LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

THIRD SEMESTER – NOVEMBER 2016

MT 3813 - OPERATIONS RESEARCH

Date: 05-11-2016 Dept. No. Max. : 100 Marks

Time: 09:00-12:00

Answer ALL the questions

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

(or)

b) Mention the salient features of dynamic programming technique. State Bellman's principle of optimality. **(5)**

c) Solve the following Integer Programming Problem using Branch and Bound Technique

Maximize $z = 7x_1 + 9x_2$

subject to $-x_1 + 3x_2 \le 6$

$7x_1 + x_2 \le 35$ where x_1, x_2 are non-negative integers.

(or)

d) (i) Explain dynamic programming problem. How is it useful in business? **(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	9	8	10

city	5	6	7
2	7	9	11
3	9	10	12
4	7	11	13

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

city	10
8	11
9	12

II a) Explain any three costs associated with inventory.

(or)

b) Explain Just in time inventory model with an example. **(5)**

c) (i)The following information is obtained from a company. The annual consumption of an item is 5200 units, the ordering costs are Rs.1000 per order. The cost per unit is Rs.200 and the storage cost is 20% of the unit price. Determine the optimum ordering quantity and the total cost per year. Also find the time of cycle. The owner of the company is following the policy of ordering 400 units. How much money can be saved by EOQ?

(ii) The probability distribution of daily sales of food packets are given below.

Daily sales	10	20	30	40	50	60
Probability	.05	.10	.20	.30	.20	.15

The cost of one packet is Rs.80 and sold for Rs.110. Determine the optimum quantity to order. **(10+5)**

(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.

Item Name	Units	Unit cost in Rs.
1	20	30
2	200	15
3	50	1000
4	200	40
5	40	230
6	160	200
7	240	50
8	150	60
9	1000	9
10	2500	6

III a) Explain balking, reneging, jockeying, collusion and queue discipline in queueing theory. **(5)**

(or)

b) Explain a single 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) At a certain petrol pump the customers arrive in a poisson process. The customers arrive at a rate of 12 per hour. The service rate is 20 customers 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 petrol pump operator. If the service rate is 30 per hour, what will be the changes in the new finding?

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

(or)

b) What is sensitivity analysis? **(5)**

c) A manufacturing firm produces two products A and B. Each 200 kilos of product A requires 20 man hours of labour and 200 kilos of B requires 30 man hours of labour. It is assumed that only 80 man hours of labour are available each week. Both products produce a profit of Rs.300 per kilo. The Manager has desire to achieve profit of Rs. 300000 per week. The firm has to supply 1400 kilos of B per week. The manager has the following subgoal. P_1 : Avoid over time. Formulate the problem as a Goal Programming problem and illustrate with graph. **(15)**

(or)

d) Solve the following Linear Programming Problem

Maximize $Z = x_1 + x_2$

$3x_1 + 2x_2 \leq 5$

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

Discuss the effect of changing the availability of resources from $\begin{bmatrix} 5 \\ 2 \end{bmatrix}$ to $\begin{bmatrix} 7 \\ 4 \end{bmatrix}$ in the optimal solution.

V a) Compare any two methods in solving quadratic programming problem. Give example for the use of any one method in our daily life. **(5)**

(or)

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

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

Minimize $z = x_1^2 + x_2^2$

subject to $x_1 + x_2 \geq 2$ **(15)**

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

(or)

d) Determine the values of x_1, x_2, x_3 that minimize the function $f = 5x_1^2 + 10x_2^2 + x_3^2 - 4x_1x_2 - 2x_1x_3 - 36x_2$ subject to the constraint $x_1 + x_2 + x_3 = 3$ using Lagrangian Multipliers.

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