UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2016/2017

COURSE NAME	:	STATISTICS
COURSE CODE	:	DAS 20502
PROGRAMME	:	DAT / DAE / DAA / DAM
EXAMINATION DATE	:	JUNE 2017
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTIONS	:	SECTION A) ANSWER **ALL** QUESTIONS SECTION B) ANSWER **THREE (3)** QUESTIONS

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

SECTION A

Q1 A study was made by a retail merchant to determine the relation between weekly advertising expenditures and sales. The data were recorded in **Table Q1**.

Table Q1

Advertising Costs ($)	Sales ($)
40	385
25	395
30	475
40	490
50	560
25	480

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

(9 marks)

(b) Find and interpret the sample correlation coefficient, r.

(2 marks)

(c) Find $\hat{\beta}_1$ and $\hat{\beta}_0$

(4 marks)

(d) Find the estimated regression line, $\hat{y}$ and sketch this line.

(3 marks)

(e) Estimate the weekly sales when advertising costs are $35.

(2 marks)

Q2 (a) A bus company advertised a mean time of 120 minutes for a trip between two cities. A consumer group had reason to believe that the mean time was more than 120 minutes. A sample of 40 trips showed a mean $\bar{x} = 125$ minutes and a standard deviation $s = 8.5$ minutes. At the 5% level of significance, test the consumer group's belief.

(10 marks)

(b) In a mathematics competition in secondary school, the mean score of 45 boys was 79 with a standard deviation of 8, while the mean score of 55 girls was 72 with standard deviation 7. Test the hypothesis testing at 1% level significance that the boys are performed better than the girls.

(10 marks)

SECTION B

Q3 The following sample data set lists the number of minutes 50 internet subscribers spent on the internet during their most recent session:

50	40	41	17	11
7	22	44	28	21
19	23	37	51	54
42	88	41	78	56
72	56	17	7	69
30	80	56	29	33
46	31	39	20	18
29	34	59	73	77
36	39	30	62	54
67	39	31	53	44

(a) Construct the frequency distribution table with the class limit 7 – 18, 19 – 30 and so on. In the table should include class midpoint, class boundary, frequency and cumulative frequency.

(8 marks)

(b) Find mean, median, mode, variance and standard deviation.

(12 marks)

Q4 (a) A desk lamp produced by The Luminar Company was found to be defective (D). There are three factories (A, B, C) where such desk lamps are manufactured. A Quality Control Manager (QCM) is responsible for investigating the source of found defects. This is what the QCM knows about the company's desk lamp production and the possible source of defects:

Factory	% of total production	Probability of defective lamps
A	$0.35 = P(A)$	$0.015 = P(D \mid A)$
B	$0.35 = P(B)$	$0.010 = P(D \mid B)$
C	$0.30 = P(C)$	$0.020 = P(D \mid C)$

The QCM would like to answer the following question: If a randomly selected lamp is defective, find the probability that the lamp was manufactured in factory C.

(9 marks)

(b) Suppose that the error in the reaction temperature, in °C, for a controlled laboratory experiment is a continuous random variable X having the probability density function.

$$f(x) = \begin{cases} \dfrac{x^2}{3}, & -1 < x < 2, \\ 0, & \text{otherwise.} \end{cases}$$

(i) Verify that $f(x)$ is a density function.

(2 marks)

(ii) Find $P(0 < X \leq 1)$.

(2 marks)

(iii) Find the expected value and variance of X.

(7 marks)

Q5 (a) Given that X has the normal distribution $N(7500, 625^2)$, find

(i) $P(X > 6525)$

(3 marks)

(ii) $P(7250 \leq X \leq 7780)$

(4 marks)

(iii) the value of X will fall ten percent of the graph.

(3 marks)

(b) The inner diameter of a piston ring is normally distributed with a mean of 10 cm and a standard deviation of 0.03 cm.

(i) Find the probability if a piston ring have inner diameter exceeding 10.075 cm.

(3 marks)

(ii) Find the probability if a piston ring have an inner diameter between 9.97 and 10.03 cm.

(4 marks)

(iii) Find the value of inner diameter that fall below fifteen percent of the piston rings.

(3 marks)

Q6 (a) Given a population numbers which are 5, 9, 11, 13, and 15. Find

(i) population mean and variance.

(5 marks)

(ii) sample mean and variance if a random sample of 3 drawn from that population.

(3 marks)

(b) The mean length for the smartphone that produced by company Apple is 14.5 cm, meanwhile 15.3 cm is from company Samsung. The standard deviation in both companies is 2.05 cm. The length of smartphone of both company are normally distributed. Five models from both companies are randomly sampled.

(i) Write the sampling distribution of both company.

(2 marks)

(ii) Find the probability that sample mean length for company Apple will less about 0.5 cm of company Samsung.

(5 marks)

(iii) Find the probability that sample mean length for company Apple will greater about 0.3 cm of company Samsung.

(5 marks)

Q7 (a) A factory is producing cookware that are in circular shape. A sample of cookware is taken and the diameters are 5, 6, 7, 8.5, 10 and 15 centimeters. Find a 99% confidence interval for the mean diameter of cookware, assuming an approximate normal distribution.

(8 marks)

(b) Two independents sampling stations were chosen for an investigation of index chemical acids pollution in rivers of Malaysia. The following data, recorded in months, represent the monthly samples collected at different stations.

First Station	Second Station
$n_1 = 36$	$n_2 = 31$
$\overline{x}_1 = 73.44$	$\overline{x}_2 = 96.41$
$s_1^2 = 0.201$	$s_2^2 = 0.594$

Find a 90% confidence interval for the difference between the population means for the two stations. Assume that the population are approximately normal distributed.

(12 marks)

- END OF QUESTIONS –

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Formula

$$S_{xy}=\sum x_i y_i-\frac{\sum x_i \sum y_i}{n},\ S_{xx}=\sum x_i^{\,2}-\frac{\left(\sum x_i\right)^2}{n},S_{yy}=\sum y_i^{\,2}-\frac{\left(\sum y_i\right)^2}{n},$$

$$r=\frac{S_{xy}}{\sqrt{S_{xx}S_{yy}}},\quad \hat{\beta}_1=\frac{S_{xy}}{S_{xx}},\ \hat{\beta}_0=\bar{y}-\hat{\beta}_1\bar{x},$$

$$Z=\frac{\bar{x}-\mu}{\sigma/\sqrt{n}},Z=\frac{\bar{x}-\mu}{s/\sqrt{n}},\ T=\frac{\bar{x}-\mu}{s/\sqrt{n}}$$

$$Z=\frac{(\bar{X}_1-\bar{X}_2)-(\mu_1-\mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1}+\frac{\sigma_2^2}{n_2}}},Z=\frac{(\bar{X}_1-\bar{X}_2)-(\mu_1-\mu_2)}{\sqrt{\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}}}$$

$$\bar{x}=\frac{\sum f_i x_i}{\sum f_i},\ M=L_M+C\times\left(\frac{n/2-F}{f_m}\right),\ M_0=L+C\times\left(\frac{d_b}{d_b+d_a}\right)$$

$$s^2=\frac{1}{\Sigma f-1}\left[\sum_{i=1}^{n} f_i x_i^{\,2}-\frac{(\Sigma f_i x_i)^2}{\Sigma f}\right]$$

$$\sum_{i=-\infty}^{\infty}p(x_i)=1,\ E(X)=\sum_{\forall x}xp(x),\ \int_{-\infty}^{\infty}f(x)\ dx=1,\ E(X)=\int_{-\infty}^{\infty}xp(x)\ dx,$$

$$Var(X)=E(X^2)-[E(X)]^2,$$

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$$P(x)=\binom{n}{x}\cdot p^x\cdot(1-p)^{n-x}\quad x=0,1,\ldots,n,\ P(X=r)=\frac{e^{-\mu}\cdot\mu^r}{r!}\quad r=0,\ 1,\ \ldots,\ \infty,$$

$$X\sim N(\mu,\sigma^2),\ Z\sim N(0,1)\ \text{and}\ Z=\frac{X-\mu}{\sigma}$$

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$$\bar{X} \sim N\left(\mu, \frac{\sigma^2}{n}\right), \quad Z = \frac{\bar{X}-\mu}{\sigma/\sqrt{n}} \sim N(0,1), \quad \bar{X}_1 - \bar{X}_2 \sim N\left(\mu_1 - \mu_2, \frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}\right),$$

$$\bar{x} - z_{\alpha/2}\left(\frac{\sigma}{\sqrt{n}}\right) < \mu < \bar{x} + z_{\alpha/2}\left(\frac{\sigma}{\sqrt{n}}\right)$$

$$\bar{x} - z_{\alpha/2}\left(\frac{s}{\sqrt{n}}\right) < \mu < \bar{x} + z_{\alpha/2}\left(\frac{s}{\sqrt{n}}\right)$$

$$\bar{x} - t_{\alpha/2,\,v}\left(\frac{s}{\sqrt{n}}\right) < \mu < \bar{x} + t_{\alpha/2,\,v}\left(\frac{s}{\sqrt{n}}\right), \quad v = n-1.$$

$$(\bar{x}_1 - \bar{x}_2) - z_{\alpha/2}\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}} < \mu_1 - \mu_2 < (\bar{x}_1 - \bar{x}_2) + z_{\alpha/2}\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}},$$

$$(\bar{x}_1 - \bar{x}_2) - z_{\alpha/2}\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}} < \mu_1 - \mu_2 < (\bar{x}_1 - \bar{x}_2) + z_{\alpha/2}\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}},$$

$$(\bar{x}_1 - \bar{x}_2) - t_{\alpha/2,\,v}\, S_P\sqrt{\frac{1}{n_1} + \frac{1}{n_2}} < \mu_1 - \mu_2 < (\bar{x}_1 - \bar{x}_2) + t_{\alpha/2,\,v}\, S_P\sqrt{\frac{1}{n_1} + \frac{1}{n_2}} \text{ where}$$

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$$S_p^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2} \text{ and } v = n_1 + n_2 - 2,$$

$$(\bar{x}_1 - \bar{x}_2) - t_{\alpha/2,\,v}\sqrt{\frac{1}{n}\left(s_1^2 + s_2^2\right)} < \mu_1 - \mu_2 < (\bar{x}_1 - \bar{x}_2) + t_{\alpha/2,\,v}\sqrt{\frac{1}{n}\left(s_1^2 + s_2^2\right)} \text{ and } v = 2(n-1),$$

$$(\bar{x}_1 - \bar{x}_2) - t_{\alpha/2,\,v}\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}} < \mu_1 - \mu_2 < (\bar{x}_1 - \bar{x}_2) + t_{\alpha/2,\,v}\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}} \text{ and}$$

$$v = \frac{\left(s_1^2/n_1 + s_2^2/n_2\right)^2}{\frac{\left(s_1^2/n_1\right)^2}{n_1 - 1} + \frac{\left(s_2^2/n_2\right)^2}{n_2 - 1}}$$