODE	:	BFC34303
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	JUNE 2018 / JULY 2018
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

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

Q1 (a) The recorded data of car speed on a particular rural road is shown in **Table 1 (a)**.

Calculate;

(i) Mean speed of the collected sample. (5 marks)

(ii) The interquartile range of the sample. (5 marks)

(b) The stem and leaf diagram developed from the number of workers per day at a construction site is shown in **Figure 1 (b)**.

(i) Construct a box and whisker plot and state the type of data distribution. (10 marks)

(ii) Calculate standard deviation and interpret this value. (5 marks)

Q2 (a) The continuous random variable X has the probability distribution function as below:

$$f(x) = \begin{cases} 5(x - x^2), 0 < x < 1 \\ 0, \quad otherwise \end{cases}$$

Find the cumulative distribution of X, then calculate:

(i) $P(X < 0.4)$ (3 marks)

(ii) $P\ (X \geq 0.7)$ (3 marks)

(iii) $P(0.5 \leq X < 0.8)$ (3 marks)

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(b) The continuous random variable Y has the probability distribution function as below:

$$f(y)=\begin{cases}\frac{1}{k}(y+\frac{1}{2}) & 0<y<3,\\ 0 & \text{otherwise.}\end{cases}$$

(i) Identify the value of k.

(3 marks)

(ii) Calculate $P(Y>2)$.

(4 marks)

(iii) Construct the cumulative distribution function of Y then identify $F(2)$.

(8 marks)

Q3 (a) The average time for a worker to complete the works of reinforcement bar for a medium size column is 1 hour. Assume that the distribution is approximately normal with standard deviation of 0.25 hours. Estimate the probability an individual worker choosing at random exceed 1.5-hours.

(4 marks)

(b) Based on an experiment, the maximum strength of titanium fibre has a mean of 3.86 kg/mm and a standard deviation of 0.32 kg/mm. A random sample of 40 pieces of titanium fibre drawn. What is the probability that the sample mean maximum strength is less than 3.00 kg/mm?

(5 marks)

(c) Suppose that during period of concrete curing, the number of reduction of humidity in a concrete is a random variable that has a normal distribution with an average of 36.6 cc per minute and a variance of 20.16 cc per minute. Calculate the probability that during a period of concrete curing, the humidity level will be reduced by;

(i) at least 44.5 cc per minute,

(4 marks)

(ii) at most 35.0 cc per minute,

(4 marks)

(iii) anywhere from 30.0 to 40.0 cc per minute.

(4 marks)

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(d) The comprehensive strength of a brick is being tested by a civil engineer. He tests 10 specimens. The mean compressive strength is 2010.7 psi and the standard deviation is 400 psi. Construct a 95% confidence interval for mean strength of the brick

(5 marks)

(e) A research engineer for a tyre manufacturer is investigating the tyre life for a new rubber compound. Sample of 16 tyres had been tested for its end-of-life in a road test and their average is 70,344 km and standard deviation is 2,550 km. Identify a 90% confidence interval of the mean life of the tyre.

(5 marks)

Q4 (a) A study was carried out to determine the annual temperature variation in UTHM. Monthly temperature data (measured in ^{0}C) was plotted in **Figure 2**. Assuming the temperature is normally distributed, test the hypothesis whether the mean temperature is greater than 35^{0}C at 5% level of significance.

(10 marks)

(b) **Table 2** shows the results collected from an experimental study between percentage of cement content (%) and concrete compressive strength (MPa).

(i) Illustrate a simple linear regression model and interpret the result.

(8 marks)

(ii) Examine the strength if the cement content is 30%.

(2 marks)

– END OF QUESTIONS –

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PROGRAMME CODE : 3 BFF
COURSE CODE : BFC34303

Table 1 (a)

Speed (m/s)	Frequency
40 - 45	2
45 - 50	5
50 - 55	10
55 - 60	13
60 - 65	8
65 - 70	17
70 - 75	20

STEM	LEAF						
1	1	8	2				
2	4	2	4	1			
3	1	5	5	3	8	5	
4	6	4	7	5	2	0	4
5	2	8	2	0	9	4	
6	1	9	4	3	7		

Figure 1 (b)

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FINAL EXAMINATION

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PROGRAMME CODE : 3 BFF
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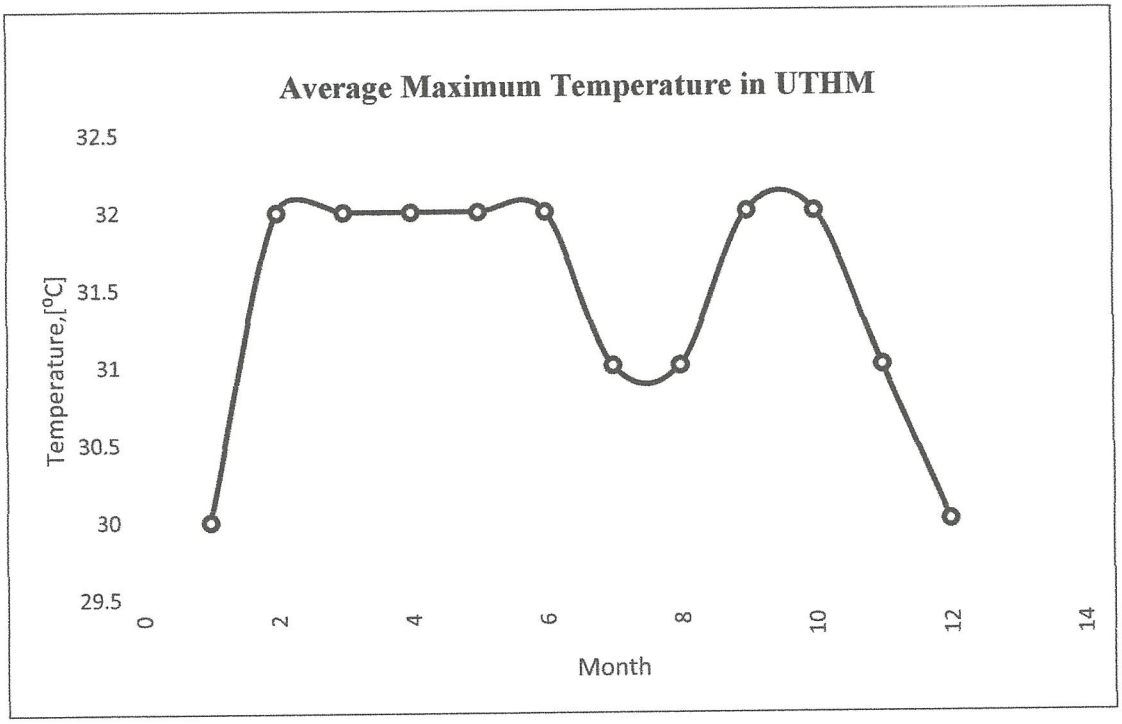

Figure 2

Table 2

Cement content [%]	10	17	28	39	45	53
Strength [MPa]	7.5	18.4	31.1	48.3	58.9	68.1

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FINAL EXAMINATION

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Lists of Formulae

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

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

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

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

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

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

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Lists of Formulae

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

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

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

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

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

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

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

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