LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

THIRD SEMESTER – **NOVEMBER 2019**

18PMT3MC03 – OPERATIONS RESEARCH

Date: 02-11-2019 Dept. No. Max. : 100 Marks

Time: 09:00-12:00

Answer ALL the questions (5 x 20 =100)

I a) Write a short note on sensitivity analysis. (5 marks)

(or)

b) Discuss the advantages and disadvantages of solving integer programming problem by the cutting plane method.

c) Solve the following linear programming problem

$$\text{Maximize } Z = 6x_1 + 8x_2$$
$$\text{subject to } 5x_1 + 10x_2 \le 60$$
$$4x_1 + 4x_2 \le 40 \text{ where } x_1, x_2 \ge 0.$$

Discuss the effect of changing the availability of resources from $\begin{bmatrix} 60 \\ 40 \end{bmatrix}$ to $\begin{bmatrix} 50 \\ 70 \end{bmatrix}$ in the optimal solution. Also find out how far the second resource can be increased?

(or)

d) Use Branch and Bound Technique to solve the following problem:

$$\text{Maximize } Z = 7x_1 + 9x_2$$
$$\text{subject to } -x_1 + 3x_2 \le 6$$
$$7x_1 + x_2 \le 35 \text{ where } x_1, x_2 \text{ are non-negative integers.}$$

(15 marks)

II a) Explain the difference between linear programming problem and goal programming problem with example. (5 marks)

(or)

b) Explain any three selective inventory control techniques with your life experience.

c) (i) Write about different types of customer behavior pattern in queue in our country.

(ii) The arrival rate of customers at a banking counter follows Poisson distribution with mean 45 customers per hour. Serving time is 1 minute. Find the average number of customers in the queue, average time spent in the queue, average number of customers in the system and average time spent in the system. (5+10 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	1	2	3	4	5	6	7	8	9	10
Number of units	400	450	650	250	800	200	570	999	100	550
Unit cost in Rs	15	30	25	40	20	5	60	50	10	70

III a) Explain different types of failure. Discuss the reason for them. (5 marks)

(or)

b) Explain terms: money value, present worth and depreciation ratio which are used in replacement problems.

c) (i) Consider the situation where the maintenance cost increases with time and money value decreases with constant rate. Which type of replacement policy will you apply for the electronic items and mechanical items?

(ii) The cost of a particular company washing machine is Rs.6,100 and its scrap value is only Rs.100. From experience the maintenance costs are found to be as follows:

Year	1	2	3	4	5	6	7	8
Maintenance cost in Rs.	200	500	800	1200	1800	2400	3200	4000

The company gives 50% discount in the maintenance cost for the customers who get the service regularly only from company. When should the washing machine be replaced?

(5+10 marks)

(or)

d) A specific requirement of a company can be met either by Machine A or Machine B. Machine A costs Rs.10,000. Annual operating cost is Rs.2000 for the first year and it increases by Rs.800 every year. Machine B costs Rs.13,000. Annual operating cost is Rs.2000 for the first year and then increases by Rs.700 every year. For both the machines scrap value is Rs.1000. Which machine modal to be purchased?

IV a) Discuss dynamic programming with suitable examples. Also State Bellman's principle of optimality.

(or)

b) Mention the characteristics of dynamic programming technique. (5 marks)

c) (i) Write some of the applications of dynamic programming. (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 rupees. Find the least cost route from city 1 to city 10 using dynamic programming technique.

City	2	3	4
1	21	20	26

City	5	6	7
2	32	36	60
3	35	40	40
4	40	38	50

City	8	9
5	70	56
6	62	39
7	66	45

City	10
8	45
9	55

(or)

d) A shop owner has six sales person and three shops X, Y, Z. Sales in shops are given in thousand rupees. Find the allocation of sales person to maximize the sales using dynamic programming technique.

Sales person	Shop X	Shop Y	Shop Z
0	0	0	0
1	28	20	24
2	40	38	43
3	55	54	57
4	60	65	50
5	73	68	62
6	85	80	93

V a) Mention different models in solving quadratic programming problems and find the relation between them.

(5 marks)

(or)

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

c) Determine optimal solution for the function f $= x^2 + 2y^2 + z^2$ subject to the constraint $2x + y + 2z = 30$ 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 $Z = 200x_1 + 500x_2 - 2x_1^2 - 3x_2^2$

subject to $2x_1 + x_2 \leq 140$

$2x_1 + 3x_2 \leq 180$ where $x_1, x_2 \geq 0$.

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