LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – **MATHEMATICS**

THIRD SEMESTER – **NOVEMBER 2018**

16/17PMT3MC03 – OPERATIONS RESEARCH

Date: 29-10-2018 Dept. No. Max. : 100 Marks

Time: 09:00-12:00

Answer ALL the questions

I a) What do you understand by the term sensitivity analysis? Discuss the effect of variation of b_i .

(or)

b) Explain Gomory's cutting plane algorithm. (5 marks)

c) Solve the following Integer Programming Problem using Branch and Bound Technique:

Maximize $z = 2x + 3y$

subject to $6x + 5y \le 25$

$x + 3y \le 10$ where x, y are non-negative integers.

(or)

d) Solve the following Linear Programming Problem:

Maximize $Z = 2x_1 + 2x_2$

subject to $5x_1 + 3x_2 \le 8$ (15 marks)

$x_1 + 2x_2 \le 4$ where $x_1, x_2 \ge 0$

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

Also find out how far the second resource can be increased.

II a) Clearly state the priority factors in goal programming. Why are all goal programming problems minimization problems?

(or)

b) Choose any two selective inventory control techniques and explain with your life experience.

(5 marks)

c) A manufacturing firm produces two products A and B. Each product must be processed through two departments. Department I has 70 hours of production capacity per week, 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 28 units.

P_2 : Minimize the underachievement of producing 14 units of product A.

P_3 : Minimize the underachievement of producing 16 units of product B.

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

(or)

d) Perform ABC analysis for the items kept in inventory of a company and explain with graphical representation. (15 marks)

Item Name	Units	Unit cost in Rs.
1	300	10
2	280	25
3	200	12
4	1100	15
5	400	22
6	2200	2
7	150	1.50
8	800	3.50
9	600	8
10	4100	6
11	280	3
12	510	32

III a) Explain briefly the replacement analysis with example. (5 marks)

(or)

b) Explain gradual failure and sudden failure in replacement and maintenance model.

c) There are two types of machines. Machine A costs Rs.45,000. Annual operating cost is Rs.1000 for the first year and then increases by Rs.6,000 every year. Machine B costs Rs.50,000. Annual operating cost is Rs.2,000 for the first year and then increases by Rs.4,000 every year. For both the machines there is no resale value and their future costs are not discounted. Which machine will you prefer? Give reason.

(or)

d) (i) In the theory of replacement models, explain individual and group replacement policies with example.

(ii) The cost of a machine is Rs.6,100 and its scrap value is only Rs.100.The maintenance costs are found from experience are given below.

Year	1	2	3	4	5	6	7	8
Maintenance cost in Rs.	100	250	400	600	900	1250	1600	2000

When should the machine be replaced? (5+10 marks)

IV a) What is the difference between dynamic programming problem and linear programming problem? (5 marks)

(or)

b) Define the terms stage and state in dynamic programming problem. State Bellman's principle of optimality.

c) (i) Mention the salient features of dynamic programming technique. (5+10 marks)

(ii) A group of students plan to travel from city 1 to city 10 so that the total cost becomes minimum. Travel cost from each city is given in the following table in hundreds of rupee. Find the least cost route from city 1 to city 10 using dynamic programming technique.

City	2	3	4
1	22	20	24

City	5	6	7
2	30	36	40
3	35	38	42
4	40	38	45

City	8	9
5	70	48
6	80	39
7	66	45

City	10
8	30
9	33

(or)

d) A medical company has six representatives to be assigned to three districts. How many of the six representatives should be assigned to each district in order to maximize the sale units?

Representatives	District 1	District 2	District 3
0	0	0	0
1	25	20	33
2	42	38	43
3	55	54	47
4	63	65	50
5	69	73	52
6	74	80	53

V a) Mention different methods of solving quadratic programming problems and find the relation between them. (5 marks)

(or)

b) State the necessary and sufficient Kuhn-Tucker conditions to solve quadratic programming problem. Also explain the concave and convex functions.

c) Determine optimal solution for the function $f = x^2 + (y+1)^2 + (z-1)^2$ subject to the constraint $x + 5y - 3z = 6$ and check whether it maximizes or minimizes using Lagrangian Multiplier Method. (15 marks)

(or)

d) Using Kuhn-Tucker conditions solve the non-linear programming problem

Maximize $z = 2x_1^2 - x_2$

subject to $x_1 + x_2 = 7$

$x_1 \geq 1$

$x_1^2 + x_2^2 \leq 15$ where $x_1, x_2 \geq 0$.

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