

Operations Research
 BE - sem - VII (CBSEGS) Mech - OR

QP CODE : 794301

21/12/16

Time 3 Hours

Total marks 80

Instructions - 1. Question no. ONE is compulsory.

2. Attempt any THREE out of remaining FIVE questions.

3. Assume suitable data where ever necessary but justify the same.

4. Use of calculators, random number tables, normal distribution tables is permitted.

5. Use graph papers where ever necessary.

1. Attempt any Four of the followings:

- a) Discuss importance of Operations Research in decision making.
- b) Explain duality in LPP with suitable example.
- c) What are the various costs associated with the inventory control models?
- d) State and explain Bellman's principle of optimality in Dynamic Programming.
- e) Explain the term Saddle point in Game theory and Solve the following game -

	B		
A	8	5	9
	12	8	10
	-4	4	6

2. a) A company produces two types of leather belts, A and B. Belt A is of a superior quality and B is of an inferior quality. The profits from the two are Rs.40 and Rs.30 per belt, respectively. Each belt of type A requires twice as much time as required by a belt of type B. If all the belts were of type B, the company could produce 1,000 belts per day. But the supply of leather is sufficient only for 800 belts per day. Belt A requires a fancy buckle and only 400 of them are available per day. Enough buckles are available for making belts of type B. Solve this problem to determine how many units of the two types of belt the company should manufacture in order to have the maximum overall profit? Use SIMPLEX method.

b) Solve the following games-

i)

	B		
A	15	2	3
	6	5	7
	-7	4	0

ii)

	B			
A	16	20	10	13
	8	13	11	15
	12	10	18	17

3. a) Comfort Travel Agency arranges 1-week tours to Goa and south Konkan region. The agency has to provide 7, 4, 7 and 8 rental cars over the next 4 weeks. The agency subcontracts with a local car dealer to supply rental needs. The dealer charges a rental fee of Rs.220 per car per week, plus a flat fee of Rs.500 for any rental transaction. The agency, however, may elect to keep the rentals for an additional week and simply continue to pay the rent. What is the best way for the agency to handle the rental situation?

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b) At a booking window customers arrive at the rate of 16 per minute approximated to Poisson's distribution. If service time is exponentially distributed with a mean of 24 per minute, determine
 a) Probability that the booking clerk waits for the customer. b) Probability that there are 3 customers in the system c) Average waiting time in the queue. d) Average number of customers in the system. (10)

4. a) Certain company makes products at four factories A, B, C and D. The unit production cost in them is Rs.2, Rs.3, Rs.1 and Rs.5 respectively. The production capacities are factory A-50 units, B-70 units, C-50 30 units and D-50 units. These factories supply the product to four stores, demands of which are 25, 35, 105 and 20 units respectively. Unit transportation cost in rupees from each factory to each store is given in the following table. Determine the extent of deliveries from each of the factories to each of the stores so that the total production and transportation cost is minimum. (10)

		Stores			
		1	2	3	4
Factorie	A	2	4	6	11
	B	10	8	7	5
	C	13	3	9	12
	D	4	6	8	3

- b) The following table gives probability distribution of failures observed for a certain type of light bulbs: (10)

Week	1	2	3	4	5
Probability of failure	0.10	0.16	0.24	0.32	0.18

There are 3000 bulbs in use and it costs Rs.18 to replace an individual bulb which has burnt out at the end of the week. If all bulbs are replaced simultaneously it would cost Rs. 8 per bulb. It is proposed to replace all bulbs at fixed interval of time, irrespective of their status and to continue replacing burnt out bulbs at the end of every week. At what interval should all the bulbs be replaced? What is the average cost of replacement if all the bulbs are replaced as per individual replacement policy?

5. a) A company has a team of four salesmen and there are four districts where company wants to start its business. After taking into account the capabilities of salesmen and the nature of districts, the company estimates that the profit per day in rupees for each salesman in each district is given in the following table. Find the assignment of salesmen to various districts which will yield maximum profit. (10)

		Districts			
		1	2	3	4
Salesmen	A	16	10	14	11
	B	14	11	15	15
	C	15	15	13	12
	D	13	12	14	15

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- b) Use Two Phase method to solve the following L.P.P. (10)

$$\text{Minimize } Z = 12x_1 + 18x_2 + 15x_3$$

$$\text{Subject to } 4x_1 + 8x_2 + 6x_3 \geq 64$$

$$3x_1 + 6x_2 + 12x_3 \geq 96$$

$$x_1, x_2, x_3 \geq 0$$

6. a) The output of production line is checked by an inspector for one or more of three types of defects, named as type A, B, and C. If defect A occurs item is scrapped, if defects B or C occurs item needs to be reworked. The time required to rework defect of type B is 15 minutes and the time required to rework defect of type C is 30 minutes. The probabilities of occurrence of defects of type A, B, and C are 0.15, 0.20, and 0.10 respectively. For ten items coming off the assembly line, determine the number of items found without any defect, total time taken for rework. (10)

Random numbers – 2396 5582 7556 7468 0858 4840 0382 1011 8934 9525
 6684 7246 2103 9536 4971 5827 8951 1547 1212 9529
 8897 1524 2433 6110 1908 4267 9808 9461 0558 9770

- b) The Roof constructions need 100 cement bags per day. Holding cost of each bag is 10 paise per day. No shortages are allowed. Cost of placing the order is Rs.900 per lot. (10)

The price per bag is quoted as follows:

Order quantity	Price per bag
$Q < 500$	Rs.25
$500 \leq Q < 2000$	Rs.24.80
$2000 \leq Q < 4000$	Rs.24.60
$4000 \leq Q$	Rs.24.40

Find the minimum cost procurement quantity and the total system cost per day.

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