LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

THIRDSEMESTER – APRIL 2018

16PMT3MC03- OPERATIONS RESEARCH

Date: 03-05-2018 Dept. No. Max. : 100 Marks
Time: 09:00-12:00

Answer ALL the questions

I a) What is sensitivity analysis? How is it useful to a company? (5 marks)

(or)

b) Mention the different types integer programming in mathematical programming. Explain with example.

c) Solve the following linear programming problem:

Maximize $Z = 5x_1 + 3x_2$

$3x_1 + 5x_2 \leq 15$

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

Discuss the effect of changing the availability of resources from $\begin{bmatrix} 15 \\ 10 \end{bmatrix}$ to $\begin{bmatrix} 17 \\ 12 \end{bmatrix}$ 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 $z = 3x_1 + 5x_2$

subject to $3x_1 + 2x_2 \leq 12$ (15 marks)

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

II a) Explain the concept of sub goals in goal programming.

(or)

b) Explain Kendall's classification. (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 who works for 8 hours a day. If the waiting time in the system is to be reduced by 3 minute what should be the new service rate and the resting 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	30,000	10
2	2,80,000	15
3	3000	8
4	11000	5
5	4,000	6
6	3,20,000	10
7	15,000	7
8	80,000	9
9	60,000	15
10	8,000	25

III a) Explain the replacement problem with examples. (5 marks)

(or)

b) Explain gradual failure and sudden failure with example.

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

(ii) The cost of a machine is Rs.6000 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	200	400	500	800	1200	2400	3000

Determine at what age the machine is to be replaced? (5+10 marks)

(or)

d) A person is offered two machines A and B for his factory. Machine A costs Rs.15000. Annual operating cost is Rs.800 for the first five year and then increases by Rs.200 after sixth year. Determine the best age at which the machine to be replaced? Machine B costs Rs.11500. Annual operating cost is Rs.1000 for the first six year and then increases by Rs.300 every year. For both the machines there is no scrap value. Which machine should be purchased? Give reason.

IV a) Mention any five applications of dynamic programming problem.

(or)

b) Explain Bellman's principle of optimality. (5 marks)

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

(ii) A salesman located in city 1 decided to travel to city 10. Find the shortest route for the salesman from city 1 to city 10 using dynamic programming technique.

city	2	3	4
1	50	45	30

city	5	6	7
2	36	53	58
3	35	35	35
4	46	50	44

city	8	9
5	70	42
6	80	50
7	95	80

city	10
8	30
9	40

(or)

d) A company has five sales men who have to be allocated to marketing three zones with return from each zone is given in the following table. Determine the optimal allocation policy.

Unit	Zone 1	Zone 2	Zone 3
0	45	30	35
1	58	45	45
2	70	60	52
3	82	70	64
4	93	79	72
5	101	90	82

V a) Explain Wolfe's method. (5 marks)

(or)

b) State the necessary and sufficient 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 $x_1 + x_2 = 6, x_1 \geq 1, x_1^2 + x_2^2 \leq 26$ where $x_1, x_2 \geq 0$.

(or)

d) Using Lagrangian multipliers method determine the maxima or minima of the function

$f = -x^2 - 2y^2 - z^2 + xy + z$ if $x + y + z = 35$. (15 marks)

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