

**STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI 600 086**  
**(For candidates admitted during the academic year 2009 – 10 & thereafter)**  
**SUBJECT CODE : MT/PE/QM13**  
**M. Sc. DEGREE EXAMINATION, NOVEMBER 2010**  
**BRANCH I - MATHEMATICS**  
**FIRST SEMESTER**

**COURSE : ELECTIVE**  
**PAPER : QUANTITATIVE TECHNIQUES FOR MANAGEMENT**  
**TIME : 3 HOURS** **MAX. MARKS : 100**

**SECTION – A** **( 5 X 8 = 40 )**  
**ANSWER ANY FIVE QUESTIONS**

1. A businessman has three alternatives open to him each of which can be followed by any of the four positive events. The conditional pay offs for each action event combination are given below.

Alternative	Pay offs conditional on events			
	A	B	C	D
X	8	0	-10	6
Y	-4	12	18	-2
Z	14	6	0	8

Determine which alternative should the businessman choose if he adopts the

- a) Maximin criterion
  - b) Maximax criterion
  - c) Hurwicz criterion, his degree of optimism being 0.7
  - d) Laplace criterion
  - e) Minimax regret criterion
2. The following have been observed for certain items.

End of month	1	2	3	4	5
Prob. Of failure	.10	.30	.55	.85	1.00

The cost of replacing an individual item is Rs 1.25. The decision is made to replace all items simultaneously at fixed intervals, and also to replace individual items as they fail. If the cost of group replacement is 50 paise, what is the best interval of group replacement? At what group replacement price per item, would a policy of strictly individual replacement become preferable to the adopted policy?

3. A television manufacturing company produces its own speakers, which are used in the production of its television sets. The television sets are assembled on a continuous production line of a rate of 8,000 per month. The speakers are produced in batches because they do not warrant setting up a continuous production line, and relatively large quantities can be produced in a short time. The company is interested in determining when and how much to produce, given the following information.
- (i) Each time a batch is produced, a set-up cost of Rs 12,000 is incurred.
  - (ii) The cost of keeping a speaker in stock is Re 0.30 per month.
  - (iii) The production cost of a single speaker (excluding the set-up cost) is Rs 10.00 and can be assumed to be a unit cost.
  - (iv) Shortage of a speaker, if there exists, costs Rs 1.10 per month.

4. In a certain food grains store it takes about seven days to get stock after placing the order, where as daily 750 tonnes of wheat are dispatched by the store to neighbouring markets. On adhoc basis, safety stock is assumed to be 20 days stock. Calculate the reorder point.
5. If for a period of 2 hours in the day (8 to 10 am) trains arrive and the yard every 20 minutes but the service time continuous to remain 36 minutes, then calculate for this period.
  - a) The probability that the yard is empty.
  - b) Average no of trains in the system on the assumption that the line capacity of the yard is limited to 4 trains only.
6. Four counter are being run on the frontier of a country to check the passports and necessary papers of the tourists. The tourists choose a counter at random. If the arrivals at the frontier is Poisson at the rate and the service time is a exponential with parameter  $\lambda/2$ , what is the steady state average queue at each counter?
7. Six truckloads of materials are delivered everyday at a factory at regular intervals of 45 minutes. The trucks carry 2, 4, 2, 4, 3, 3 tons of material respectively. Unloading has to be carried out by teams of two men, each team capable of handling 800 kg/hr, upto a maximum of 6 teams simultaneously. Assuming that the penalty for detaining a lorry for more than 45 minutes (including unloading time) is Rs. 10 per hour and the cost of each labour is Rs. 8 per day, determine the least costly manning.

## SECTION – B

( 3 X 20 = 60 )

## ANSWER ANY THREE QUESTIONS

8. a) A manager has a choice between (i) A risky contract promising Rs 7 lakhs with probability 0.6 and Rs 4 lakhs with probability 0.4 and (ii) a diversified portfolio consisting of two contracts with independent outcomes each promising Rs 3.5 lakhs with probability 0.6 and Rs 2 lakhs with probability 0.4. Construct a decision tree for using EMV criteria. Can you arrive at the decision using EMV criteria?
- b) The demand for a seasonal products is given below.

Demand	40	45	50	55	60	65
Probability	0.10	0.20	0.30	0.25	0.10	0.05

The product costs Rs 60 per unit and sells at Rs 80 per unit. If the units are not sold within the season, they will have no market value.

- (i) Determine the optimum number of units to be produced.
  - (ii) Calculate EVPI and interpret it.
9. A computer contains 10,000 resistors when any resistor fails, it is replaced. The cost of replacing a resistor individually is Re 1. If all the resistors are replaced at the same time, the cost per resistor would be reduced to 35 paise. The percentage of servicing resistors say  $S(t)$  at the end of month  $t$  and  $P(t)$  the probability of failure during the month  $t$  are,

$t$	0	1	2	3	4	5	6
$S(t)$	100	97	90	70	30	15	0
$P(t)$	-	0.03	0.07	0.20	0.40	0.15	0.15

What is the optimum replacement plan?

10. a) Find the optimal order quantity for a product for which the price breaks are as follows.

Quantity	Unit Cost
$0 \leq Q_1 \leq 50$	Rs 10.00
$50 \leq Q_2 < 100$	Rs 9.00
$100 \leq Q_3$	Rs 8.00

The monthly demand for the product is 200 units, the cost of storage is 25% of the unit cost and ordering cost is Rs 20.00 per order.

- b) A probability distribution of monthly sales of an item is as follows

Monthly Sales (Units)	0	1	2	3	4	5	6
Probabilities	0.01	.06	.25	.30	.22	.10	.06

The cost of carrying inventory (unsold during the month) is Rs 30 per unit per month and cost of unit shortage is Rs 70. Determine the optimum stock to minimize the expected cost.

11. a) A mechanic services four machines. For each machine the mean time between service requirements is 5 hours and is assumed to form an exponential distribution. The repair time tends to following the same distribution and has a mean time of 1 hour. When a machine is down for repairs, the time lost has a value of Rs 25 per hour. The mechanic costs Rs 55 per day. Find the following:
- What is the expected number of machines in operation?
  - What is the expected downtime cost per day?
  - Would it be desirable to provide two mechanics, each to service only two machines?
- b) Consider a single server queuing system with a Poisson input, exponential service times. Suppose the mean arrival rate is 3 calling with per hour, the expected service time is 0.25 hours and the maximum permissible number calling units within the system is two. Derive the steady state probability distribution of the number of calling units in the system, and then calculate the expected number in the system.
12. A company manufacturers around 200 mopeds. Depending upon the availability of raw materials and other conditions. The daily production has been varying from 196 mopeds to 204 mopeds, whose probability distribution is as given below.

Production per day	196	197	198	199	200	201	202	203	204
Probability	0.05	.09	.12	.14	.20	.15	.11	.08	.06

The finished mopeds are transported in a specially designed three storied lorry that can accommodate only 200 mopeds. Using the given 15 random numbers namely 82, 89, 78, 24, 53, 61, 18, 45, 04, 23, 50, 77, 27, 54, 10. Simulate the process to find out.

- What will be the average number of mopeds waiting in the factory?
- What will be the average number of empty spaces on the lorry?



