LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

THIRD SEMESTER – NOVEMBER 2017

16PMT3MC03 - OPERATIONS RESEARCH

Date: 06-11-2017 Dept. No. Max. : 100 Marks
Time: 09:00-12:00

Answer ALL the questions

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

(or)

b) What is an integer programming problem? Explain the different types of it.

c) Solve the following linear programming problem:

Maximize $Z = x_1 + 6x_2$

$2x_1 + 3x_2 \leq 9$

$2x_1 \leq 5$ where $x_1, x_2 \geq 0$.

Discuss the effect of changing the availability of resources from $\begin{bmatrix} 9 \\ 5 \end{bmatrix}$ to $\begin{bmatrix} 8 \\ 6 \end{bmatrix}$ in the optimal solution. Also find out how far the resource can be decreased.

(or)

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

Maximize $z = x_1 + 5x_2$

subject to $x_1 + 10x_2 \leq 20$ (15 marks)

$x_1 \leq 2$ where x_1, x_2 are non-negative integers.

II a) State some problem areas in management where goal programming can be applied.

(or)

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

(5 marks)

c) A travel company has one reservation clerk at a time serving 8 hours a day. He handles information of buses and makes reservation. The customers arrive at a rate of 8 per hour and the clerk can serve 12 customers on an average per hour. The time is exponentially distributed. What is 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 resting time of the clerk. If the waiting time is to be reduced to 5 minutes what should be the new service rate and the resting time of the clerk?

(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	48,000	5
2	2,000	11
3	300	15
4	800	8
5	4,800	7
6	1200	16
7	18,000	20
8	300	4
9	5,000	9
10	500	12

III a) What is a replacement problem? Describe some replacement situations with examples.

(5 marks)

(or)

b) Explain with example the different failure mechanism of items.

c) (i) Explain individual and group replacement policies with example.

(ii) The cost of a machine is Rs.6100 and its scrap value is only Rs.100. The maintenance costs are found from experience to be as follows:

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

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

(or)

d) Machine A costs Rs.9000. Annual operating cost is Rs.200 for the first year and then increases by Rs.2000 every year and in the fourth year the operating cost becomes Rs.6200. Determine the best age at which the machine to be replaced? Machine B costs Rs.10000. Annual operating cost is Rs.400 for the first year and then increases by Rs.800 every year and in the sixth year the operating cost becomes Rs.4400. For both the machines there is no scrap value. Which machine will you prefer? Give reason.

IV a) Explain dynamic programming problem. How is it useful in business?

(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) A salesman decided to travel from city 1 to city 10 so that the total cost becomes minimum. Find the least cost route for the salesman from city 1 to city 10 using dynamic programming technique.

city	2	3	4
1	20	40	30

city	5	6	7
2	70	40	60
3	30	20	40
4	40	10	50

city	8	9
5	10	40
6	60	30
7	30	30

city	10
8	30
9	40

(or)

d) Six units of capital can be invested in three activities with return from each activity given in the following table. Find the allocation of capital to each activity that will maximize the total return.

Unit	Activity 1	Activity 2	Activity 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 any four models in quadratic programming problem and explain the method of solving the model without any constraint. (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 $z = 5x_1^2 - x_2$

subject to $x_1 + x_2 = 8$

$x_1^2 + 3x_2^2 \le 5$

$x_1 \ge 2$ where $x_1, x_2 \ge 0$.

(or)

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

(15 marks)

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