

Code No: 117FZ

R13

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech IV Year I Semester Examinations, March - 2017

OPERATIONS RESEARCH

(Common to ME, CSE, IT, MCT, AME, MNE, AGE, MSNT)

Time: 3 Hours

Max. Marks: 75

Note: This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

Part- A (25 Marks)

- 1.a) What is meant by redundant constraint? [2]
- b) What are the shadow prices? What is its significance in simplex method of solving LPP? [3]
- c) When does degeneracy occur in Transportation Problem? [2]
- d) Distinguish between assignment and allocation problem [3]
- e) What are the conditions recommended for the replacement of a machine with a new one when you already have an old one? [2]
- f) Explain the possibility and working rules of a maximization case in sequencing. [3]
- g) Which competitive situation is called a game? [2]
- h) What are the consequences of over-inventory and under-inventory situations? [3]
- i) Define Bellman's principle of optimality with examples. [2]
- j) What do you understand by (M/M/1) : (  $\alpha$ /FCFS). Explain the terms [3]

Part-B (50 Marks)

2. Solve the following problem by simplex method adding artificial variable

$$\text{Max. } Z=2x_1+5x_2+7x_3$$

$$\text{Subject to } 3x_1+2x_2+4x_3 \leq 100$$

$$x_1+4x_2+2x_3 \leq 100$$

$$x_1+x_2+3x_3 \leq 100$$

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

[10]

OR

3. Old hens can be brought at Rs 20 each and young ones at Rs. 50 each. The old hens lay 3 eggs per week and the young ones lay 5 eggs per week, each egg being worth of Rs. 1.50 ps. A hen (young or old) costs Rs. 1.50 per week to feed; I have only Rs. 800 to spend for hens. How many of each kind should I buy to give a profit of at least Rs.60/- per week, assuming that I cannot house more than 20 hens? [10]

4. Solve the following transportation problem, by findings; find the IBFS by North West corner rule and OBFS by stepping stone method, where the entries are cost coefficients. [10]

	To Destination				Availability	
		1	2	3		4
From Origins	1	15	0	20	10	50
	2	12	8	11	20	50
	3	0	16	14	18	100
Requirement		30	40	60	70	200

OR

5. Raju and Co. has four lathe machines on which four workers operate. Any worker can operate any machine but due to the difference in skill and machine complexity the time of operation varies. The average times in hours when same job done on each machine by each worker is given below

	L <sub>1</sub>	L <sub>2</sub>	L <sub>3</sub>	L <sub>4</sub>
W <sub>1</sub>	7	6	4	9
W <sub>2</sub>	5	5	8	8
W <sub>3</sub>	4	5	4	6
W <sub>4</sub>	7	8	5	8

- a) Find optimal allocation.  
 b) The company wants to replace the less efficient lathe with a new machine. The probable times (in hrs) that each worker can operate is estimated as 4, 5, 6 and 6 respectively. Verify whether the company has to replace any machine. If so, which machine is to be replaced? [10]
6. There are six jobs, each of which must go through machines A, B and C. Processing time (in hours) are given in the following table

Job	1	2	3	4	5	6
Machine A	12	10	9	14	7	9
Machine B	7	6	6	5	4	4
Machine C	6	5	6	4	2	4

Order of the processing of each job is ACB. Sequence suggested is 5-3-6-2-1-4.

Find the total time elapsed for the sequence suggested. [10]

OR

7. An individual is planning to purchase a car will cost Rs. 1, 20,000. The resale value of the car at the end of the year is 85% of the previous year value. Maintenance and operation costs during the first year are Rs. 20,000 and they increase by 15% every year. The minimum resale value of car can be Rs. 40,000.

- a) When should the car be replaced to minimize average annual cost (ignore initial)?  
 b) If interest of 12% is assumed, when should the car be replaced? [10]

8. Write the assumptions made in game theory. Solve the following game graphically. [10]

1	-3
3	5
-1	6
4	1
2	2
-5	0

OR

9. The demand for an item in a company is 15000 units per year and the company can produce the items at a rate of 300 per month. The cost of one set-up is Rs. 500 and holding cost of 1 unit per month is 15 paise. The shortage cost of one unit is Rs. 20 per month. Determine:
- Optimum production batch quantity and number of shortages.
  - Optimum cycle time and production time.
  - Maximum inventory level in the cycle.
  - Total associated cost per year if the cost of the items is Rs. 20 per unit. [10]

10. A person repairing radios finds that the time spent on the radio sets has an exponential distribution with mean 20 minutes. If the radios are repaired in the order in which they come in and their arrival is approximately Poisson with an average rate of 15 for 8-hour day, what is the repairman's expected idle time in each day? How many jobs are ahead of the average set just brought in? [10]

OR

11. A medical representative located at city 1 has to travel to city 10. He knows the distance of alternative routes from city 1 to city 10 and has drawn the network map based on the distance between the cities as in the following table. Draw the network and find the shortest possible route. Also, find the shortest routes from any city to city 10. [10]

From city	To city	Corresponding distance in km
1	2, 3, 4	4, 6, 3
2	5, 6, 7	7, 10, 5
3	5, 6, 7	3, 8, 4
4	5, 6, 7	6, 10, 5
5	8, 9	4, 8
6	8, 9	3, 7
7	8, 9	8, 4
8	10	7
9	10	9

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