LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION - **MATHEMATICS**

THIRD SEMESTER – **NOVEMBER 2013**

MT 3813 - OPERATIONS RESEARCH

Date : 09/11/2013 Dept. No. Max. : 100 Marks

Time : 9:00 - 12:00

Answer ALL the questions

All questions carry equal marks

I a) Explain the necessity of having integer programming with an example. Mention different methods used to solve.

(or)

b) What is dynamic programming? How is it useful in our life? (5)

c) Solve the following integer programming problem using Gomary's Method.

Maximize $Z = x_1 + x_2$

Subject to

$3x_1 + 2x_2 \le 5$

$x_2 \le 2 \quad x_1, x_2 \ge 0$ and non-negative integers. (15)

(or)

d) (i) Mention the characteristics of dynamic programming technique. Explain how dynamic programming is used to solve the allocation problem.

(ii) Find the shortest route for traveling from city 1 to 10 using dynamic programming technique.

	2	3	4
1	2	4	3

	5	6	7
2	8	4	6
3	5	7	9
4	4	3	5

	8	9
5	9	4
6	6	7
7	8	6

	10
8	12
9	16

(5+10)

II a) What is an inventory control? Why it is necessary for an institution? Differentiate direct and indirect inventories.

(or)

b) Explain ABC inventory control. (5)

c) (i) A company has a demand of 2500 units of a certain product every week. The price of one unit is Rs.30. The ordering cost is Rs.130 per order. The carrying cost of one unit is 10% for one month. Assuming no shortages are allowed, find the economical order quantity. Also find the number of orders and total inventory cost.

c) (ii) A company has to supply 12,000 bottles per year. It finds that it can produce 2000 bottles per month. The cost of one setup is Rs.400 and the holding cost is Rs.0.15. Find the optimal lot size assuming the cost of one bottle is Rs.4. What is the number of production runs and time between them? (8+7)

(or)

d) Classify the materials given below into an ABC classification. Also explain with a graph.

Item No.	Units	Unit cost in Rs.
1	30,000	10
2	2,80,000	15
3	3,000	10
4	1,10,000	5
5	4,000	5
6	2,20,000	10
7	15,000	5
8	80,000	5
9	60,000	15
10	8,000	10

III a) Explain Kendall's notation for representing queuing models with queue discipline.

(or)

b) Explain any four customer behaviour pattern in queueing system. (5)

c) On an average 96 patients require the service of an emergency clinic per day. Also on average, one patient requires 10 minutes of treatment. Assume that clinic can handle one emergency at a time. It costs Rs.200 per patient as service charge and 10 minutes of service time. Each minute of decrease in average time would cost Rs.10 per patient treated, how much would have to be budgeted by the clinic to decrease the average time of the queue from $1\frac{1}{3}$ to $\frac{1}{2}$ patients. (15)

(or)

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

IV a) Explain the concept of goal programming. Mention the differences between LP and GP approach.

(or)

b) What is sensitivity analysis? (5)

c) A camera company produces two products A and B. Each product must be processed through two departments. Department I has 80 hours of production capacity, and department II has 60 hours per week. Each unit of Product A requires 2 hours in department I and 3 hours in department II. Each unit of product B requires 4 hours in department I and 4 hours in department II. Management has set the following goals.

P_1 : Minimize the underachievement of joint total production of 23 units.

P_2 : Minimize the underachievement of producing 9 units of product B.

P_3 : Minimize the underachievement of producing 7 units of product A.

Formulate this problem as a GP problem and illustrate with graph. (15)

(or)

d) Solve the following Linear Programming Problem

Maximize $Z = 5x_1 + 3x_2$

$3x_1 + 5x_2 \le 15$

$5x_1 + 5x_2 \le 10$ where $x_1, x_2 \ge 0$

Discuss the effect of changing the availability of resources from $\begin{bmatrix}15\\10\end{bmatrix}$ to $\begin{bmatrix}12\\9\end{bmatrix}$.

V a) Write the necessary and sufficient conditions of Kuhn-Tucker to solve quadratic programming problem.

(or)

b) State Wolfe's algorithm. (5)

c) Using Kuhn-Tucker conditions solve the NLP

Maximize $z = 2x_1 - x^2_1 + x_2$

subject to $2x_1 + 3x_2 \le 6$

$2x_1 + x_2 \le 4$ where $x_1, x_2 \ge 0$

(or)

d) Determine the maxima or minima of the function $f = 2x_1^2 - 24x_1 + 2x_2^2 - 8x_2 + 2x_3^2 - 12x_3 + 200$ if $x_1 + x_2 + x_3 = 11$ using Lagrangian multipliers where $x_1, x_2, x_3 \ge 0$. (15)