Part C: Essay Questions
(Answer all questions)
Time: One (01) hour and 15 minutes
Total Marks= 40

1. In my drawer I have 5 identical red socks, 3 identical blue socks and 2 identical green socks. I draw socks out of the drawer in turn and without replacement, colour unseen. Using probability trees or otherwise, evaluates the following probabilities. Show your arguments clearly.
   a) I draw two socks out of the drawer. What is the probability that they are a pair (i.e. both the same colour)?
   b) Suppose the first sock drawn is a red one. If I draw two more socks, what is the probability that I have a pair among the three socks?
   c) Suppose the first two socks are one red and one blue. If I draw two more socks, what is the probability that I have two pairs?

   (10 marks)

2. An agro-economist examines the cellulose content of a variety of alfalfa hay. Suppose that the cellulose content in the population has a standard deviation of 8 mg. A sample of 15 cuttings has a mean cellulose content of 145 mg.
   a) A previous study claimed that the mean cellulose content was 140 mg. Perform a hypothesis test to determine if the mean cellulose content is different from 140 mg, if α=0.05.
   b) Find a 95% confidence interval for the mean cellulose content.

   (10 marks)

3. Performance of four (4) food rations on body weight gain of a cattle breed was investigated. Four farms were used in the experiment and four bulls of four different age groups were used at each farm. Note that age groups were same in all four farms and there were total of sixteen bulls used in the experiment.
   a) Suggest the most appropriate experimental design for the study.
   b) Give the layout of the design.
   c) Give the break-down of the ANOVA table (source of variation and degree of freedom only.)
   d) Give the appropriate test to determine the effect of four(4) food rations.

   (10 marks)

4. In Sri Lanka, all patients surviving a stroke are supposed to have their cholesterol levels measured soon after their stroke and regularly thereafter. A sample of medical records of men and women who had suffered a stroke was examined to determine whether there was a difference between the sexes in the proportions of stroke survivors who had a recently recorded cholesterol measurement. The following data were obtained.

	Cholesterol level recorded	
Sex	*No*	*Yes*
Female	109	22
Male	97	77

a) Perform a suitable test of the null hypothesis that there is no association between an individual's sex and the chance of he or she having a recently recorded cholesterol measurement.

b) Compute and interpret an approximate 95% confidence interval for the difference between the proportions of females and males having a recently recorded cholesterol measurement. (Estimated variance of difference between the proportions of females and males is 0.002485)

(10 marks)