

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 214402

Roll No.

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**MCA.**

(SEM. IV) THEORY EXAMINATION 2013-14

**COMPUTER BASED OPTIMIZATION TECHNIQUES**

*Time : 3 Hours*

*Total Marks : 100*

**Note :-** Attempt questions from each section as indicated.

**SECTION-A**

1. Attempt all parts of this question : (2×10=20)
  - (a) What is Operations Research ? Enlist some applications of Operations Research.
  - (b) Explain briefly the following terms :
    - (i) Slag Variables
    - (ii) Surplus Variables
  - (c) Define Dynamic Programming Problem.
  - (d) Write short note on Convex Programming Problem.
  - (e) What is Duality ? Explain with example.
  - (f) Discuss the structure of Non-Linear Programming Problem.

- (g) Define the term Inventory. Discuss some advantages and disadvantages of holding inventory.
- (h) Discuss the following :
  - (i) Penalty Cost
  - (ii) Ordering Cost
- (i) Discuss steady state in terms of Queueing theory.
- (j) List various queue disciplines and describe them briefly.

**SECTION-B**

2. Attempt any three parts : (3×10=30)

- (a) (i) What is Linear Programming Problem ? Explain the detailed structure of Linear Programming (5)
- (ii) Solve the following LPP graphically :  
MAX.  $Z = 9X_1 - 4X_2$   
such that  $2X_1 + 4X_2 \leq 4$ ,  $4X_1 + 8X_2 \geq 40$   
and  $X_1, X_2 \geq 0$ . (5)

- (b) Use Wolfe's method to solve the quadratic programming problem :

$$\text{MAX. } Z = 2X_1 + 3X_2 - 2X_1^2$$

such that

$$X_1 + 4X_2 \leq 4,$$

$$X_1 + X_2 \leq 4$$

and

$$X_1, X_2 \geq 0 \quad (10)$$

- (c) Develop a algorithm for north-west corner method for solving transportation problem. (10)
- (d) Derive the equation to obtain total minimum cost where economic lot size model is available with uniform rate of demand, finite rate of replenishment (production rate), having no shortages. (10)
- (e) State and prove Markovian's Property for inter-arrival times in queueing theory. (10)

### SECTION-C

Note :- Attempt all questions. (10×5=50)

3. Attempt any one part : (10×1=10)

- (a) A firm manufactures 3 products A, B and C. The profits are Rs. 3, Rs. 2 and Rs. 4 respectively. The firm has two machines and the below is the required processing time in minutes for each machine on each product.

Machine G and H have 2000 and 2500 machine- minutes respectively. The firm must manufacture 100 A's, 200 B's and 50 C's but not more than 150 A's.

- (i) Formulate a LPP to maximize the profit.
- (ii) Solve the resultant LPP by Simplex method. (10)

(b) Solve the following by using Revised Simplex method.

$$\text{MAX. } Z = X_1 + 2X_2$$

subject to :

$$X_1 + X_2 \leq 3,$$

$$X_1 + 2X_2 \leq 5,$$

$$3X_1 + X_2 \leq 6$$

$$\text{and } X_1, X_2 \geq 0 \quad (10)$$

4. Attempt any one part : (10×1=10)

(a) Divide unity into n parts  $P_1, P_2, P_3, \dots, P_n$  such that at the quantity  $P_1 \log P_1 + P_2 \log P_2 + \dots + P_n \log P_n$  is minimum. (10)

(b) Find the value of :

$$\text{MAX } y_1, y_2, y_3$$

subject to constraints

$$y_1 + y_2 + y_3 = 5;$$

$$y_1, y_2, y_3 \geq 0. \quad (10)$$

5. Attempt any one part : (10×1=10)

(a) Determine the basic feasible solution to the following transportation problem :

O1	50	30	220	1
O2	90	45	170	3
O3	250	2500	50	4
Required	4	2	2	(10)

(b) Explain the algorithmic step by step procedure for solving Vogel's approximation method for solving transportation problem. (10)

6. Attempt any one part : (10×1=10)

- (a) (i) Discuss group replacement technique in detail. (3)
- (ii) A computer contains 10000 resistors when any one of the resistors fails, it is replaced. Cost of replacing a single resistor is Rs. 10 only. If all resistors are replaced at the same time, cost per resistor would be reduced to Rs. 3.50. The percent surviving by the end of month is as follows :

Month	0	1	2	3	4	5	6
Percentage	100	97	90	70	30	15	0

Will you prefer a complete replacement or individual replacement. Justify your answer. (7)

(b) (i) Write the algorithmic step by step procedure to compute optimum purchase quantity in an inventory model with two price breaks. (5)

(ii) A shopkeeper estimates annual requirements of an item as 2000 units. He buys from Supplier at a cost of Rs. 10 per item and the cost of ordering is Rs. 50 each time. If stock holding costs are 25% per year of stock value, how frequently should he replenish his stock ? (5)

7. Attempt any one part : (10×1=10)

(a) (i) Discuss queueing model Model-I [M/M/1] : [ $\infty$ /FCFS]. (3)

(ii) In a railway marshalling yard, good trains arrive at a rate of 30 trains per day. Assuming that inter-arrival time follows an exponential distribution and service time distribution is also an exponential with an average of 36 minutes. Calculate :

1. Expected Queue Size (Line Length)

2. Probability that queue size exceeds 10. (7)

(b) (i) Discuss queueing model Model-IV [(M/M/1)] : [( $\infty$ /FCFS)]. (3)

(ii) A super market has two Salesgirls at the Sales Centre. If the services time for each customer is exponential with a mean of 4 minutes and if people arrive in a Poisson's distribution fashion at the rate of 10 an hour then calculate :

1. Probability that a customer has to wait for service.
2. Expected percentage of idle time for each sales girl.
3. If a customer has to wait, what is the expected length of his waiting time. (7)