

**STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI 600 086**  
**(For candidates admitted during the academic year 2009 – 10)**

**SUBJECT CODE : MT/PE/QM13**

**M. Sc. DEGREE EXAMINATION, NOVEMBER 2009**  
**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. The demand for a seasonal product is given below

<b>DEMAND</b>	40	45	50	55	60	65
<b>PROBABILITY</b>	0.1	0.2	0.3	0.25	0.10	0.05

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

- (i) Determine the optimum number of units to be produced.  
(ii) Calculate EVPI and interpret it.

2. A survey agency requires 150 investigators, 225 senior investigators and 40 supervisors. The persons recruited must atleast 18 years of age. The retirement age is 58 years. From the table determine (i) number of persons to be recruited each year (ii) the age at which promotions should take place.

Age	18	19	20	21	22	23	24	25	26	27
No. in service	500	300	240	192	154	130	114	103	95	90
Age	28	29	30	31	32	33	34	35	36	37
No. in service	87	83	80	77	75	73	70	68	65	62
Age	38	39	40	41	42	43	44	45	46	47
No. in service	60	57	53	50	47	44	40	37	33	30
Age	48	49	50	51	52	53	54	55	56	57
No. in service	26	23	19	16	14	11	9	7	6	3

3. Find the optimal order quantity for a product for which the price-breaks is as follows:

<b>Quantity</b>	<b>Unit cost</b>
$0 < Q_1 < 50$	Rs. 10
$50 < Q_2 < 100$	Rs. 9
$Q_3 < 100$	Rs. 8

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 per order.

4. The demand for an item is 18,000 units per year. The holding cost per unit time is Rs. 1.20 and the shortage cost is Rs. 5.00, the production cost is Rs. 400. Assuming replenishment rate is instantaneous, determine the optimal order quantity.
5. A constructor has to supply 10,000 bearings per day to an automobile manufacturer. He finds that when he starts production run, he can produce 25000 bearings per day. The cost of holding a bearing in stock for one year is 2 paise and the set up cost of a production run is Rs. 18. How frequently should he produce?
6. Given the average arrival rate of 20 per hour, is it better for a customer to get service at single channel with mean service rate of 22 customer or at one of the two channels in parallel with a mean service rate of 11 assume that both queues are M/M/S types.
7. A company manufactures around 200 bikes. Depending on the availability of raw materials and other conditions, the daily production has been varying from 196 to 204 whose probability distribution is given below.

<b>PRODUCTION</b>	196	197	198	199	200	201	202	203	204
<b>PROBABILITY</b>	0.05	0.09	0.12	0.14	0.20	0.15	0.11	0.08	0.06

The finished bikes are transported in a lorry that can accommodate 200 bikes. Use the following random numbers 82, 89, 78, 24, 53, 61, 18, 45, 04, 23, 50, 77, 27, 54, 10. Simulate and find out

- (i) What is the average number of bikes waiting in the factory?  
(ii) What is the average number of empty spaces in the lorry?

### SECTION – B

( 3 X 20 = 60 )

### ANSWER ANY THREE QUESTIONS

8. The following table gives the pay off of different alternatives and events.

<b>ALTERNATIVES</b>	<b>N1</b>	<b>N2</b>	<b>N3</b>	<b>N4</b>
<b>S1</b>	4000	-100	6000	18000
<b>S2</b>	20000	5000	400	0
<b>S3</b>	20000	15000	-2000	1000

Indicate the decision as per (i) Pessimistic criterion (ii) Optimistic criterion  
(iii) Regret criterion (iv) Laplace criterion

9. A manufacturer is offered 2 machines A and B. A has a cost price of Rs. 2500, its running cost is Rs. 400 for each of the 5 years and increases by 100 each subsequent year. Machine B having the same capacity as A, has a cost price of Rs. 1250, its running cost is Rs. 600 for each of the 6 years and increases by 100 each subsequent year. If money is worth 10% per year, which machine should be purchased? Scrap value of both machines is negligibly small.

10. a) A company uses rivets at a rate of 5000 kg per year, rivets costing Rs. 2.00/kg. It costs Rs. 20 to place an order and carrying cost of inventory is 10% per year. How frequently should the order be placed and how much?
- b) The probability distribution of monthly sales of a certain item is as follows.

Monthly Sales	0	1	2	3	4	5	6
Probability	0.02	0.05	0.30	0.27	0.20	0.10	0.06

The cost of carrying inventory is Rs. 10 per unit per month. The current policy is to maintain a stock of 4 items at the beginning of each month. Assuming that the cost of shortage is proportional to both time and quantity short, obtain the imputed cost of a shortage for one its for one time unit.

11. A bank has 2 tellers the first teller handles withdrawals and the second only deposits. The distribution of deposits and withdrawals both follow exponential distribution with mean service time of 3 minutes per customer. Depositors and withdrawers both arrive in a poisson fashion with mean arrival rate 16 and 14 per hour.
- (i) What would be effect if on the average waiting time for depositors and withdrawers if each teller could handle both deposits and withdrawals?
- (ii) What would be effect if this could be accomplished by increasing service time to 3.5 minutes?

12. A book store wishes to carry system analysis and design in stock. Demand is probabilistic and lead times are given.

<b>DEMAND</b>	0	1	2	3	4
<b>PROBABILITY</b>	0.05	0.10	0.30	0.45	0.10

Each time an order is placed the store incurred an ordering cost of Rs. 10/- per order. Carrying cost of Rs. 0.50 per book per day. Inventory carrying cost is calculated on the basis of the stock at the end of each day. The Manager has 2 options for his inventory decision.

- (a) Order 5 books when the inventory at he beginning of the day + orders outstanding is less then 8 books. Lead time is less than 1 days.
- (b) Order 8 books when the inventory at the beginning of the day + orders outstanding is less than 8 books. Lead time is less than 2 days.

Currently the store has the stock of 8 books plus 6 books ordered earlier and is expected to arrive the next day. Use simulation for 10 cycles and recommend your decision to the manager. No order should be placed before a quantity corresponding to the previous order is received. Use the following random numbers 89, 34, 78, 63, 61, 18, 39, 16, 13, 73.

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