THE OPEN'UNIVERSITY OF SRI LANKA

Bachelor/Diploma in Industrial Studies/Continuing Education Programme

APPLIED MATHEMATICS - LEVEL 03

PSU 1182/ PSE 3182/PSZ3182/ PSZ4182/NSU1142– Bio Statistics

FINAL EXAMINATION (REHELD) - 2010/2011

DURATION: TWO HOURS.

DATE: 17.01.2011	TIME: 9.30am – 11.30am

ANSWER **FOUR** QUESTIONS ONLY.

Statistical Tables are provided. Non programmable calculators are permitted.

1. A researcher is interested in comparing the effects of two diets (say D_1 and D_2) on the weight gain of rats. The weight gains (in grams) after feeding the rats with one of the diets for one month are given below.

Diet D_1					Diet D_2				
0.8	0.9	1.2	1.2	1.2	0.7	1.1	1.1	1.1	1.5
1.3	1.3	1.6	1.7	1.8	1.5	1.8	1.8	2.0	2.0
1.8	1.8	1.9	1.9	2.1	2.1	2.1	2.3	2.5	2.5
2.1	2.2	2.4	2.5	2.5	2.5	2.5	2.7	2.7	2.8

i) Write down the null hypothesis and the alternative hypothesis you would test in order to address the researcher's objectives. Clearly describe the notation you use.

ii) Using a 5% significance level, test the hypotheses stated in part (i). Clearly state the findings.

iii) Explain the following terms in relation to this study.
   a) Critical value
   b) Type I error

2. A researcher is interested in comparing the effects of three fertilizers on the yield of two varieties of tomatoes (say *A* and *B*). Further, he wants to know, whether to apply 500 milliliters of water daily or to apply 1 liter of water every other day to receive the better yield. He is planning to apply 5 grams of fertilizer per plant every month. Two hundred plants are available for the study. Of those, 125 plants are of Variety *A* and the rest are of Variety *B*. The plants are located in plots of 5 each. Plants in the same plot are close to each other and it is difficult to apply different fertilizers for plants in the same plot.

i) Clearly describe how you advise the researcher to design this study. If you use the random number table, clearly state how you read the values.

ii) Explain the following terms in relation to this study.
   a) replicate
   b) random variation
   c) interaction

3. The following table is prepared by a student by converting the grades obtained by a sample of 60 students for a Statistics course.

Mark range	Number of students
0 – 19	2
20 – 39	3
40 – 59	11
60 – 79	17
80 – 99	27

i) Construct a suitable graphical summary that can be used to read the percentiles of the data.

ii) Using the graphical summary constructed in part (i), estimate the 5th percentile of the data. In relation to this study, what does it measure?

iii) Suppose students who have scored at least 70 marks are allowed to register for an Advanced Statistics course. Using the graphical summary constructed in part (i), estimate the percentage of students who will be allowed to register for the Advanced Statistics course.

iv) Using the graphical summary constructed in part (i), give an estimate for the random variation in the marks of different students.

4. The following summary table is extracted from an unpublished report.

Age range (Years)	Number of girls	Heights (inches)
5 – 9	5	40, 40, 41, 43, 43
10 – 14	7	47, 47, 48, 48, 49, 50, 50
15 – 19	8	56, 56, 57, 57, 57, 58, 59, 59
20 – 24	9	58, 58, 59, 60, 60, 61, 61, 61, 61
25 – 29	1	50

i) Construct a suitable graphical summary to highlight how the height of girls changes with age.

ii) Clearly state the findings from the graphical summary constructed in part (i).

iii) Using the graphical summary constructed in part (i), estimate the height of a 17 year old girl.

iv) If the height of a girl is 53 inches, estimate her age.

5. In a press, books are printed in two shifts. Around 1000 books are printed in each shift. At the end of the second shift on a given day, the management has discovered that the machine has an ink leakage problem, but when this occurred is not known. All the books printed after the ink leakage problem occurred have to be discarded.

Suppose the books printed in the two shifts are piled up in two separate columns. However, within each column, books are not piled up according to the order they were printed. It is difficult to reach the books piled up at the bottom to check whether they need to be discarded or not. The management seeks your advice to estimate the number of books that need to be discarded. The resources are available to sample 200 printed books.

i) Clearly describe how you advise the management to design this study. If you use the random number table, clearly describe how you read the values.

ii) Explain the following terms in relation to this study.
   a) Population
   b) Sampling unit

iii) State whether the following statements are true or false. Give reasons for your answer.
   a) The data collected in this study are binary.
   b) The data collected in this study are qualitative.

6. A researcher interested in finding out whether there is a difference in how the weight changes with age of girls and of boys collected information on the variables V_1, V_2 and V_3 described below.

V_1: Gender coded as 1 – girl; 2 – boy

V_2: Age recorded to the nearest year

V_3: Weight recorded to the nearest kilogram (kg)

a) Classify the variables as discrete or continuous.

b) Classify the data as nominal, ordinal, interval or ratio.

c) The data collected from 20 girls and 30 boys are summarised in the accompanying table.

Age range	Girls		Boys	
	No.	Weight (kg)	No.	Weight (kg)
5 – 9	5	16, 16, 17, 20, 20	8	18, 18, 18, 19, 21, 21, 23, 23
10 – 14	7	31, 31, 32, 32, 33, 33, 33	11	33, 33, 33, 34, 34, 35, 36, 36, 37, 37, 38
15 – 19	6	44, 44, 45, 45, 45, 46	10	47, 47, 50, 50, 51, 51, 52, 52, 52, 53
20 – 24	2	47, 49	1	59

State whether the following statements are true or false. Give reasons for your answer in each case.

i) In this study, the effect of gender is confounded with the effect of age.

ii) The study described here is an observational study.

iii) Pie charts are suitable to highlight the variations in the weights of girls and of boys in different age categories.