

Code No: **R31032**

R10

Set No. 1
III B.Tech I Semester Supplementary Examinations, June - 2015
OPERATIONS RESEARCH
(Mechanical Engineering)
Time: 3 hours
Max. Marks: 75
Answer any FIVE Questions
All Questions carry equal marks

- 1
 - a) What is duality principle? Explain. [7]
 - b) Use the duality principle to solve the following L.P.P and find the solution of primal from the dual solution. [8]

Minimize $z = 4x_1 + 2x_2 + 3x_3$
 subjected to: $x_1 + 4x_3 \geq 5$
 $2x_1 + 3x_2 + x_3 \geq 4$ and
 $x_1, x_2, x_3 \geq 0.$
- 2
 - a) Briefly explain the Vogel's Approximation Method. [7]
 - b) An oil corporation has got three refineries R1, R2, R3 and it has to send petrol to four different depots D1, D2, D3 and D4. The cost of supplying of one litre of petrol from each refinery to each depot is given below. The requirements of the depot and the available petrol at the refineries are also given. Find the minimum cost of shipping after obtaining the initial solution by Vogel's Approximation Method. [8]
- 3
 - a) Briefly explain what you mean by "individual and group replacement policy" in Replacement Analysis. [7]
 - b) There is a special light bulb that never lasts longer than 2 weeks. There is a chance of 0.3 that a bulb will fail at the end of first week. There are 100 new bulbs initially. The cost for individual replacements is Rs.1.25 and the cost per bulb for group replacement is Rs.0.50. Is it cheaper to replace all the bulbs,
 (i) Individually (ii) every week (iii) every second week. [8]
- 4
 - a) Explain the following: (i) competitive games (ii) Two-person zero -sum game. [7]
 - b) Solve the following game using dominance principle. [8]

	Player B				
Player A		1	2	3	4
	I	19	6	7	5
	II	7	3	14	6
	III	12	8	18	4
	IV	8	7	13	-1

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- 1 a) What is an unbounded solution? Explain. [7]
- b) Use the graphical method to solve the following LP Problem [8]

Maximize $Z = 3x_1 + 4x_2$
 subject to the constraints
 $x_1 - x_2 = -1$
 $-x_1 + x_2 \leq 30$
 $x_1, x_2 \geq 0$.
- 2 Obtain the VAM starting solution for the following transportation problem. And solve it. [15]

Depots ↓	Customer				Supply
	1	2	3	4	
1	18	16	8	11	100
2	14	14	8	10	125
3	19	15	16	15	70
4	8	12	19	11	80
Demand	55	130	95	95	375

- 3 A manufacturer finds from his records that the cost per year associated with the machine whose purchase price is Rs 5000/- are as follows: [15]

Year	1	2	3	4	5	6	7	8
Running cost in Rs.	1500	1600	1800	2100	2500	2900	3400	4000
Resale value in Rs.	3500	2500	1700	1200	800	500	500	500

Determine age at which the machine should be replaced.

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- 4 a) Consider the following pay-off matrix and determine the optimal strategy. [7]

		B		
		I	II	III
A	I	6	9	4
	II	5	10	7
	III	9	8	9

- b) Write a note on zero-sum games. [8]
- 5 A company distributes its product by trucks loaded at its only loading station. Both company's trucks and contractor's trucks are used for this purpose. It was found out that on an average every five minutes on truck arrived and the average loading time was three minutes. 50% of the trucks belong to the contractor. Find out: [15]
- The probability that a truck has to wait.
 - The waiting time of truck that waits and
 - The expected waiting time of contractor's trucks per day assuming a 24 hours shift.
- 6 a) A Company uses annually 48000 units of a raw material costing Rs. 1.20 / unit. Placing each order costs Rs. 45/-, carrying cost is 1.5 % /year of the average inventory. Find E.O.Q and Minimum cost. [7]
- b) Discuss the impact on lot size if shortages are allowed. [8]
- 7 a) Discuss the relation between linear and dynamic programming. [7]
- b) Solve the following problem by using dynamic programming: [8]
- $$\begin{aligned} \text{Max. } Z &= 2x_1 + 9x_2 \text{ subject to} \\ 2x_1 + x_2 &\leq 25 \\ x_2 &\leq 11 \\ x_1, x_2 &\geq 0. \end{aligned}$$
- 8 Name some simulation languages. Discuss the characteristic of any one such languages. [15]

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 1 a) Describe the different methods of solving O.R. models. [7]

 b) Write the dual of the following primal problem. [8]

$$\begin{aligned}
 &\text{Minimize } Z = x_1 + 3x_2 \quad \text{Subject to :} \quad 3x_1 + 4x_2 \geq 5 \\
 &\quad \quad \quad \quad \quad \quad \quad \quad \quad \quad x_1 + x_2 \geq 2 \\
 &\quad \quad \quad \quad \quad \quad \quad \quad \quad \quad x_1 + 2x_2 \geq 3 \\
 &\quad \quad \quad \quad \quad \quad \quad \quad \quad \quad x_1, x_2, x_3 \geq 0
 \end{aligned}$$

 2 Solve the following transportation problem. [15]

		Destinations					
		D1	D2	D3	D4	D5	Availability
Origins	O ₁	9	12	9	6	9	5
	O ₂	7	3	7	7	5	4
	O ₃	6	5	9	11	3	2
	O ₄	6	8	11	2	2	9
Requirements		4	4	6	2	4	20

 3 The following failure rates have been observed for a certain type of light bulbs: [15]

End of week :	1	2	3	4	5	6	7	8
Probability of failure to date :	0.05	0.13	0.25	0.43	0.68	0.88	0.96	1.00.

The cost of replacing an individual bulb is Rs1.25. The decision is made to replace all bulbs simultaneously at fixed intervals and also to replace individual bulbs as they fail in service. If the cost of group replacement is 30 paise per bulb, what is the best interval between group replacements?

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- 4 a) For the following pay-off matrix, determine the best strategies and the value of the game. [7]

		Y		
		j	k	l
X	p	60	50	40
	q	70	70	40
	r	80	60	75

- b) Briefly explain the limitations of game theory. [8]
- 5 a) Gives a brief description of the various types of queues. [7]
- b) In a color TV manufacturing plant, a loading unit takes exactly 10 minutes to load two TV sets at a time into a wagon and again comes back to the position to load another set of TVs. If the arrival of TVs is a Poisson stream at an average of 2 TVs every 20 minutes calculate the average waiting time of 2 TV sets in a stationary state. [8]
- 6 a) An automobile spares company has an annual demand for 5000 spares. The cost of placing order is Rs. 250/- & inventory carrying cost is 30 %. The price / spare is Rs. 50/-. The Supplier offers 2 % discount if 1000 or more spares are purchased. What should be the ordering quantity? [7]
- b) Explain briefly: i) Sit up Cost ii) Holding Cost iii) Lead time. Give examples for each. [8]
- 7 a) Write a note on the application of dynamic programming. [7]
- b) Define the following terms in dynamic programming : [8]
 i) State ii) State variable iii) Immediate return iv) Optimal return
- 8 Define simulation. Explain utility of simulation to solve inventory problems. [15]

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1. a) Define Operations Research in at least three different ways. [7]

- b) Solve the following using graphical method [8]

 maximize $Z = 9x + 10y$ subject to

$11x + 9y \leq 9900$

$7x + 12y \leq 8400$

$6x + 16y \leq 9600$ and

$x \geq 0, y \geq 0$

2. a) When do you say a solution to a transportation problem is degenerate? [7]

- b) A company has three plants X, Y, Z and each producing 50,100,150 units of similar products. There are five ware houses W1, W2, W3, W4 and W5 having demand of 100, 70, 50, 40 and 40 units respectively. The cost of transporting the products from plants to warehouses is given in the following matrix. [8]

	W1	W2	W3	W4	W5
X	20	28	32	55	70
Y	48	36	40	44	25
Z	35	55	22	45	48

Determine the transportation schedule so that the cost is minimized.

3. State the conditions under which the problem of processing of jobs through three machines has been solved. Describe the corresponding algorithm. Find the sequence that minimizes the total time required to complete the following tasks: [15]

Task	A	B	C	D	E	F	G
Machine I	9	8	7	4	3	8	7
Machine II	1	3	2	5	4	4	3
Machine III	5	7	5	11	6	6	12

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Set No. 4

- 4 a) Briefly explain (i) pure strategy (ii) mixed strategy (iii) optimal strategy [7]
 b) Find the saddle point, optimum strategies and value of the game in the following pay off matrix. [8]

X

		A	B	C	D
Y	I	-3	4	2	9
	II	7	8	6	10
	III	6	2	4	-1

- 5 a) State some of the important distributions of arrival intervals and service times. [7]
 b) In a car garage A, it takes 15 minutes to wash one car. Cars arrive to the garage at an average rate of one every 25 minutes and arrival process is Poisson. In Car-garage B, it takes 25 minutes to wash one car and cars arrive to this shop at an average rate of one every 45 minutes, the arrival process being Poisson during steady state. Determine (a) at which garage you expect the bigger queue. (b) at which garage you require more times waiting including the service time. [8]
- 6 a) What are the reasons for stocking items in inventory? [7]
 b) A manufacturing company purchases 10000 parts of a machine for its annual requirements ordering one month usage at a time. Each part costs Rs. 30/-. The ordering cost per order is Rs. 25/- and the carrying charges are 25% of the average inventory per year. You have been asked to suggest a more economical purchasing policy for the company. What advice would you offer, and how much would it save the company per year? [8]
- 7 a) What are the situations warranting the use of dynamic programming? [7]
 b) Six units of capital are available to invest in four business ventures. The returns from each unit of investment in all the four ventures are given in the table below. Find how the capital should be allocated to business proposals in order to maximize profit using dynamic programming. [8]

	Expected returns from Business proposals				
	Unit	A	B	C	D
Capital	0	0	0	0	0
	1	5	2	6	2
	2	6	4	7	3
	3	7	6	8	4
	4	8	8	8	5
	5	8	9	8	6
	6	8	10	8	6

- 8 a) Discuss about various types of simulation models. [7]
 b) What are the advantages and disadvantages of simulation models? [8]
