UNIVERSITY OF RUHUNA

BACHELOR OF SCIENCE IN FISHERIES AND MARINE SCIENCES DEGREE

Level IV, Semester I Examination - September 2018

FSC4113 - Statistics for Fisheries & Aquatic Sciences

Time: Two (02) hours

INSTRUCTIONS:

Calculators are allowed.

Use a significance level of 0.05.

Answer any **four (04)** questions.

1.
(a)
   (i) What are the parameters of the normal distribution?
   (ii) Write down most suitable estimators for the each parameter.
   (iii) State the empirical rule for data having a normal distribution.

(b) Suppose that the distribution of pH readings for soil samples taken in a certain geographic region can be approximated by a normal distribution with mean 6.00 and standard deviation 0.10. The pH of a randomly selected soil sample from this region is to be determined.

   (i) What is the probability that the resulting pH is between 5.90 and 6.15?

   (ii) What is the probability that the resulting pH exceeds 6.10?

   (iii) What is the probability that the resulting pH is at most 5.95?

   (iv) Describe the largest 5% of the pH distribution.

2.
(a) In a lake pollution study, the concentration of lead in the upper sedimentary layer of a lake bottom is measured from 25 sediment samples of 1000 cubic centimeters each. The sample mean and standard deviation of the measurements are found to be 0.38 and 0.06, respectively. Compute a 95% confidence interval for the mean concentration of lead per 1000 cubic centimeters of sediment in the lake bottom. Assume that the concentration of lead is normally distributed.

(b) Environmental engineers were interested in determining whether a cleanup project on a nearby lake was effective. Prior to initiation of the project, they obtained 10 water samples at random from the lake and analyzed the samples for the amount of dissolved oxygen (in ppm). Due to diurnal fluctuations in the dissolved oxygen, all measurements were obtained at the 2 pm peak period. The before and after data are presented in the following table:

Before Cleanup	11.0	11.2	11.4	11.5	11.6	11.9	12.1	11.2	11.7	11.2
After Cleanup	10.2	10.3	10.6	10.7	10.8	11.1	11.3	10.3	10.8	10.4

(i) To conduct matched-pairs t-test, what is assumed about the distribution of the difference scores?

(ii) Assume that all assumptions are met. Do the data indicate that the cleanup project on a nearby lake was effective? Use the matched-pairs t-test.

3. A farmer wants to test three brands of weight-gain diets for fish to determine if the mean weight gain for each of these brands is the same. He selected 15 fish and randomly put each of them on one of these three brands of diet. The following table lists the weights (in grams) gained by these fish after a period of 1 week.

Brand A	Brand B	Brand C
8	6	12
13	13	8
17	6	7
9	4	15
6	7	9

Answer the following questions for testing the mean weight gain for all fish is the same for each of these three brands of diets.

(a) State the assumptions you would need to make in order to carry out an analysis of variance on these data.

(b) State the null and alternative hypotheses for a one-way analysis of variance test.

(c) Construct the analysis of variance table.

(d) Assuming that the assumptions in the Part (a) above are satisfied, test the hypothesis in the Part (b) at 5% level of significance. State your conclusions.

4. The following table gives information on the incomes (in thousands of rupees) and fish consumptions (in kilograms) for the last month for a random sample of 10 households.

Income (x)	55	83	38	61	33	49	67	45	63	70
Fish Consumption(y)	2.8	4.8	2.6	3.2	1.8	3.0	3.4	2.8	3.3	3.6

(a) Obtain the least square estimates of β_0 and β_1 for the linear model $y = \beta_0 + \beta_1 x + \varepsilon$.

(b) Interpret the meaning of β_1.

(c) Test the hypothesis that $\beta_1 = 0$. Do the results of this test indicate that the linear model is a reasonable model?

(d) How much of the variability in y is explained by the linear regression model?

5.

(a) Let A and B are two events. If P(A)=0.5, P(B)=0.5 and P($A \cup B$)=0.8,

(i) Are A and B independent? Why or why not?

(ii) Can A and B be mutually exclusive? Why or why not?

(b) A random sample of 100 persons was selected from each of four regions in Sri Lanka. These people were asked whether or not they support a certain farm subsidy program. The results of the survey are summarized in the following table.

	Favor	Oppose	Uncertain
North	56	33	11
East	73	23	4
South	67	28	5
West	59	35	6

Using the 1% significance level, test the null hypothesis that the percentages of people with different opinions are similar for all four regions.

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