LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

FIFTH SEMESTER – NOVEMBER 2012

# MT 5507/MT 5504 - OPERATIONS RESEARCH

 Date : 06/11/2012 Dept. No. Max. : 100 Marks

 Time : 9:00 - 12:00

**PART – A**

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

1. Define the following: (i) Basic solution (ii) Basic feasible solution
2. Express the following linear programming problem into standard form:

Maximize $z = 7x\_{1}+5x\_{2}$

Subject to $2x\_{1}+3x\_{2}\leq 20$

 3$x\_{1}+ x\_{2} \geq 10$

 $x\_{1} , x\_{2} \geq 0$

1. What is a transportation problem?
2. Give the mathematical formulation of an assignment problem.
3. Define a pure strategy in game theory.
4. Define a saddle point.
5. Define a spanning tree in a network.
6. Define a critical path in a network.
7. What is the Economic order quantity?
8. Differentiate the deterministic and the probabilistic demand inventory models.

 **PART – B**

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

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

Minimize $z = 3x\_{1}+2x\_{2}$

Subject to $5x\_{1}+x\_{2} \geq 10$

 $x\_{1}+ x\_{2} \geq 6$

 $x\_{1}+4x\_{2} \geq 12$

 $x\_{1} , x\_{2} \geq 0$

1. Solve the following LPP by dual simplex method.

Maximize $z = -3x\_{1}-x\_{2}$

Subject to $x\_{1}+ x\_{2} \geq 1$

 $2x\_{1}+3x\_{2} \geq 2$

 $x\_{1} , x\_{2} \geq 0$

1. Determine an initial basic feasible solution to the following transportation problem by Vogel Approximation Method.

 $ D E F G$ Available

 $\begin{matrix}A\\B\\C\end{matrix}\left[\begin{matrix}21\\17\\32\end{matrix} \begin{matrix}16&15&3\\18&14&23\\27&18&41\end{matrix}\right] \begin{matrix}11\\13\\19\end{matrix}$

 Requirement 6 10 12 15

1. Solve the following assignment problem.

 Jobs

 I II III

 Men $\begin{matrix}A\\B\\C\end{matrix}\left[ \begin{matrix}120&100&80\\80&90&110\\110&140&120\end{matrix}\right] $

1. Solve the following game graphically

 $\left[\begin{array}{c}\begin{matrix} 12& 1\\ 20& 3 \end{matrix} \begin{matrix}30&-10\\10& 5\end{matrix}\\\begin{matrix}-5&-2\\15&-4\end{matrix} \begin{matrix} 25& 0\\ 10& 6\end{matrix}\end{array} \right]$

1. A project consists of a series of tables labeled A, B, …, H, I with the following relationships (W < X, Y means X&Y cannot start until W is completed; X, Y < W means W cannot start until both X&Y are completed). With this notations construct the network diagram having the following constraints: A < D, E; B, D < F; C < G; B < H; F, G < I
2. Determine the critical path of the following network.
3. A particular item has a demand of quantity 9000 units/year. The cost of the one procurement is Rs.100 and the holding cost per unit is Rs.2.40 per year. The replacement is instantaneous and no shortages are allowed. Determine
	1. the economic lot size
	2. the number of orders per year
	3. the time between orders

 **PART – C**

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

1. a) Find the optimal solution for the following transportation problem using MODI method.

 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 |

20. Use the penalty (Big-M) method to solve the following LP problem. (10)

Minimize $z = 16x\_{1}+16x\_{2}$

Subject to $2x\_{1}+4x\_{2}\geq 3$

 $3x\_{1}+2x\_{2}\geq 4$

 $x\_{1} , x\_{2} \geq 0$

21. a) Define the Total float, free float and Independent float. (6)

b) The following indicates the details of the activities of a project.

 The durations are in days. (14)

|  |  |  |  |
| --- | --- | --- | --- |
| Activities | TO | TM | TP |
| 1 – 2 | 4 | 5 | 6 |
| 1 – 3 | 8 | 9 | 11 |
| 1 – 4 | 6 | 8 | 12 |
| 2 – 4 | 2 | 4 | 6 |
| 2 – 5 | 3 | 4 | 6 |
| 3 – 4 | 2 | 3 | 4 |
| 4 – 5 | 3 | 5 | 8 |

1. Draw the network
2. Find the critical path
3. Find the mean and standard deviation of the project completion time
4. a) Reduce the following game to $2×2$ game and hence find the optimum strategies and the value

 of the game. (12)

 Player B

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | I | II | III | IV |
| I | 3 | 2 | 4 | 0 |
| II | 3 | 4 | 2 | 4 |
| III | 4 | 2 | 4 | 0 |
| IV | 0 | 4 | 0 | 8 |

 Player A

b) Solve the following unbalanced assignment problem of minimizing total time for doing all the jobs. (8)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  | Jobs |  |  |
| Operators | 1 | 2 | 3 | 4 | 5 |
| 1 | 6 | 2 | 5 | 2 | 6 |
| 2 | 2 | 5 | 8 | 7 | 7 |
| 3 | 7 | 8 | 6 | 9 | 8 |
| 4 | 6 | 2 | 3 | 4 | 5 |
| 5 | 9 | 3 | 8 | 9 | 7 |
| 6 | 4 | 7 | 4 | 6 | 8 |

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