UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2022/2023

COURSE NAME	:	BIOSTATISTICS
COURSE CODE	:	BWJ 20903
PROGRAMME CODE	:	BWW
EXAMINATION DATE	:	JULY/ AUGUST 2023
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTIONS	:	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 QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

Q1 (a) A random sample of 48 participants in jungle tracking shows an average of 38 victims in jungle tracking were treated in the emergency room due to an injury with a standard deviation of four. Calculate the 95% confidence interval of the mean number of victims in the emergency room.

(6 marks)

(b) A machine produces wood rods used to make fortresses. A random sample of ten blocks of wood was selected, and the diameter was measured. The resulting data in millimetre is shown in **Table Q1(b).**

Table Q1(b)

23.3	22.8	23.0	22.5	23	23.1	22.9	22.7	23.1	23.2

(i) Construct a 98% confidence interval of the mean diameter of wood rods used to make fortresses.

(7 marks)

(ii) Construct a 98% confidence interval of the variance diameter of wood rods used to make fortresses.

(6 marks)

Q2 (a) Define the **Type I** and **Type II** error.

(2 marks)

(b) A researcher is interested to investigate whether the average age of lifeguards differs from 33 years. A sample of 14 lifeguards is randomly selected, and their ages are recorded. The mean age of the sample is found to be 32.1 years, with a sample standard deviation of two years. The researcher aims to determine whether there is sufficient evidence to support the claim using a significance level of 0.05.

(10 marks)

(c) Two different lighting techniques are compared by measuring the intensity of light at two selected locations. 11 measurements in the first area had a standard deviation of 2.7 foot-candles and nine measurements in the second area had a standard deviation of 4.2 foot-candles. Can it be concluded that the variance of lighting in the second area is greater than in the first area? Use a 0.05 level of significance.

(12 marks)

Q3 A researcher wanted to study the relationship between the calcium weight and the yield of paddy. A sample of eight plots of paddy was measured for the weight of calcium (x) and the weight of paddy (y). The results are shown in **Table Q3**.

Table Q3

Calcium (mg)	50	55	54	55	57	52	53	55
Paddy weight (kg/m^2)	2.2	3	2.5	2.7	3	2	2.5	2.8

(a) Sketch a scatter plot of the data.

(3 marks)

(b) Construct a simple linear regression model and interpret the result.

(13 marks)

(c) Estimate the weight of the paddy when calcium is 51 mg.

(2 marks)

(d) Calculate the coefficient of correlation and coefficient of determination. What can you conclude from the result?

(6 marks)

Q4 The analysis of variance (ANOVA) for the length of three different species of fish is shown in **Table Q4.**

Table Q4

	DF	SS	MS	F
Treatment	2	192.2	**B**	**D**
Error	**A**	1100.6	**C**	
Total	26			

(a) Calculate the **A**, **B**, **C** and **D** values.

(4 marks)

(b) Test the hypothesis that there is a difference between the length of species of fish at 0.01 level of significance.

(9 marks)

-END OF QUESTIONS-

FINAL EXAMINATION

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FORMULAE

$$T = \frac{\overline{X} - \mu}{S/\sqrt{n}} \sim t_{\alpha, n-1}$$

$$F = \frac{S_1^2}{S_2^2} \sim f_{\alpha, n_1-1, n_2-1}$$

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

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

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

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

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