LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

FOURTH SEMESTER – **APRIL 2013**

MT 4811 - OPERATIONS RESEARCH

Date : 27/04/2013 Dept. No. Max. : 100 Marks

Time : 1:00 - 4:00

Answer ALL the questions

All questions carry equal marks

I a) What is the effect of Sensitivity Analysis in finding the optimal solution in IPP?

(or)

b) Enumerate the procedure in arriving at the solution in Integer Programming problem with Gomarian Constraint. (5)

c) Solve the following LP problem

Maximize $Z = 4x_1 + 6x_2 + 2x_3$

subject to the constraints

$$x_1 + x_2 + x_3 \le 3$$

$$x_1 + 4x_2 + 7x_3 \le 9$$

$$x_1, x_2, x_3 \ge 0$$

Discuss the effect of discrete change in the availability of resources from $[3, 9]^T$ to $[9, 15]^T$ (15)

(or)

d) Solve the pure IPP

Max $z = -4x_1 + 5x_2$

subject to the constraints

$-3x_1 + 3x_2 \le 6$

$2x_1 + 4x_2 \le 12$ and $x_1, x_2 \ge 0$ are integers.

II a) Explain the concept of goal programming.

(or)

b) Compare the differences between LP and GP approach. (5)

c) An LED light manufacturing company has two products A and B, which must be processed through assembly and finishing departments. Assembly has 90 hours and finishing has 72 hours of work. Manufacturing A requires 6 hours in assembly and 3 hours in finishing. Each of B requires 3 hours in assembly and 6 hours in finishing. If profit is Rs.120 for A and Rs.90 for B, Determine the best combination of A and B to realize a maximum profit of Rs.2100. Formulate this problem as GP and then explain it by using graphical method.

(or)

d) A paint brush manufacturing company produces two products A and B. Each product must be processed through two departments. Department I has 40 hours of production capacity per day, and

department II has 50 hours. Each unit of Product A requires 2 hours in department I and 6 hours in department II. Each unit of product B requires 3 hours in department I and 4 hours in department II. Management has ranked the following goals it would like to achieve in determining the daily product mix.

P_1 : Minimize the underachievement of joint total production of 12 units.

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

P_3 : Minimize the underachievement of producing 10 units of product A.

Formulate this problem as GP and then explain it by using graphical method. (15)

III a) Explain the following terms in inventory: ordering cost, holding cost, lead time, EOQ and replenishment. (5)

(or)

b) A vendor buys one cheese bread for Rs.18 and sells it for Rs.24. He cannot return the unsold. The daily demand has the following distribution. If each day's demand is independent of the previous day's sale, how many bread should be ordered per day?

No. of breads	100	200	300	400	500	600 or more
Probability of need	0.9488	0.0400	0.0100	0.00100	0.0002	0.000

c) Group the items given below into an ABC classification.

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

Explain by graphical representation. (15)

(or)

d) (i) A company has a demand of 9000 units per year. The cost of one unit is Rs.2. The setup cost is Rs.100 and the holding cost is Rs.2.40 per unit. Assuming no shortages are allowed, find the optimal inventory policy. Also find the number of orders, time between two orders and total inventory cost.

(ii) Water pumps valves are produced at the rate of 75000 items per year. The demand occurs at the rate of 15000 items per year. If the setup cost is Rs.1000 per setup and holding cost is Re 1.20 per unit of item per year. Find the economic lot size for one run. Also find the number of cycles.

(10+5)

IV a) Explain single server queuing model.

(or)

b) Explain Kendall's classification. (5)

c) In a logistics company, delivery vans arrive at a rate of 30 per day. Assume that the inter arrival time follows an exponential distribution and the time taken to do service (cleaning, fuel filling, etc) also follows exponential with an average 36 minutes. Calculate the following:

(1) The mean system and queue size.
(2) The probability that the queue size exceeds 10.
(3) If the input of vans increases to an average 33 per day, what will be the changes in (1) and (2) ?
(4) The expected waiting time in the queue.
(5) The average number of vans in the queue.

(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 $\rho = \frac{\lambda}{\mu} < 1, n \geq 0$. (15)

V a) Write Kuhn-Tucker conditions for a quadratic programming problem.

(or)

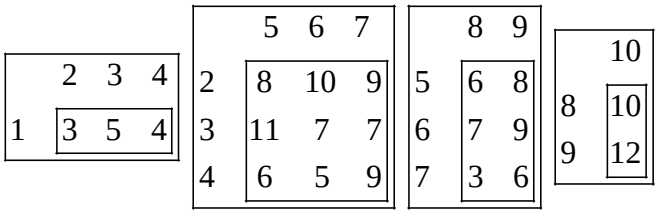
b) Write Wolfe algorithm. (5)

c) Determine the maxima or minima of the function $Z = x_1^2 + 4x_2^2 + x_3^2 - 4x_1x_2 - 6x_3$ if $x_1 + x_2 + x_3 = 15$ using Lagrangian multipliers. (15)

(or)

d) (i) Explain dynamic programming technique and state few applications.

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



(5+10)

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