



**LOYOLA COLLEGE (AUTONOMOUS) CHENNAI-600034**

**M.Sc. DEGREE EXAMINATION- MATHEMATICS**

THIRD SEMESTER- NOVEMBER 2015

**MT 3813 – OPERATIONS RESEARCH**

Date : 07/11/2015  
Time : 09:00-12:00

Dept. No.

Max. : 100 Marks

**Answer ALL the questions**

I a) Compare Gomory's cutting plane method with branch and bound method. Which is the method you prefer? Justify your answer.

(or)

b) What is dynamic programming? Write some of the applications. (5)

c) Solve the following integer programming problem using Gomory's Method.

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

Subject to

$$2x_1 + 4x_2 \leq 7$$

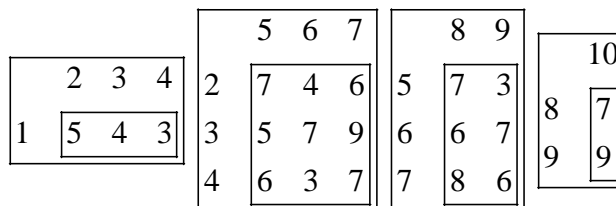
$$5x_1 + 3x_2 \leq 15 \quad x_1, x_2 \geq 0 \text{ and non-negative integers.}$$

(15)

(or)

d) (i) Mention the characteristics of dynamic programming technique.

(ii) Using dynamic programming technique find the shortest route from node 1 to 10.



(5+10)

II a) What is an inventory control? Explain JIT inventory model.

(or)

b) Explain ABC inventory control. (5)

c) (i) A company has a demand of 9000 part of a machine for one year. Each part costs Rs.20. The ordering cost is Rs.15 per order. The carrying cost of one part is 15% of unit price for one year. Suggest the most economical purchasing policy. Also find the number of orders, total inventory cost and also the saving for the company.

(ii) Find the optimum order quantity for a product for which the price breaks are as follows.

Quantity	Unit cost
$0 \leq Q < 500$	Rs.10
$500 \leq Q$	Rs.9.25

The weekly demand for the product is 200 units, the cost of ordering is Rs.300. The cost of storage is 20% of unit cost. (8+7)

(or)

d) Following information is known about a group of items kept in inventory of a company. Perform ABC analysis and explain with graphical representation.

Item No.	Units	Unit cost in Rs.
1	7,000	50
2	2,400	30
3	1500	100
4	600	220
5	3,800	15
6	4,000	5
7	6,000	2
8	3,000	35
9	300	80
10	2,900	4

III a) Explain Kendall's notation for representing queuing models with queue discipline.

(or)

b) Explain the customer behaviour pattern in queueing system. (5)

c) In a hospital an emergency care unit treats 90 patients per day. Also on average, one patient requires 10 minutes of active attention. Assume that facility can handle only one emergency at a time. It costs Rs.500 per patient as service charge and 10 minutes of service time. Each minute of decrease in average time would cost Rs.50 per patient treated, how much would have to be budgeted by the hospital to decrease the average size of the queue from  $\frac{4}{3}$  to  $\frac{1}{2}$  patients. (15)

(or)

d) With usual notation show that the probability distribution of queue length  $p_n$  is given by  $p_n = \dots^n (1 - \dots)$

where  $\dots = \frac{\rho}{1 - \rho} < 1, n \geq 0$ .

IV a) Explain the concept of sub goals in goal programming. Mention the differences between LP and GP approach.

(or)

b) Write an explanatory note on sensitivity analysis. (5)

c) (1) Explain the concept of goal programming.

(2) A company produces two products A and B. Each product must be processed through two departments. Department I has 70 hours of production capacity, and department II has 50 hours per week. Each unit of Product A requires 2 hours in department I and 3 hours in department II. Each unit of product B requires 4 hours in department I and 5 hours in department II. Management has set the following goals.

$P_1$  : Minimize the underachievement of joint total production of 32 units.

$P_2$  : Minimize the underachievement of producing 11 units of product A.

$P_3$  : Minimize the underachievement of producing 9 units of product B.

Formulate this problem as a GP problem and illustrate with graph.

(2+13)

(or)

d) Solve the following Linear Programming Problem

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

$$x_1 + 4x_2 \leq 8$$

$$x_1 + 2x_2 \leq 4 \text{ where } x_1, x_2 \geq 0$$

Discuss the effect of changing the availability of resources from  $\begin{bmatrix} 8 \\ 4 \end{bmatrix}$  to  $\begin{bmatrix} 9 \\ 6 \end{bmatrix}$  and  $\begin{bmatrix} 8 \\ 4 \end{bmatrix}$  to  $\begin{bmatrix} 9 \\ 4 \end{bmatrix}$ .

V a) State Kuhn-Tucker conditions to solve quadratic programming problem.

(or)

b) Determine the maxima or minima (if any) of the quadratic function

$$f = x_1 + 2x_3 + x_2x_3 - x_1^2 - x_2^2 - x_3^2$$

(5)

c) Using Kuhn-Tucker conditions solve the NLP

$$\text{Minimize } z = 2x_1 + 3x_2 - x_1^2 - 2x_2^2$$

$$\text{subject to } x_1 + 3x_2 \leq 6$$

$$5x_1 + 2x_2 \leq 10 \text{ where } x_1, x_2 \geq 0.$$

(or)

d) Determine the maxima or minima of the function  $f = 2x_1^2 + 10x_1 + x_2^2 + 8x_2 + 3x_3^2 + 6x_3 - 100$  if

$$x_1 + x_2 + x_3 = 20 \text{ using Lagrangian multipliers where } x_1, x_2, x_3 \geq 0.$$

(15)

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