23

RAJARATA UNIVERSITY OF SRI LANKA, MIHINTALE
FACULTY OF APPLIED SCIENCES, DEPARTMENT OF PHYSICAL SCIENCES

B.Sc. (General) Degree

Third Year – Semester II Examination - August 2013

MAT 3205 – Introduction to Statistical Decision Theory

Answer all four questions. **Time allowed: Two hours**

1. (a) Briefly explain any two of the following terms:
   (i) Maximax criterion.
   (ii) Maximin criterion.
   (iii) Minimax regret criterion.

   (b) A factory manufactures three types of bottles. Payoffs can vary according to the fluctuations in the market demand conditions. The following table gives the payoffs for each type of bottle under three market conditions.

Bottle types	Market Demand		
	High(Rs.)	Moderate(Rs.)	Poor(Rs.)
Type1	50000	25000	-15000
Type2	75000	-25000	15000
Type3	15000	10000	60000

Find the optimum decision if the company adopts, each of the following strategies:
   (i) Maximax criterion.
   (ii) Maximin criterion.
   (iii) Minimax regret criterion.

2. A textile sales company has to decide on the number of kids T-shirts to order for the New Year Festival. If it orders a batch of 50 T-shirts the cost is Rs.180 per T-shirt, if it orders a batch of 100 T-shirts the cost is Rs.160 per T-shirt and if it orders a batch of 150 or more T-shirts the cost is Rs.100 per T-shirt. Selling price of a T-shirt is Rs.200, and any leftover at the end of the New Year Season will be sold at a 50% discount price. The orders must be placed for the season at the beginning with no opportunity for re-ordering. Probability of demand is estimated as follows:

Demand	50	100	150	200	250
Probability	0.10	0.20	0.25	0.3	0.15

   (i) Construct the pay- off table for the above problem.

   (ii) Determine the optimum stock action for the textile sales company.

3. A farmer has to decide which of the three crops he should plant on his land. The profit from each crop is highly dependent on the rainfall during the growing season. The estimated probability of occurrence of rainfall and the profit(Rs.) for each crop is given in the following table:

Rainfall	Probability	Crops		
		Crop A	Crop B	Crop C
Heavy	0.4	8000	4500	5000
Light	0.6	5000	6000	5000

The farmer wants to undertake a research survey to gather further information on which he is to base his decision on planting. Relevant data are given in the following table:

Actual rainfall	Rainfall prediction		
	Substantial	Moderate	Light
Heavy	0.5	0.2	0.3
Light	0.2	0.7	0.1

Perform a posterior analysis and decide which crop (A, B or C) the farmer should plant on his land, based on the rainfall prediction.

4. (a) Consider the following notations for an EOQ model:

q – order quantity

R – demand rate

t_0 – ordering cycle length

k – set up cost

h – holding cost

If the demand rate is uniform and replenishment rate is infinite, show that the optimum inventory policy is

$$q^* = \sqrt{\frac{2kR}{h}} \text{ units} \quad \text{and} \quad t_0^* = \frac{q^*}{R} \text{ time units.}$$

(b) A motor company purchases spare parts at the rate of 1000 units per month. It costs Rs.9000 to initiate a purchase order and the inventory carrying cost is Rs.10 per unit, per month.

(i) Determine the optimum inventory policy for ordering the spare parts.

(ii) Determine the number of orders per year.