LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

THIRDSEMESTER – APRIL 2017

MT 3813- OPERATIONS RESEARCH

Date: 28-04-2017 Dept. No. Max. : 100 Marks
01:00-04:00

Answer ALL the questions

I a) What is an integer programming problem? How will you construct Gomory's constraint?

(or)

b) State the characteristic of dynamic programming technique. (5)

c) Solve the following LPP using Branch and Bound Technique

Maximize $z = -x_1 + 4x_2$

subject to $-10x_1 + 20x_2 \le 22$

$5x_1 + 10x_2 \le 49$ where x_1, x_2 are non-negative integers.

(or)

d) (i) Mention some of the applications of dynamic programming? (5+10)

(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	4	7	9

city	5	6	7
2	3	9	10
3	5	8	11
4	6	7	12

city	8	9
5	6	5
6	8	9
7	8	7

city	10
8	3
9	5

II a) Explain any three costs associated with inventory analysis.

(or)

b) What is price break? (5)

c) (i) The annual consumption of mini motor is 12800 units, the ordering costs are Rs.1500 per order. The cost per mini motor is Rs.60 and the annual carrying cost is 25% of the unit price. Determine the EOQ, time between two orders and the total cost per year. Also find the time of cycle.

(ii) The probability distribution of monthly sales of a certain cellphone model is as follows.

Monthly sales	10	20	30	40	50	60	70
probability	.01	.06	.25	.35	.20	.03	.10

The cost of carrying inventory is Rs.30 per unit per month and the cost of unit shortage is Rs.70 per month. Determine the optimum stock level which minimizes the total expected cost.

(10+5)

(or)

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

Product type	Number of Units	Unit price in Rs.
1	1000	2.50
2	250	0.55
3	150	6.50
4	300	1.00
5	100	1.55
6	700	1.40
7	500	7.00
8	15	5.00
9	600	1.60
10	25	33.00

III a) Explain static and dynamic queue disciplines. (5)

(or)

b) Explain the multi-server queueing system.

c) With usual notation show that the probability distribution of queue length p_n is given by $p_n = \rho^n(1-\rho)$ where $\rho = \frac{\lambda}{\mu} < 1, n \geq 0$. (15)

(or)

d) A bank has one trainee teller. The customers arrive at a rate of 8 per hour. The trainee teller 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 trainee teller. The trained teller can serve 20 customers. How much time is saved by the trained teller?

IV a) What is the difference between goal programming problem and linear programming problem?

(or)

b) What is sensitivity analysis? Is it really useful for a company? Justify. (5)

c) In a production shop of a company two products X and Y are manufactured. Each product must be processed through two machines. Machine I has 90 hours of production capacity, and Machine II has 60 hours per week. Each unit of Product X requires 5 hours in Machine I and 3 hours in Machine II. Each unit of product Y requires 4 hours in Machine I and 2 hours in Machine II. The company Manager has set the following goals. P_1: Minimize the underachievement of joint total production of 32 units. P_2 : Minimize the underachievement of producing 10 units of product Y. P_3 : Minimize the underachievement of producing 7 units of product X. Formulate the problem as a GP problem and illustrate with graph.

(or)

d) Solve the following Linear Programming Problem

Maximize $Z = 2x_1 + 2x_2$

$5x_1 + 3x_2 \leq 8$

$2x_1 + 4x_2 \leq 8$ where $x_1, x_2 \geq 0$

Discuss the effect of changing the availability of resources from $\begin{bmatrix} 8 \\ 8 \end{bmatrix}$ to $\begin{bmatrix} 10 \\ 12 \end{bmatrix}$ in the optimal solution. (15)

V a) Compare Lagrangian, Kuhn-Tucker methods of solving quadratic programming problem. (5)

(or)

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

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

Maximize $z = 2x_1 - x_1^2 + x_2$

subject to $2x_1 + 3x_2 \leq 6$ (15)

$2x_1 + x_2 \leq 4$ where $x_1, x_2 \geq 0$.

(or)

d) Determine the maxima or minima of the function $f = x_1^2 + x_2^2 + x_3^2$ if $x_1 - x_2 + 2x_3 = 6$ using Lagrangian Multipliers.

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