

**MT-130**

March-2019

4<sup>th</sup> Years Integrated M.Sc. (CA & IT), Sem.-VIII**Operations Research (QT)**

Time : 2:30 Hours]

[Max. Marks : 70

1. Answer any **one** : 14

- (a) The manager of a flower shop has the following information about the daily demand of roses :

<b>Dozens of roses:</b>	70	80	90	100
<b>Probability:</b>	0.1	0.2	0.4	0.3

The manager purchases the roses for ₹ 10 per dozen and sells them for ₹ 30 per dozen. Unsold roses are donated to a hospital. How many dozens he should order for a day to maximize his profit ? What is the optimum expected profit ? Also calculate the EVPI.

**OR**

- (b) From the following matrix , the elements of which indicate profit, obtain the decision following the principle : (i) maximax (ii) maximin (iii) Laplace

**Event**

↓ <b>Action</b> →	<b>a1</b>	<b>a2</b>	<b>a3</b>	<b>a4</b>	<b>a5</b>
<b>S1</b>	26	22	13	22	18
<b>S2</b>	26	22	34	30	20
<b>S3</b>	18	22	18	18	20
<b>S4</b>	22	22	18	18	18

How your principle of decision will change in (i) (ii) and (iii) above if the elements in the matrix represents cost and what will be the decisions ?

2. Answer any **two** : 7 + 7

- (a) In a factory machines breakdowns on an average rate of 10 machines/hour. The down cost of the machine is ₹ 20/hour. The factory works 8 hours a day. The manager is considering two mechanics for repairing the machines. Mechanic A takes on an average 5 minutes to repair a machine and charges ₹ 10/hour. Mechanic B takes on an average 4 minutes to repair a machine and charges ₹ 15/hour. Which of the two mechanics should be hired, assuming that machine breakdown rate is Poisson distributed and repair follow exponential distribution.

- (b) Telephone users arrive at a booth following a Poisson distribution with an average time of 5 minutes between one arrival and the next. The time taken for a telephone call, on an average, 3 minutes and follows exponential distribution. What is the probability that the telephone booth is busy ? What is the average number of Telephone users waiting for the services ? What changes in the parameter will reduce the waiting time in the system to half of the present waiting time.
- (c) Goods truck arrive randomly at a stockyard with a mean of 8 trucks /hour. A team of four persons can unload a truck in 6 minutes. Trucks waiting in queue to be unloaded are paid a waiting charge at the rate of ₹ 60/hour. Each person of the team is paid ₹ 20/hour. It is possible to increase the strength of the unloading team by 2 teams or 3 teams (4 persons in each team) that will reduce the unloading time to 4 minutes and 3 minutes respectively. Find the optimal number of teams.

3. Answer any **two** :

7 + 7

- (a) A dealer is supplying the following information to you with regard to a product dealt in by him.

Annual demand: 10000 units, ordering cost: ₹ 10/order, Holding cost: 20% of the value of the inventory per year, price: ₹ 20/unit.

The dealer is considering the possibility of back order to occur and annual back ordering cost is estimated to be 25% of the value of the inventory and in this situation he wants you to find the following:

- (i) What should be the optimum number of units of the product he should buy in one lot ?
- (ii) What quantity of the product should be allowed to be back ordered ?
- (iii) What should be the maximum quantity in inventory at any time of the year ?

Would you recommend to allow back ordering, give reason in support of your answer.

- (b) A stockist has to supply 400 units of a product every Monday to his customers. He gets the product at ₹ 50/unit from the manufacturer. The cost of ordering is ₹ 75/order. The of carrying inventory is 7.5% per year of the cost of the product. Find :

- (i) The economic lot size
- (ii) The total optimal cost( including the capital cost)
- (iii) The total weekly profit if the item is sold for ₹ 55/unit

- (c) An item is produced at a rate of 50 items/day. The demand occurs at the rate of 25 items/day. The set up cost is ₹ 100/setup and holding cost is ₹ 0.01 per unit of the item per day. Find:

- (i) The economic lot size of one run
- (ii) Time of cycle
- (iii) The minimum total cost of one run

4. Answer any **one** :

14

- (a) A company manufactures around 200 bicycles. Depending upon the availability of raw materials and other conditions, the daily production has been varying from 196 bicycles to 204 bicycles whose probability distribution is given below :

<b>Production/day :</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 bicycles are transported in a truck that can accommodate only 200 bicycles. Using the following 15 random numbers :

82,89,78,24,53,61,18,45,04,23,50,77,27,54 and 10

Simulate the process to find out

- (i) The average number of bicycles waiting in the factory.  
(ii) The number of empty spaces in the truck.
- (b) A dentist schedules all her patients for 30 minutes appointments. The following table shows the various categories of work, their probabilities and the time needed to complete the work:

<b>Category</b>	<b>Time required (in minutes)</b>	<b>Probability of category</b>
Filling	45	0.40
Crown	60	0.15
Cleaning	15	0.15
Extraction	45	0.10
Checkup	15	0.20

Simulate the dentist's clinic for four hours and determine the waiting time for the patients as well as the idleness of the doctor. Assume that all the patients arrive exactly at their schedule arrival time, starting at 8 a.m. Use the following random number : 40,82,11,34,25,66,17,79

5. Answer any **two** :

7 + 7 = 14

- (a) Calculate the trend value by the method of least square. Also calculate the trend value for 2012.

<b>Year :</b>	2001	2002	2003	2004	2005	2006	2007
<b>Sales (₹ Lacs) :</b>	125	128	133	135	140	141	143

- (b) The following data relate to advertising expenditure (₹ in lacs) and their corresponding sales (₹ in crores) :

<b>Advertising Expenditure :</b>	10	12	15	23	20
<b>Sales :</b>	14	17	23	25	21

- (i) Find the equation of the line fitting the data.  
(ii) Estimate the value of sales corresponding to Advertising expenditure of ₹ 30 Lakhs.  
(iii) Calculate the standard error of estimate of sales on Advertising expenditure.

- (c) A sample survey of 5 families was taken and figures were obtained with respect to their annual savings  $x_1$  (₹ in 100's), annual income  $x_2$  (₹ in 1000's), and family size  $x_3$ . The data are summarize below :

Family	their annual savings $x_1$	Annual income $x_2$	family size $x_3$
1	10	16	3
2	5	13	6
3	10	21	4
4	4	10	5
5	8	13	3

- (i) Find the least square regression equation of  $x_1$  on  $x_2$  and  $x_3$ .
- (ii) Estimate the annual savings of a family whose size is 4 and annual income is ₹ 16000.
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