

**Code No: 821AJ**
**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**
**MCA II Semester Examinations, December - 2019**
**OPERATIONS RESEARCH**
**Time: 3hrs**
**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**
**5 × 5 Marks = 25**

- 1.a) State the various types of OR models according to structure. [5]
- b) State the variants of assignment problem. How are they resolved? [5]
- c) State and explain Johnson's algorithm for n jobs and two machine problems. [5]
- d) State and explain Bellman's principle of optimality. [5]
- e) State the functions of inventory. [5]

**PART - B**
**5 × 10 Marks = 50**

- 2.a) Define OR. State and explain various phases of OR.
- b) Solve the following LPP by using the graphical method. [4+6]

$$\begin{aligned}
 &\text{Minimize } Z = 6x_1 + 4x_2 \\
 &\text{st } 2x_1 + 3x_2 \leq 30 \\
 &\quad 3x_1 + 2x_2 \geq 24 \\
 &\quad x_1 + x_2 \geq 3 \quad x_i \geq 0 \forall i
 \end{aligned}$$

**OR**

3. Solve the following LPP problem by two-phase method

$$\begin{aligned}
 &\text{Max } Z = 4x_1 + 3x_2 + 5x_3 \\
 &\text{st } x_1 + 3x_2 + 2x_3 \leq 10 \\
 &\quad 2x_1 + 2x_2 + x_3 \geq 6 \\
 &\quad x_1 + 2x_2 + 3x_3 = 14, \quad x_i \geq 0 \forall i
 \end{aligned}$$

**[10]**

4. A company has three factories I, II, III and four warehouses 1, 2, 3, 4. The transportation cost (in Rs.) per unit from each factory to each ware house is given in table. The requirements of each warehouse and the capacity of each factory are given below.

	1	2	3	4	Availability
I	25	17	25	14	400
II	15	10	18	24	600
III	16	20	8	13	600
Requirement	300	300	500	500	

Find the minimum cost of transportation schedule. Use Vogel's method for finding the initial basic feasible solution. [10]

**OR**

5. Give the following across city distance table, find the minimum distance root provided his home town is A. [10]

	To				
From	A	B	C	D	E
A	$\infty$	7	6	8	4
B	7	$\infty$	8	5	3
C	6	8	$\infty$	9	7
D	8	5	9	$\infty$	8
E	4	6	7	8	$\infty$

6. Two jobs are to be processed on four machines A, B, C and D. The technological order for these jobs on machines is as follows:

Job 1	A	B	C	D
Job 2	D	B	A	C

Processing times are given in the following table:

	Machines			
	A	B	C	D
Job 1	4	6	7	3
Job 2	4	7	5	8

Solve it by graphical method.

[10]

**OR**

7. A manufacturer is offered two machines A and B. Machine A is priced at Rs.5000 and its running costs are estimated at Rs.800 for each of the first five years increasing by Rs.200 per year in the sixth and subsequent years. Machine B that has the same capacity as A costs Rs.2500 but would have running costs Rs.1200 per year for six years, increasing by Rs.200 per year thereafter. If money is worth 10% per year, which machine should be purchased? [10]
8. A company has to transport some goods from city A to city J. The cost of transportation between the different cities is given in the following network. Find the optimal route connecting cities A and J. [10]

	B	C
A	5	4

	D	E	F
B	4	3	-
C	-	2	6

	G	H	I
D	3	6	-
E	5	7	8
F	-	9	9

	J
G	7
H	3
I	8

**OR**

- 9.a) Explain the terms i) Payoff matrix ii) saddle point iii) value of the game.  
 b) Solve the following game graphically where pay off matrix for player A has been prepared.

8	-6
7	-4
-7	6
-4	-2

[5+5]

10. Beta industry estimates that it will sell 24000 units of its product for the forthcoming year. The ordering cost is Rs.150 per order and carrying cost per unit per year is 20% of the purchase price per unit. The purchase price per unit is Rs.50. Find:  
 a) Economic Order Quantity  
 b) No. of orders per year  
 c) Time between successive orders.  
 Derive the formula for economic ordering quantity by clearly stating the assumptions of it and use it.

[10]

**OR**

- 11.a) Explain about Kendal notations used in queuing theory.  
 b) In a railway yard goods train arrive at a rate of 30 trains/day. Assuming that the inter arrival time follows an exponential distribution and service time distribution is also exponential with an average 36 minutes. Calculate the following:  
 i) The average number of trains in the queue.  
 ii) The average waiting of a train in the system.  
 iii) The probability that the number of trains in the system exceeds 10.

[4+6]

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