Printed Pages: 7 | 625 | NMCA315

(Following Paper ID and Roll No. to be filled in your Answer Book)

**Paper ID : 214305** Roll No. | | | | | | | | | | |

## MCA

## (SEM. III) THEORY EXAMINATION, 2015-16

## COMPUTER AIDED OPTIMIZATION TECHNIQUES

**[Time:3 hours]** **[Total Marks:100]**

**Note :** Attempt all 3 sections.

### Section - A

1. Attempt all parts. Write answer in brief. (2x10=20)

   (a) Define present worth factor.

   (b) Define the following terms :

      (i) Lead time

      (ii) Re-order point

   (c) What are the limitations of graphical method ?

   (d) Write the following LPP into canonical form

$$\begin{aligned} \max z = \; & 2x_1 - x_2 + 2x_3 \\ \text{subject to :} \; & -x_1 + x_2 + 2x_3 \le 7 \\ & 5x_1 - 2x_2 \ge 5 \\ & x_1, x_2 \ge 0 \end{aligned}$$

(e) How would you deal with the assignment problems, where the objective function is of maximization type ?

(f) How would you deal with degeneracy in transportation problem ?

(g) Write the K-T conditions for the following non-linear programming problem :

max z = $2x_1^2 - 3x_1x_2$

subject to : $x_1 + x_2 \leq 5$

$x_1, x_2 \geq 0$

(h) What is convex programming problem ?

(i) State the characteristics of waiting line.

(j) Define Poison distribution.

## Section - B

**Note :** Attempt **any five** questions. (5x10=50)

2. (a) In relation to linear programming, explain the implications of the following assumptions of the model :

   (i) Linearity of objective function and constraints.

   (ii) Continuous variable.

   (iii) Certainity.

(b) A firm manufactures 3 products A, B and C. The profits are Rs. 3, Rs. 2 and Rs. 4 respectively. The firm has 2 machines and below is the required processing time in minutes for each machine on each product.

| Product ? / Machine ? | A | B | C |
|---|---|---|---|
| G | 4 | 3 | 5 |
| H | 2 | 2 | 4 |

Machine G and H have 2000 and 3000 machine minutes respectively. The firm must manufacture 100 A's, 200 B's and 50 C's, but not more than 150 A's. Set up an LPP to maximize profit.

3. (a) The manager of a company manufacturing car parts has entered into a contract of supplying 1000 numbers per day of a particular part to a car manufacturer. He finds that his plant has a capacity of producing 2000 numbers per day of the part. The cost of the part is Rs. 50. Cost of holding stock is 12% per annum and set up cost per production run is Rs. 100. What should be run size for each production run ? How frequently should production runs be made ?

(b) The cost pattern for two machines A and B, when value is not considered is given below :

| Year : | 1 | 2 | 3 |
|---|---|---|---|
| Machine A : | 900 | 600 | 700 |
| Machine B : | 1400 | 100 | 700 |

Find the cost pattern for each machine, when money is worth 10% per year, and hence find which machine is less costly ?

4. What is degeneracy in LPP ? With the help of the following example, explain the same :

$$\text{Max } Z = 3x_1 + 9x_2$$

Subject to : $x_1 + 4x_2 \leq 8; x_1 + 2x_2 \leq 4; x_1, x_2 \geq 0$

5. (a) Show that an assignment problem can be treated as a particular case of transportation problem.

(b) Four jobs has to be assigned to 4 person such that one person performs one job only. The cost of asssigning jobs to persons is given the table :

| | Person | | | |
|---|---|---|---|---|
| Job | 1 | 2 | 3 | 4 |
| A | 16 | 10 | 14 | 11 |
| B | 14 | 11 | 15 | 15 |
| C | 15 | 15 | 13 | 12 |
| D | 13 | 12 | 14 | 15 |

Solve the above assignment problem to minimize the total cost.

6. Solve the following all-integer programming problem using branch and bound method :
Max $Z = 6x_1 + 8x_2$
Subject to : $4x_1 + 16x_2 \leq 3$; $14x_1 + 4x_2 \leq 28$; $x_1, x_2 \geq 0$ & integers.

7. Find the solution to the problem :

$$\max \begin{pmatrix} x_1 & x_2 \end{pmatrix} \begin{pmatrix} 3 & 4 \\ 0 & 3 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \end{pmatrix}$$

subject to : $x_1^2 + x_2^2 = 1$

8. A ship is to be loaded with stock of 3 items. Each unit of item has a weight $w_i$ and $r_i$. The maximum cargo weight the ship can take is 5 and the details of the three items are as follows :

| Item (i) | Weight ($w_i$) | Value ($r_i$) |
|---|---|---|
| 1 | 1 | 15 |
| 2 | 3 | 40 |
| 3 | 2 | 60 |

Find the most valuable cargo load without exceeding maximum cargo weight by dynamic programming.

9. (a) Patients arrive at a clinic according to Poisson distribution at the rate of 30 patients per hour. The waiting room capacity is 5. Examination time per patient is exponential with mean rate 20 per hour. Find the expected no. of patients in the clinic.

(b) Find the distribution of inter-arrival time for Poisson arrivals in a queing system.

## Section - C

Attempt **any two** questions : (15x2=30)

10. Use dual simplex method to solve the LPP :

$$\min z = 10x1 + 6x_2 + 2x_3$$

$$\text{subject to} : -x_1 + x_2 + x_3 \geq 1;$$

$$3x_1 + x_2 - x_3 \geq 2;$$

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

Also write the dual of the given problem and read it's solution from the optimal table of the given LPP.

11. A company has 3 plants at locations A, B and C, which supply to warehouses located at D, E, F, G and H. Monthly plant capacities are 800, 500 and 900 units respectively. Monthly warehouse requirements are 400, 400, 500, 400 and 800 units respectively. Unit transportation costs (in rupees) are given below. Determine an optimum distribution for the company in order to minimize the total transportation cost.

| | | To | | | | |
|---|---|---|---|---|---|---|
| | | D | E | F | G | H |
| From | A | 5 | 8 | 6 | 6 | 3 |
| | B | 4 | 7 | 7 | 6 | 5 |
| | C | 8 | 4 | 6 | 6 | 4 |

12. Use revised simplex method to solve the LPP

$\max z = 6x_1 - 2x_2 + 3x_3$

subject to : $2x_1 - x_2 + 2x_3 \le 2$

$x_1 + 4x_3 \le 4$

$x_1, x_2, x_3 \ge 0$

—x—