

Uva Wellassa University of Sri Lanka
Faculty of Science and Technology
Department of Science and Technology
300 Level 2nd Semester Examination – Dec./Jan. 2017/18
SCT 333-1 Data Handling and Statistics



Instructions to candidates.

Duration: Two (02) hours

Number of questions: Four (04) essay questions

Mark allocation: 100 mark

Answer All Questions.

1.

- a. An experiment was conducted to compare the effectiveness of two sources of nitrogen, namely, ammonium chloride and urea, on grain yield of paddy. The results on the grain yield of paddy (kg/plot) under the two treatments are given below table 01.

Table 01: Effectiveness of two sources of nitrogen

Ammonium chloride	13.4	10.9	11.2	11.8	14.0	15.3	14.2	12.6	17.0	16.2	16.5	15.7
Urea	12.0	11.7	10.7	11.2	14.8	14.4	13.9	13.7	16.9	16.0	15.6	16.0

Use an appropriate parametric test to determine whether there is a difference between two sources of nitrogen (at the 5% significance level). Briefly explain on your results.

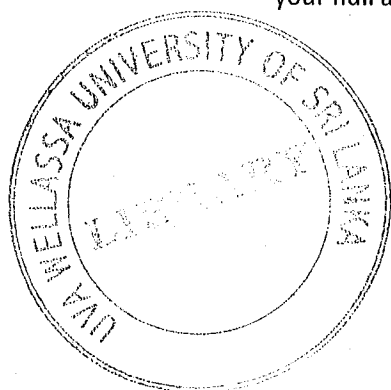
(10 mark)

- b. In a study of supermarket checkout experiemnt was found that, checkout prices can be varied item wise. Itcan be summerized as: often correct, customers can sometimes be charged more or less than the prices posted on the shelves. It is suggested that discrepancies in prices may be associated with whether or not items are on special offer compared with their normal prices. A random sample of 819 items is investigated and for each item it is noted whether the checkout equipment is undercharging, overcharging or charging the correct price. The results are shown in the contingency table 02 below.

Table 02: Results of supermarket checkout equipment

	Normal-priced items	Special offer items	Total
Undercharged	20	7	27
Overcharged	15	29	44
Correct price	384	364	748
Total	419	400	819

- i. Investigate whether price accuracy is associated with items being on special offer or not. State your null and alternative hypotheses and report your conclusions clearly. (10 mark)



- ii. Adapt the table to classify the normal-priced and special offer items according to whether or not they are charged correctly. Calculate a 95% confidence interval for the difference in the proportions of items which are charged incorrectly in the normal-priced and special offer categories. (07 mark)

- iii. Briefly comment on your answers to parts (a) and (b) (03 mark)

2. The data below (Table 03) consist of 16 indexed observation on rubber consumptions.
(The data are stored in a Minitab work sheet named "Rubber.mtw" given on your computer.)

Table 03: Indexed observation on rubber consumptions

Obsevation No	Total Rubber Consumption Y_1	Tire Rubber Consumption Y_2	Car Production X_1	Gross National Product X_2	Disposable Personal Income X_3	Motor Fuel Consumption X_4
1	0.909	0.871	1.287	0.984	0.987	1.046
2	1.252	1.220	1.281	1.078	1.064	1.081
3	0.947	0.975	1.061	1.061	1.007	1.051
4	1.022	1.021	0.787	1.013	1.012	1.046
5	1.044	1.002	0.796	1.028	1.029	1.036
6	0.905	0.890	1.392	0.969	0.993	1.020
7	1.219	1.213	0.892	1.057	1.047	1.057
8	0.923	0.918	1.400	1.001	1.024	1.034
9	1.001	1.014	0.721	0.996	1.003	1.014
10	0.916	0.914	1.032	0.976	0.993	1.013
11	1.173	1.170	0.685	1.046	1.027	1.037
12	0.936	0.952	1.291	1.004	1.001	1.007
13	0.965	0.946	1.170	1.002	1.014	1.008
14	1.106	1.096	0.817	1.049	1.032	1.024
15	1.011	0.999	1.231	1.023	1.020	1.030
16	1.080	1.093	1.086	1.035	1.053	1.029

- a. Examine data carefully and state preliminary conclusions. (07 mark)
- b. Use these data to develop suitable fitted equations for predicting Y_1 and Y_2 separately in terms of the predictor variables X_1, X_2, X_3 and X_4 . (08 mark)
- c. Write a brief report of your findings (it should included all relevent hypothesis with ANOVA, model checking with appropriate test and validation and necessary and relevant analysis). (15 mark)
3. An experiment on plant hormone was conducted in a laboratory using tissue cultured plants to evaluate the growth of plants on 5 different levels of hormone concentrations. Each concentration was repeated 10 times.
- a. Identify the most suitable experimental design for this experiment giving justifications. (03 mark)

- b. Prepare the lay-out of the experimental design you proposed above elaborating your randomization procedure. (03 mark)
 - c. What is the model that you will use? (describe each and every parameter in the model) (03 mark)
 - d. What are the model assumptions and mention appropriate tests to check the validity of assumptions? (05 mark)
 - e. Construct the partial ANOVA giving sources of variations and degrees of freedom only. (03 mark)
 - f. What are the advantages and disadvantages of the experimental design you proposed? (03 mark)
4. An experiment was carried out to study the effect of two factors on the blood sugar level in rabbits. One factor was two types (I and II) of insulin and the other factor was the dose level ("low" or "high") at which each type of insulin was given. Four rabbits were used in the experiment, and each was given all four treatment combinations, in random order, separated by suitable intervals of time in the hope of avoiding carryover effects from one treatment to the next. Measurements of blood sugar level (mg/100cc) are given in below table 03.

Table 03: Measurements of blood sugar level

Rabbit	Type of insulin			
	1		2	
	Dose level		Dose level	
	Low (1)	High (2)	Low (1)	High (2)
A	88	59	76	63
B	89	58	74	65
C	86	61	79	62
D	85	59	72	68

- a. Calculate the mean responses for the four treatment combinations, and illustrate these in a graph. Is there any suggestion of interaction between the two factors? (04 mark)
- b. What is the suitable model to describe the above situation (describe each and every parameter in the model)? (03 mark)
- c. Construct the suitable ANOVA table. What is your decision based on ANOVA with all possible hypothesis. (06 mark)
- d. What is the R^2 and explain it? (02 mark)
- e. What is more affected treatment combination on the blood sugar level? (Write all possible hypothesis for mean comparison between treatment combination.) (05 mark)