LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

FIFTH SEMESTER – **APRIL 2018**

MT 5507– OPERATIONS RESEARCH

Date: 27-04-2018 Dept. No. Max. : 100 Marks
Time: 09:00-12:00

PART – A

Answer ALL questions: **(10 x 2 = 20 marks)**

1. What is the limitation of graphical method?
2. What is the need for an artificial variable in a LPP?
3. Define degeneracy in transportation problem.
4. Write the mathematical formulation of an assignment problem.
5. Define Two-person zero sum game.
6. For what value of λ, the game with the following matrix is strictly determinable.

$$\begin{array}{c} \\ A_1 \\ A_2 \\ A_3 \end{array}\begin{bmatrix} B_1 & B_2 & B_3 \\ \lambda & 6 & 2 \\ -1 & \lambda & -7 \\ -2 & 4 & \lambda \end{bmatrix}.$$

7. Define a spanning tree in a network.
8. State any two rules to be followed while constructing a network.
9. What is meant by inventory?
10. Define Lead time and reorder level.

PART – B

Answer any FIVE questions: **(5 x 8 = 40 marks)**

11. Use graphical method to solve the following LPP.

$$Maximize\, Z = x_1 - 2x_2$$
$$Subject to$$
$$-x_1 + x_2 \le 1$$
$$6x_1 + 4x_2 \ge 24$$
$$0 \le x_1 \le 5$$
$$2 \le x_2 \le 4$$

12. Use duality to solve the following LPP

$$Minimize\ Z = 2x_1 + 2x_2$$
$$Subject to$$
$$2x_1 + 4x_2 \ge 1$$
$$-x_1 - 2x_2 \le -1$$
$$2x_1 + x_2 \ge 1$$
$$and\ x_1, x_2 \ge 0.$$

13. Solve the following assignment problem

$$\begin{array}{c} \\ 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{array}
\begin{array}{c} \begin{array}{ccccc} \text{I} & \text{II} & \text{III} & \text{IV} & \text{V} \end{array} \\
\begin{bmatrix} 11 & 17 & 8 & 16 & 20 \\ 9 & 7 & 12 & 6 & 15 \\ 13 & 16 & 15 & 12 & 16 \\ 21 & 24 & 17 & 28 & 26 \\ 14 & 10 & 12 & 11 & 15 \end{bmatrix} \end{array}$$

14. Solve the following game graphically

$$\begin{array}{cc} & \text{Player A} \\ \text{Player B} & \begin{bmatrix} 2 & 2 & 3 & -2 \\ 4 & 3 & 2 & 6 \end{bmatrix} \end{array}$$

15. For any 2 x 2 two person zero sum game without any saddle point having the pay off matrix for Player A as given below:

$$\begin{array}{ccc} & & \text{Player B} \\ & & \begin{array}{cc} B_1 & B_2 \end{array} \\ \text{Player A} & \begin{array}{c} A_1 \\ A_2 \end{array} & \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \end{array}$$

, find the optimum strategies of players A and B and its value of the game.

16. a) List out the differences between CPM and PERT.

b) Construct a network for the project whose activities are given below

Activity:	0 -1	1-2	1-3	2-4	2-5	3-4	3-6	4-7	5-7	6-7
Duration: (weeks)	3	8	12	6	3	3	8	5	3	8

Find its critical path.

17. A tyre producer make 1200 tyres per day and sells than at approximately half that rate. Accounting figures show that the productions set up cost is Rs.1,000 and carrying cost per unit is Rs.5. If annual demand is 1,20,000 tyres, what is the optimal lot size and how many production runs should be scheduled per year?

18. Find the shortest path from node A to node E for the following network using Dijkstra’s algorithm.

PART – C

Answer any TWO questions: (2 x 20 = 40 marks)

19. Use Big-M method to solve the following LPP.

$$Minimize\ \ Z = 4x_1 + 3x_2$$

$$subject to$$

$$\begin{aligned} 2x_1 + x_2 &\geq 10 \\ -3x_1 + 2x_2 &\leq 6 \\ x_1 + x_2 &\geq 6 \\ and \quad x_1, x_2 &\geq 0 \end{aligned}$$

20. Solve the following transportation problem

					Supply
	2	3	11	7	6
	1	0	6	1	1
	5	8	15	9	10
Demand	7	5	3	2	

21. a) Using dominance property solve the following game:

$$\begin{array}{c|c} & \begin{array}{cccc} I & II & III & IV \end{array} \\ \begin{array}{c} I \\ II \\ III \\ IV \end{array} & \begin{bmatrix} 3 & 2 & 4 & 0 \\ 3 & 4 & 2 & 4 \\ 4 & 2 & 4 & 0 \\ 0 & 4 & 0 & 8 \end{bmatrix} \end{array}$$

b) Find the optimum order quantity for a product for which the price break-up is as follows:

Quantity	unit cost (Rs.)
$0 \le Q_1 < 500$	10.00
$500 \le Q_2$	9.52

The monthly demand for the product is 200 units, the cost of storage is 2% of the units cost and the cost of ordering is Rs.350. **(12+8)**

22. Using the maximal flow algorithm, find the maximal flow of the network given below:

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