CONFIDENTIAL

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2022/2023

COURSE NAME	:	STATISTICS II
COURSE CODE	:	DAS 20703
PROGRAMME CODE	:	DAU
EXAMINATION DATE	:	FEBRUARY 2023
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWERS **ALL** QUESTIONS.
		2. THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK**.
		3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK.

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

Q1 (a) Mr Chia works on the construction site in Kelana Jaya every Monday and Thursday. He wears either a fluorescent orange vest or a fluorescent yellow vest when working onsite. On Monday, the probability he wears an orange vest is 0.73. If Mr Chia wears an orange vest on Monday, the probability that he will wear a yellow vest on Thursday is 0.42. If he does not wear an orange vest on Monday, the probability that he will wear an orange vest on Thursday is 0.85.

(i) Draw a tree diagram to summarize the above information.

(4 marks)

(ii) Find the probability Mr Chia wears same coloured vest on Monday and Thursday.

(3 marks)

(iii) By multiplicative rule, calculate the probability Mr Chia wears yellow vest on Monday and orange vest on Thursday.

(3 marks)

(b) Given that the probability density function

$$g(y) = \begin{cases} y & , \quad 0 \le y < 1 \\ t(1 - \frac{1}{2}y) & , \quad 1 \le y \le 2 \\ 0 & , \quad \text{otherwise} \end{cases}$$

where t is a constant.

(i) Find the value of t.

(3 marks)

(ii) Find $P(y \le 0.5)$ and $P(-3 \le y \le 1.8)$.

(4 marks)

(iii) Calculate the expected value.

(3 marks)

Q2 (a) The length of electrical components produced by a company is normally distributed with a mean of 10 cm and a standard deviation of 0.03 cm. If a component is chosen at random, find

(i) the probability that the length of this component is exceeding 10.075 cm.
(3 marks)

(ii) the probability that the length of this component is between 9.97 and 10.03 cm.
(4 marks)

(iii) the probability that the length of this component is 10.0 cm.
(3 marks)

(b) 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)

Q3 (a) Given a population numbers which are 5, 9, 11, 13, and 15. Find the;

(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 Oppo is 14.5 cm, meanwhile 15.3 cm is from company Huawei. The standard deviation in both companies is 2.05 cm. The length of smartphone of both companies are normally distributed. Five models from both companies are randomly sampled.

(i) Write the sampling distribution of both companies.
(2 marks)

(ii) Find the probability that sample mean length for company Oppo will less about 0.5 cm of company Huawei.
(5 marks)

(iii) Find the probability that sample mean length for company Oppo will be greater about 0.3 cm of company Huawei.
(5 marks)

Q4 (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)

Q5 (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)

- END OF QUESTIONS -

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Formula

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

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

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

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

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

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

$$\sum_{i=-\infty}^{\infty}p(x_i)=1,\ E(X)=\sum_{\forall x}xp(x),\ \int_{-\infty}^{\infty}f(x)\ dx=1,\ E(X)=\int_{-\infty}^{\infty}xp(x)\ dx,\ Var(X)=E(X^2)-[E(X)]^2,$$

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

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

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

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

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

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

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

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

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

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

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

$$(\bar{x}_1 - \bar{x}_2) - t_{\alpha/2,\,v}\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}} < \mu_1 - \mu_2 < (\bar{x}_1 - \bar{x}_2) + t_{\alpha/2,\,v}\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}} \text{ and } v = \frac{\left(s_1^2/n_1 + s_2^2/n_2\right)^2}{\frac{\left(s_1^2/n_1\right)^2}{n_1-1} + \frac{\left(s_2^2/n_2\right)^2}{n_2-1}}$$