UNIVERSITI TUN HUSSEIN ONN MALAYSIA
FINAL EXAMINATION
SEMESTER II
SESSION 2021/2022

COURSE NAME	:	STATISTICS FOR ENGINEERING TECHNOLOGY
COURSE CODE	:	BNJ22502/BNP22502/BNT22502
PROGRAMME CODE	:	BNA/ BNB/ BNC/ BND/ BNE/ BNF/ BNM/ BNN
EXAMINATION DATE	:	JULY 2022
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTION	:	1. ANSWER 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 EXAMINATION PAPER CONSISTS OF SIX **(6)** PAGES

Q1 (a) The average life of a laptop is 8 years for a female and 6 years for a male, with a standard deviation of 1 and 2 years respectively. A random sample of 44 females and 55 males are taken for analysis. Assuming that the lives of these laptop follow approximately a normal distribution, find the probability that the mean life of a random

(i) sample of male laptop falls between 6.6 and 7.7 years.

(7 marks)

(ii) sample of female is not less than 2.5 years than the sample of male laptop.

(7 marks)

(b) The average running times of films produced by Company A is 98.4 minutes and a standard deviation of 7.8 minutes, while those of Company B have a mean running times of 110.7 minutes with standard deviation of 29.8 minutes. Assume the populations are approximately normally distributed. If a random sample of 36 films from Company B and 49 films form Company A are selected, calculate the probability that

(i) a random sample from Company B will have mean running times at least 13 minutes more than the mean running times of Company A.

(7 marks)

(ii) a random sample from Company B will have mean running times less than 15 minutes more than the mean running times of Company A.

(4 marks)

Q2 (a) The inspection division of a county weights and measures department wants to estimate the mean amount of soft drinks filled in a 2-liter bottle. The actual mean of this situation is different from the sample mean by 0.011 liters with 97% confidence. Assume that the standard deviation is 0.05 liters.

(i) Obtain the sample size needed for this situation.

(6 marks)

(ii) Given that the sample size is 81 and the sample variance is 0.81, construct a 96% confidence interval for the standard deviation.

(6 marks)

(b) The local branch of the Internal Revenue Service spent an average of 21 minutes helping every 11 people prepare their tax returns, and the standard deviation was 5.6 minutes. While a volunteer tax preparer spent an average of 27 minutes helping 9 people prepare their taxes. The standard deviation was 4.3 minutes.

(i) Construct a 98% confidence interval for the difference in the mean of local branch and volunteer tax preparer. Assume that the variances are equal.

(7 marks)

(ii) Construct a 95% confidence interval for the ratio of two variances.

(6 marks)

Q3 (a) Explain Type I and Type II error

(4 marks)

(b) In last Ramadan people in Taman Pagoh Jaya donated an average of RM100 to the mosque for the fasting activities. Test the hypothesis at 0.01 level of significance that the average contribution this year is more than last year if random sample of 54 Muslim people showed an average donation of RM95 with a standard deviation of RM2. Assume that the donations are approximately normally distributed.

(9 marks)

(c) A large automobile manufacturing company is trying to decide whether to purchase brand A or Brand B tires for its new models. To help arrive at a decision, an experiment is conducted using 15 each brand. The tires are run until they wear out. The result are as follows.

Table Q3(c): Result of Brand A and Brand B tiers in kilometers

Brand A	$\bar{x}_A = 37800$ $s_A = 5100$
Brand B	$\bar{x}_B = 39900$ $s_B = 5800$

Test the hypothesis at the 0.05 level of significance that there is no difference in the 2 brands of tires. Assume the populations to be approximately normally distributed with equal variance.

(12 marks)

Q4 The data below shows that the weights (in kg) of a mother and her newborn baby.

Table Q4: Newborn baby weights

Mother's weight, x	56	46	70	75	57	59	65	67
Baby's weight, y	2.7	2.9	3.5	3.7	3.0	3.2	3.3	3.1

(a) Sketch a scatter plot of the data. Then, interpret the relationship between the variables.

(4 marks)

(b) Construct a linear regression model that relate compressive strength to density. Interpret your result.

(11 marks)

(c) Based on appropriate coefficient, explain the relationship between the variables.

(6 marks)

(d) By using appropriate coefficient, define how good the model can explain the data.

(4 marks)

- END OF QUESTIONS -

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$X \sim N(\mu, \sigma^2)$

$$\bar{X} \sim N(\mu, \frac{\sigma^2}{n}) \qquad Z = \frac{\bar{X}-\mu}{\sigma/\sqrt{n}} \sim N(0,1)$$

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

$$\bar{X}_1 - \bar{X}_2 \sim N(\mu_1-\mu_2, \frac{\sigma_1^2}{n_1}+\frac{\sigma_2^2}{n_2}) \qquad Z = \frac{\bar{X}_1-\bar{X}_2-(\mu_1-\mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1}+\frac{\sigma_2^2}{n_2}}} \sim N(0,1)$$

$$T = \frac{\bar{X}-\mu}{S/\sqrt{n}} \sim t_{\alpha,n-1} \qquad F = \frac{S_1^2}{S_2^2} \sim f_{\alpha,n_1-1,n_2-1}$$

$$\chi^2 = \frac{(n-1)S^2}{\sigma^2} \sim \chi^2_{\alpha,n-1} \qquad s^2 = \frac{1}{n-1}\left(\sum x^2 - \frac{(\sum x)^2}{n}\right)$$

$$T = \frac{\bar{X}_1-\bar{X}_2-(\mu_1-\mu_2)}{S_P\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}} \sim t_{\alpha,\ n_1+n_2-2} \qquad S_P^2 = \frac{(n_1-1)S_1^2+(n_2-1)S_2^2}{n_1+n_2-2}$$

$$T = \frac{\bar{X}_1-\bar{X}_2-(\mu_1-\mu_2)}{\sqrt{\frac{S_1^2}{n_1}+\frac{S_2^2}{n_2}}} \sim t_{\alpha,v} \qquad v = \frac{\left(S_1^2/n_1+S_2^2/n_2\right)^2}{\frac{\left(S_1^2/n_1\right)^2}{(n_1-1)}+\frac{\left(S_2^2/n_2\right)^2}{(n_2-1)}} \text{ or } v = 2(n-1)$$

$$\hat{y} = \hat{\beta}_0+\hat{\beta}_1 x \qquad \hat{\beta}_0 = \bar{y}-\hat{\beta}_1\bar{x} \qquad \hat{\beta}_1 = \frac{S_{xy}}{S_{xx}} \qquad \text{SSE} = S_{yy} - \hat{\beta}_1 S_{xy} \qquad \text{MSE} = \frac{\text{SSE}}{n-2}$$

$$s_{xx} = \sum_{i=1}^{n} x_i^2 - \frac{\left(\sum_{i=1}^{n} x_i\right)^2}{n} \qquad s_{yy} = \sum_{i=1}^{n} y_i^2 - \frac{\left(\sum_{i=1}^{n} y_i\right)^2}{n} \qquad s_{xy} = \sum_{i=1}^{n} x_i y_i - \frac{\sum_{i=1}^{n} x_i \sum_{i=1}^{n} y_i}{n}$$