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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2014/2015

COURSE NAME	:	STATISTICS
COURSE CODE	:	DAS 20502
PROGRAMME	:	2 DAU
EXAMINATION DATE	:	DECEMBER 2014 / JANUARY 2015
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTION	:	A) ANSWER **ALL** QUESTIONS B) ANSWER **TWO (2)** QUESTIONS ONLY

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

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SECTION A

Q1 The yield of a chemical process is related to the operating temperature (°C). An experiment conducted gives the result in **Table Q1.**

Table Q1

Temperature	150	155	160	165	170	175	180	185	190	195
Yield	91	89	83	84	80	81	75	74	70	71

(a) Construct a scatter diagram for these data using the graph paper. Does the scatter diagram exhibit a linear relationship between temperature and the yield?

(4 marks)

(b) Find S_{xx}, S_{yy} and S_{xy}.

(11 marks)

(c) Compute the correlation coefficient, r and interpret the result.

(3 marks)

(d) Find out the slope $\hat{\beta}_1$ and estimates of intercept $\hat{\beta}_0$.

(4 marks)

(e) Find the regression line equation.

(1 marks)

(f) Predict the yield of chemical process if the temperature change to 100°C.

(2 marks)

Q2 (a) It was claimed that in a country that the mean age of all juveniles held in public custody in a year 2000 was 15.8 years. The mean age of 95 randomly selected juveniles currently being held in public custody is 15.4 years and the standard deviation of the ages is 1.95 years. Perform the appropriate hypothesis test using $\alpha = 0.05$.

(12 marks)

(b) A competitor claimed that the mean lifetime of a battery produced by Factory Star was lower than 30 hours. To prove that the competitor claim is wrong, the battery producer in Factory Star took 8 batteries at random and the lifetime each is as in **Table Q2** below:

Table Q2

Battery	A	B	C	D	E	F	G	H
Lifetime (hours)	15	28	33	24	28	25	31	27

Test the hypothesis at the 1% level of significance.

(13 marks)

SECTION B

Q3 (a) A boxes contain 10 marbles (2 red, 5 blue, 3 green). Two marbles are drawn without replacement. Let X be the random variable giving the number of ''red'' marbles.

(i) Construct probability distribution function by drawing tree diagram.

(8 marks)

(ii) Find the cumulative distribution function.

(4 marks)

(b) Given the continuous probability function

$$f(x) = \begin{cases} 1 - kx & , \quad 0 \le x \le 2 \\ 0 & , \quad \text{otherwise} \end{cases}$$

(i) Show that $k = \frac{1}{2}$.

(4 marks)

(ii) Find $P(1.2 \le X \le 1.8)$.

(3 marks)

(iii) Find the expected value, $E(X)$.

(3 marks)

(iv) Sketch the given function.

(3 marks)

Q4 (a) Explain the difference between Binomial, Poisson and Normal distribution. Give example.

(5 marks)

(b) The number of laptop sold by a new laptop dealer follows a Poisson distribution with a mean of 13.5 laptop sold in three days.

(i) Find the probability that at least 6 laptop are sold today.

(2 marks)

(ii) Find the mean and standard deviation of Y, the number of laptop sold in two days. What is the probability that fewer than 11 laptops are sold in two days?

(4 marks)

(iii) Find the mean and standard deviation of W, the number of laptop sold in four days. What is the probability that more than 20 laptops are sold in four days?

(4 marks)

(c) The average number of sodium (in mg) in a certain brand of low fat frozen food is 500 mg and the standard deviation is 30 mg. Assume the variable is normally distributed. Find the probability if the selected low fat frozen food will contain

(i) less than 515 mg sodium.

(4 marks)

(ii) more than 515 mg sodium.

(2 marks)

(iii) between 515 and 580 mg sodium.

(4 marks)

Q5 (a) Given a population numbers which are 10, 7, 8, 9, 6, 11, 5, 10, 8 and 6. Find

(i) population mean and variance.

(5 marks)

(ii) sample mean and variance if a random sample of 7 drawn from that population.

(3 marks)

(b) The heights of all students taking Diploma in Applied Science are approximately normally distributed with mean 157.48 cm and standard deviation 5.08 cm.

(i) Write the normal distribution.

(2 marks)

(ii) Write the sampling distribution if a random sample of 9 students taking Diploma in Applied Science is selected.

(3 marks)

(iii) From **Q5 b(ii)**, find the probability that the mean height is greater than 152.48 cm

(5 marks)

(iv) From **Q5 b(ii)**, find the probability that the mean height will be between 140 and 160 cm.

(7 marks)

Q6 (a) Find the probability values for:

(i) $P(T \geq 2.681), \quad n = 13$

(2 marks)

(ii) $P(T < 3.767), \quad n = 24$

(3 marks)

(iii) $P(T \geq -2.056), \quad n = 27$

(3 marks)

(b) An interview were conducted by the PTPTN executive for a study on university student's expenses on food. The mean expenses for month are RM 525.25 with standard deviation RM 86.05.

(i) Find 95% confidence interval for the mean expenses on food if random sample of 80 students was selected.

(8 marks)

(ii) Find 90% confidence interval for the mean expenses on food if random sample of 23 students was selected.

(9 marks)

- END OF QUESTION –

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Table 1: Descriptive Statistics

$\mu = \frac{\sum_{i=1}^{n} x_i}{N}$	$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$
$\sigma^2 = \frac{\sum_{i=1}^{n}(x_i - \mu)^2}{N}$	$s^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}$
$s^2 = \frac{1}{\sum f - 1}\sum_{i=1}^{n} f_i(x_i - \bar{x})^2$ or	$s^2 = \frac{1}{\sum f - 1}[\sum_{i=1}^{n} f_i {x_i}^2 - \frac{(\sum f_i x_i)^2}{\sum f}]$
$M = L_m + C(\frac{\frac{n}{2} - F}{f_m})$	$M_0 = L + C(\frac{d_1}{d_1 + d_2})$

Table 2: Probability

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$	$P(A\|B) = \frac{P(A \cap B)}{P(B)}$

Table 3: Probability Distribution

Binomial $X \sim B(n,p) = \binom{n}{r} p^r (1-p)^{n-r}$ for $n = 0,1,\ldots,n$
Poisson $X \sim P_O(\mu) = \frac{e^{-\mu}\mu^r}{r!}$ for $\mu = 0,1,2\ldots$
Normal $X \sim N(\mu, \sigma^2)$, $f(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\left[\frac{(x-\mu)^2}{2\sigma^2}\right]}$
Standard Normal $Z \sim N(0,1)$, $f(z) = \frac{1}{\sqrt{2\pi}} e^{-\left[\frac{z^2}{2}\right]}$, $z = \frac{x-\mu}{\sigma}$

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Table 4 : Sampling Distribution

$\bar{X} \sim N(\mu, \frac{\sigma^2}{n})$	$z = \frac{\bar{X} - \mu}{\frac{\sigma}{\sqrt{n}}}$
$\bar{X}_1 - \bar{X}_2 \sim N\left(\mu_1 - \mu_2, \frac{\sigma^2{}_1}{n_1} + \frac{\sigma^2{}_2}{n_2}\right)$	$Z = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{\sigma^2{}_1}{n_1} + \frac{\sigma^2{}_2}{n_2}}}$

Table 5 : Estimation

$e = \pm z_{\frac{\alpha}{2}}\left(\frac{\sigma}{\sqrt{n}}\right)$ or $\pm z_{\frac{\alpha}{2}}\left(\frac{s}{\sqrt{n}}\right)$	$\bar{X} \pm Z_{\frac{\alpha}{2}}\left(\frac{\sigma}{\sqrt{n}}\right)$
$\bar{X} \pm Z_{\frac{\alpha}{2}}\left(\frac{s}{\sqrt{n}}\right)$	$\bar{X} \pm t_{\frac{\alpha}{2},v}\left(\frac{s}{\sqrt{n}}\right)$
$(\bar{X}_1 - \bar{X}_2) \pm Z_{\frac{\alpha}{2}}\sqrt{\frac{\sigma_1{}^2}{n_1} + \frac{\sigma_2{}^2}{n_2}}$	$(\bar{X}_1 - \bar{X}_2) \pm Z_{\frac{\alpha}{2}}\sqrt{\frac{s_1{}^2}{n_1} + \frac{s_2{}^2}{n_2}}$
$(\bar{X}_1 - \bar{X}_2) \pm Z_{\frac{\alpha}{2}} S_p\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$ where $S_p{}^2 = \frac{(n_1 - 1)s_1{}^2 + (n_2 - 1)s_2{}^2}{n_1 + n_2 - 2}$	
$(\bar{X}_1 - \bar{X}_2) \pm t_{\frac{\alpha}{2},v}\sqrt{\frac{s_1{}^2}{n_1} + \frac{s_2{}^2}{n_2}}$ where $v = \frac{\left(\frac{s_1{}^2}{n_1} + \frac{s_2{}^2}{n_2}\right)^2}{\frac{\left(\frac{s_1{}^2}{n_1}\right)^2}{n_1 - 1} + \frac{\left(\frac{s_2{}^2}{n_2}\right)^2}{n_2 - 1}}$	
$(\bar{X}_1 - \bar{X}_2) \pm t_{\frac{\alpha}{2},v} S_p\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$ where $S_p{}^2 = \frac{(n_1 - 1)s_1{}^2 + (n_2 - 1)s_2{}^2}{n_1 + n_2 - 2}$	

Table 6 : Hypothesis Testing

$Z = \frac{\bar{X} - \mu}{\frac{\sigma}{\sqrt{n}}}$	$T = \frac{\bar{X} - \mu}{\frac{s}{\sqrt{n}}}$

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Table 7 : Simple Linear Regression

$\hat{\beta}_0 = \bar{y} - \hat{\beta}_1\bar{x}$	$\hat{\beta}_1 = \dfrac{S_{xy}}{S_{xx}}$	$\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 x$

$S_{xx} = \sum_{i=1}^{n} x_i^2 - \dfrac{\left(\sum_{i=1}^{n} x_i\right)^2}{n}$	$S_{xy} = \sum_{i=1}^{n} x_i y_i - \dfrac{\left(\sum_{i=1}^{n} x_i\right)\left(\sum_{i=1}^{n} y_i\right)}{n}$
$S_{yy} = \sum_{i=1}^{n} y_i^2 - \dfrac{\left(\sum_{i=1}^{n} y_i\right)^2}{n}$	$r = \dfrac{S_{xy}}{\sqrt{S_{xx}S_{yy}}}$