LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

THIRD SEMESTER – **APRIL 2019**

16/17PMT3MC03– OPERATIONS RESEARCH

Date: 09-04-2019 Dept. No. Max. : 100 Marks

Time: 09:00-12:00

Answer ALL the questions

I a) Write a short note on sensitivity analysis. How can a change in resource availability affect the solution?

(5 marks)

(or)

b) Explain different types of integer programming problem?

c) Solve the following linear programming problem:

Maximize $Z = 2x_1 + 3x_2$

$x_1 + x_2 \le 5$

$x_1 + 2x_2 \le 6$ where $x_1, x_2 \ge 0$.

Discuss the effect of changing the availability of resources from $\begin{bmatrix} 5 \\ 6 \end{bmatrix}$ to $\begin{bmatrix} 7 \\ 9 \end{bmatrix}$ in the optimal solution.

(15 marks)

(or)

d) Solve the following integer programming problem using Branch and Bound Technique:

Maximize $z = 2x_1 + 3x_2$

subject to $6x_1 + 5x_2 \le 25$

$x_1 + 3x_2 \le 10$ where x_1, x_2 are non-negative integers.

II a) What is goal programming? State its assumptions.

(or)

b)Explain balking, reneging, jockeying, collusion and queue discipline in queueing theory.

(5 marks)

c) A supermarket has a single service counter. The customers arrive at a rate of 8 per hour. The average number of customers that can be attended by the cashier is 12 per hour. The time is exponentially distributed. Calculate the average number of customers in the queue, average time spend in the queue, average number of customers in the system, average time spend in the system and also the idle time of the cashier. **(15 marks)**

(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.

Items	Units	Unit cost in Rs.
1	8,000	6
2	3,000	10
3	300	15
4	800	8
5	4,800	7
6	1200	16
7	10,000	5
8	300	4
9	5,000	9
10	700	11

III a)What is a replacement problem? **(5 marks)**

(or)

b) Explain individual and group replacement policies with example.

c) (i) Explain gradual failure and sudden failure.

(ii) The cost of a machine is Rs.12,200 and its scrap value is only Rs.200.The maintenance costs are found from experience to be as follows:

Year	1	2	3	4	5	6	7	8
Maintenancecost in Rs.	200	500	800	1200	1800	2500	3200	4000

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

(or)

d) Machine A costs Rs.45,000. Annual operating cost is Rs.1,000 for the first year and then increases by Rs.10,000every 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 scrap value. Which machine will you prefer? Give reason.

IV a) State Bellman's principle of optimality.

(or)

b)Mention some of the applications of dynamic programming? **(5 marks)**

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

(ii) Find the shortest route from city 1 to city 10 using dynamic programming technique.

city	2	3	4
1	10	20	30

city	5	6	7
2	40	40	60
3	30	20	40
4	20	10	50

city	8	9
5	50	40
6	60	30
7	30	30

city	10
8	50
9	50

(or)

d) Fivesalesmen are to be allocated to different zones. The estimated returns from each salesman are given in the following table. Find the optimal allocation policy.

nber of sale			
0	4	3	3
1	5	4	4
2	7	6	5
3	8	7	6
4	9	7	7
5	10	9	8

V a) What is quadratic programming problem? How is it different from linear programming problem? **(5 marks)**

(or)

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

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

Minimize $z = x_1^2 - x_2$

subject to $x_1 + x_2 = 6$

$x_1^2 + x_2^2 \leq 26$

$x_1 \geq 1$ where $x_1, x_2 \geq 0$.

(or)

d) Determine the maxima or minima of the function $f = x^2 + y^2 + z^2 - 10x - 6y - 4z$ subject to the constraint $x + y + z = 30$ at x, y, z using Lagrangian Multiplier Methods.

(15 marks)

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