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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2014/2015

COURSE NAME	:	STATISTICAL MODELLING
COURSE CODE	:	BWB 31303
PROGRAMME	:	3 BWB
EXAMINATION DATE	:	DECEMBER 2014/ JANUARY 2015
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

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

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Q1 Let X and Y be a random variables with

$$f(x,y)=\begin{cases} e^{-(x+y)} & , x>0 \text{ and } y>0 \\ 0 & , \text{elsewhere} \end{cases}$$

(a) Show that $f(x,y)$ is the probability density function of the random variable X and Y

(4 marks)

(b) Find $P(X<1, Y<2)$

(4 marks)

(c) Find the joint cumulative distribution function of X and Y

(4 marks)

(d) Find marginal density function of X and marginal density function of Y

(6 marks)

(e) Find $f(x \mid y), f(y \mid x)$ and $f(0<x<1 \mid y)$

(7 marks)

Q2 (a) (i) List down five steps of statistical analyses

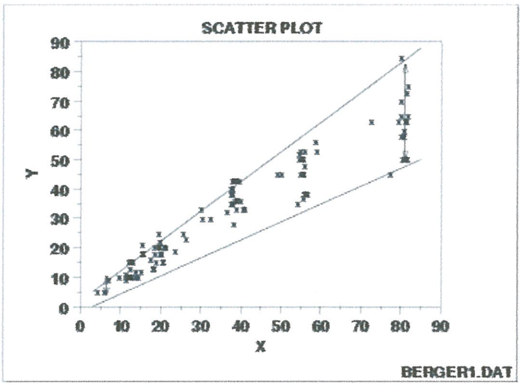
(5 marks)

(ii) There are two types of variables which are qualitative and quantitative variables. Explain and give example for each type.

(4 marks)

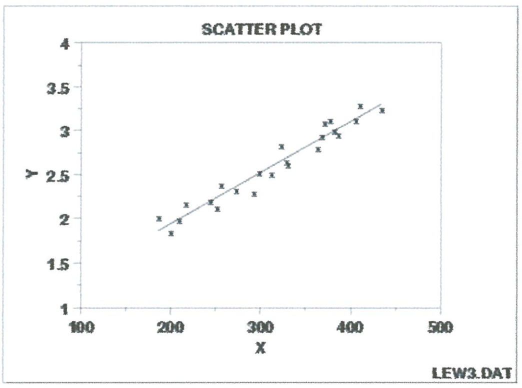
(b) Describe the scatter plots and histogram pattern (state the equation and state how to deals with this kind of data if any)

(i) Scatter plot 1



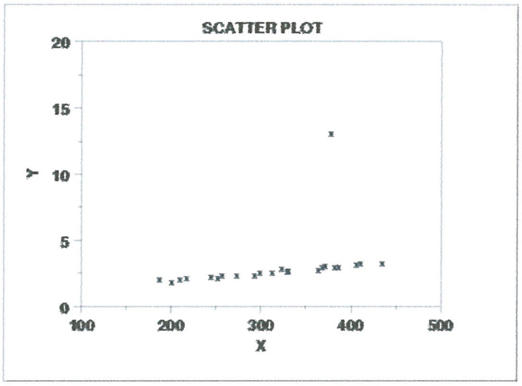
(3 marks)

(ii) Scatter plot 2



(2 marks)

(ii) Scatter plot 3



(3 marks)

(c) The time taken by 60 students to answer a probability question is recorded as given in the **Table Q2** below

Table Q2 : The time taken to answer question

Time (minutes)	1	2	3	4	5	6	7
Frequencies (no. of students)	2	4	21	18	10	4	1

Find the mean, median and standard deviation of the time taken by the students in answering the questions.

(8 marks)

Q3 The following **Table Q3** shows the relationship between thickness of material (millimeter) and the thermal conductivity of the material (watt per meter Kelvin) for eight materials where the pressure and temperature are at normal rate.

Table Q3 : The thermal conductivity on different thickness

Thickness, x	2.78	1.41	2.74	0.92	2.44	3.50	3.68	1.97
Thermal Conductivity, y	2.16	0.88	1.04	1.10	0.96	2.18	1.54	1.39

(a) Sketch a scatter plot for the data above.

(4 marks)

(b) Use the method of least squares to estimate the regression line and interpret the result.

(11 marks)

(c) Estimate the thermal conductivity if given the thickness is 4.02.

(2 marks)

(d) Calculate the sample coefficient of correlation and interpret the result.

(3 marks)

(e) Calculate the coefficient of determination and interpret the result.

(5 marks)

Q4 Consider the following 3x3 table (**Table Q4**) of observed frequencies. The entries are the number of employees of a company who are categorized according to their job status and the make of the cars they own

Table Q4 : Number of employees of a company who are categorized according to their job status and the made of the cars they own

Made of cars (Y) / Job status (X)	Malaysian (M)	Japanese (J)	Korean (K)
Top Executives (TE)	2	3	1
Intermediate Executives (IE)	1	4	1
Workers (W)	7	27	7

(a) Calculate:

(i) the likelihood of an intermediate executive owning a Japanese car as compared to a worker owning a Japanese car.

(ii) the odds of a top executive owning a Malaysian car to a Korean car.

(4 marks)

(b) Construct 95% large sample confidence intervals for $dp_{j(IE,W)}$ for $j=M,J,K$ and use these confidence intervals to verify that the made of the cars do not influence both the intermediate officers and workers in their decision to buy the cars.

(21 marks)

- END OF QUESTION –

FINAL EXAMINATION

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Formula

$$\hat{\beta}_1 = \frac{Sxy}{Sxx}, \hat{\beta}_0 = \bar{y} - \hat{\beta}_1 \bar{x}, \qquad Sxy = \sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y}) = \sum_{i=1}^{n} x_i y_i - \frac{1}{n}\left(\sum_{i=1}^{n} x_i\right)\left(\sum_{i=1}^{n} y_i\right)$$

$$, Sxx = \sum_{i=1}^{n}(x_i - \bar{x})^2 = \sum_{i=1}^{n} x_i^2 - \frac{1}{n}\left(\sum_{i=1}^{n} x_i\right)^2, \qquad Syy = \sum_{i=1}^{n}(y_i - \bar{y})^2 = \sum_{i=1}^{n} y_i^2 - \frac{1}{n}\left(\sum_{i=1}^{n} y_i\right)^2$$

$$SSE = Syy - \hat{\beta}_1 S_{xy} \quad , \quad MSE = \frac{SSE}{n-2}, \qquad T_{test} = \frac{\hat{\beta}_1 - \beta_C}{\sqrt{MSE/S_{xx}}}$$

$$T_{test} = \frac{\hat{\beta}_0 - \beta_C}{\sqrt{MSE(1/n + \bar{x}^2 / Sxx)}}$$

$$\hat{\beta}_1 - t_{\alpha/2,v}\sqrt{MSE/Sxx} < \beta_1 < \hat{\beta}_1 + t_{\alpha/2,v}\sqrt{MSE/Sxx}, \qquad \text{where } v = n\text{-}2$$

$$\hat{\beta}_0 - t_{\alpha/2,v}\sqrt{MSE\left(\frac{1}{n} + \frac{\bar{x}^2}{Sxx}\right)} < \beta_0 < \hat{\beta}_0 + t_{\alpha/2,v}\sqrt{MSE\left(\frac{1}{n} + \frac{\bar{x}^2}{Sxx}\right)},$$

$$r^2 = \frac{Syy - SSE}{Syy} = 1 - \frac{SSE}{Syy} \qquad r = \frac{Sxy}{\sqrt{Sxx \cdot Syy}}$$