UNIVERSITY OF RUHUNA

BACHELOR OF SCIENCE IN FISHERIES AND MARINE SCIENCES DEGREE

Level IV Semester I Examination - 2017 July / August

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) An extinct species was considered to have an average life of 25 years, with a standard deviation of only 2 years, and to be normally distributed. Of a family of 50 members of the species, born at the same time, how many would be expected to have lived

(i) between 20 and 26 years,

(ii) less than 22 years?

What would be the age at death of the thirty-fifth member of the family to be die?

(b) It is conjectured that an impurity exists in 30% of all drinking wells in a certain rural community. In order to gain some insight into the true extent of the problem, it is determined that some testing is necessary. It is too expensive to test all of the wells in the area, so 10 are randomly selected for testing.

(i) Using the binomial distribution, calculate the probability that exactly 3 wells have the impurity. Assume that the conjecture is correct.

(ii) What is the probability that more than 3 wells are impure?

2. A thermal power station discharges its cooling water into a river. An environmental scientist wants to determine whether this has adversely affected the dissolved oxygen level. She has taken water samples one kilometer upstream from the power station, and one kilometer downstream from the power station, and has measured the dissolved oxygen level. The data are:

Upstream	Downstream
10.1	9.7
10.2	10.3
13.4	6.4
8.2	7.3
9.8	11.7
	8.9

(a) State the null and alternative hypotheses to determine whether the mean amount of the dissolved oxygen level is higher in the upstream than the downstream.

(b) To test the hypotheses in part (a) with pooled t-test, we must make two assumptions. What are the two assumptions?

(c) Complete the pooled t-test and state your conclusion.

3. It is known that a toxic material was dumped in a river leading into a large salt water commercial fishing area. Researchers studied the way the water carried the toxic material by measuring the amount of the material (in parts per million) found in oysters harvested at three different locations, ranging from the estuary out into the bay where the majority of commercial fishing was carried out. The resulting data are given below:

Site 1	Site 2	Site 3
15	19	22
26	15	26
20	10	24
20	26	26
29	11	15
28	20	17
21	13	24
26	15	
	18	

Answer the following questions for testing whether there is a significant difference in the average parts per million of toxic material found in oyster harvested at three sites.

(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.

(a) In studying the effect of air quality on a lake, the experimenter takes observations on the pH of the water and the air quality as measured on an air quality index. The index goes from 0 to 100 with larger numbers representing high pollution. These data are obtained:

pH (x)	4.5	4.1	4.8	4.0	5.0	6.0	3.5	4.9	3.2	6.1
Air quality (y)	40	50	30	60	20	10	70	30	85	15

(i) Estimate the correlation coefficient ρ.

(ii) Test for a significant negative correlation at the 0.05 level of significance.

(b) Fifty eight trout caught in a lake had average weight = 2.18 kilograms and standard deviation = 0.80 kilograms. From these data estimate the mean weight of catchable trout in this lake and give a 90% error margin.

5.

It is suspected that there is an association between the day of the week on which an item is produced and the quality of the item. To support this contention, a random sample of 500 items is selected from stock and each item is classified as to the day on which it was produced via its lot number. The item is also rated for quality. The data gathered are shown in the table below:

	Day produced					
Quality	**Mon**	**Tue**	**Wed**	**Thu**	**Fri**	
Excellent	44	74	79	72	31	
Good	14	25	27	24	10	
Fair	15	20	20	23	9	
Poor	3	5	5	0	0	
						500

(a) Explain the guideline on expected cell frequencies in a contingency table for the chi-square test.

(b) To satisfy the criterion, combine the quality of categories "Fair" and "Poor" to form a new table with three rows and five columns. Use this table to test for independence.

(c) Has an association between quality and day of production been established? Explain.

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