LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – **MATHEMATICS**

SIXTH SEMESTER – **APRIL 2022**

16/17/18UMT6MS01 – OPERATIONS RESEARCH

Date: 22-06-2022 Dept. No. Max. : 100 Marks

Time: 01:00 PM - 04:00 PM

PART – A

Answer ALL Questions **(10 x 2 = 20)**

1. Define optimal basic feasible solution in a linear programming problem.
2. Define slack variable in a linear programming problem.
3. What is a transportation problem?
4. Define degeneracy in transportation problem
5. What is an unbalanced assignment problem?
6. Define payoff matrix.
7. What is the maxi-min principle in game theory?
8. Define a path, cycle and tree in a network.
9. Write any two differences between CPM and PERT.
10. What is economic order quantity?

PART – B

Answer any FIVE Questions **(5 x 8 = 40)**

11. Use the graphical method to solve the following linear programming problem.

Maximize $Z = 2\,x_1 + x_2$ subject to the constraints

$$x_1 + 2x_2 \le 10$$
$$x_1 + x_2 \le 6$$
$$x_1 - x_2 \le 2$$
$$x_1 - 2x_2 \le 1$$
$$\text{and} \quad x_1, x_2 \ge 0.$$

12. Use the simplex method to solve the following linear programming problem.

Maximize $Z = 5\,x_1 + 3x_2$ subject to the constraints

$$x_1 + x_2 \le 2$$
$$5x_1 + 2x_2 \le 10$$
$$3\,x_1 + 8x_2 \le 12$$
$$\text{and} \quad x_1, x_2 \ge 0.$$

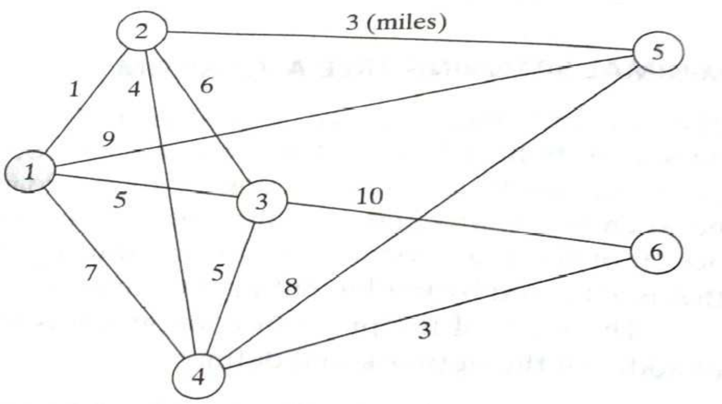
13. Determine an initial feasible solution to the following transportation problem by North West Corner method and Least cost method.

	Destination					
Source		**D1**	**D2**	**D3**	**D4**	**Supply**
	S1	6	4	1	5	**14**
	S2	8	9	2	7	**16**
	S3	4	3	6	2	**5**
	Demand	**6**	**10**	**15**	**4**	

14. Solve the following assignment problem.

	Persons					
Jobs		**P1**	**P2**	**P3**	**P4**	**P5**
	J1	10	5	13	15	16
	J2	3	9	18	13	6
	J3	10	7	2	2	2
	J4	7	11	9	7	12
	J5	7	9	10	4	12

15. A TV cable company is in the process of providing cable service to five new housing development areas. The following figure depicts possible TV linkages among the five areas in which the TV company is labelled 1 and the areas are labelled from 2 to 6. The cable miles are shown on each arc. Determine the most economical cable network.



16. Solve the following game using graphical method.

$$\begin{array}{cc} & \text{Player } B \\ \text{Player } A & \begin{bmatrix} -6 & 7 \\ 4 & -5 \\ -1 & 2 \\ -2 & 5 \\ 7 & -6 \end{bmatrix} \end{array}$$

17. Solve the following game using dominance principle.

Player A	Player B			
	B1	**B2**	**B3**	**B4**
A1	3	2	4	0
A2	3	4	2	4
A3	4	2	4	0
A4	0	4	0	8

18. A manufacturer has to supply his customer with 600 units of his product per year. Shortages are not allowed and the storage cost amounts to Rs. 60 per unit per year. The set-up cost per run is Rs. 80.00. Find the optimum run size and the minimum average yearly cost.

PART – C

Answer any TWO Questions **(2 x 20 = 40)**

19. Solve the following linear programming problem by simplex method.

$$\text{Maximize } Z = 3x_1 + 5x_2 + 4x_3$$

Subject to the constraints

$$2x_1 + 3x_2 \leq 8$$

$$2x_2 + 5x_3 \leq 10$$

$$3x_1 + 2x_2 + 4x_3 \leq 15$$

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

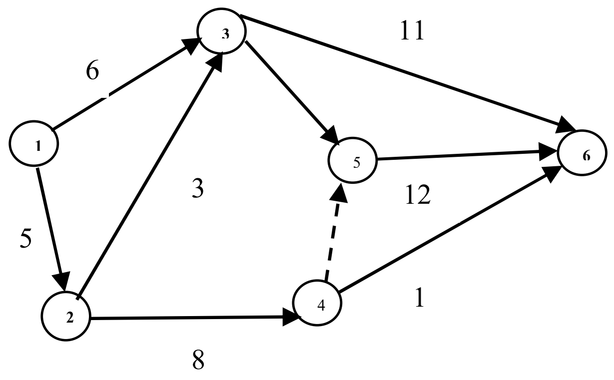
20. Find the optimal solution to the following transportation problem.

	Destination					
Source		**D1**	**D2**	**D3**	**D4**	**Supply**
	S1	19	30	50	10	**7**
	S2	70	30	40	60	**9**
	S3	40	8	70	20	**18**
	Demand	**5**	**8**	**7**	**14**	**34**

21. (a). Draw the network for the project whose activity and precedence relationships are given below.

Activity	A	B	C	D	E	F	G	H	I	J
Predecessor	–	-	-	–	A, B	E	F	D	G, H	C, I
Duration(weeks)	3	2	4	3	2	2	2	1	2	4

(b). Determine critical path for the network given below (All the durations are given in days).



(6+14)

22. (a). A commodity is to be supplied at a constant rate of 200 units per day. Supplies of any amount can be had at any required time, but each ordering costs Rs. 50; cost of holding the commodity in inventory is Rs. 2.00 per unit per day while the delay in the supply of the item induces a penalty of Rs.10 per unit day. Find the optimal policy (Q, t), where t is the reorder cycle period and Q is the inventory level after reorder.

(b). The annual demand of a product is 10,000 units. Each unit costs Rs.100 if orders placed in quantities below 200 units but for orders of 200 or above the price is Rs. 95. The annual inventory holding cost is 10 percent of the value of the item and the ordering cost is Rs. 5 per order. Find the economic lot size.

(10+10)

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