Name : ....

Roll No. : ....

Invigilator's Signature : ....

CS/MMA/SEM-1/MMA-101/2011-12

2011

QUANTITATIVE METHODS – I

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : $10 \times 1 = 10$

i) The scientific method in O.R. study generally involves

a) Judgment phase b) Research phase

c) Action phase d) all of these.

ii) Which of the following is not a major requirement of a Linear Programming Problem ?

a) There must be alternative course of action among which to decide

b) An objective for the firm must exist

c) The problem must be of maximization type

d) Resources must be limited.

iii) Which of the following assertations is true of an optimal solution to an Linear Programming Problem ?

a) Every LP has an optimal solution

b) The optimal solution always occur at extreme points

c) If an optimal solution exists, there will always be at least one at a corner

d) All of these.

iv) An objective function in a linear program can be which of the following ?

a) A maximization function

b) A nonlinear maximization function

c) A quadratic maximization function

d) An uncertain quantity.

v) Which of the following is an essential condition in a situation for linear programming to be useful ?

a) Competing objectives b) Nonlinear constraints

c) Uncertainty d) Homogeneity.

vi) Which of the following is a common application of linear programming in operations management ?

a) Cost of quality studies

b) Plant location studies

c) Cost allocation studies

d) Product design decisions.

vii) The North West Corner rule

a) is used to find an initial feasible solution

b) is used to find an optimal solution

c) is based on the concept of minimizing opportunity cost

d) none of these.

viii) In Vogel's Approximation Method, the opportunity cost associated with a row is determined by

a) the difference between the smallest cost and the next smallest cost in the row

b) the difference between the smallest unused cost and the next smallest unused cost in the row

c) the difference between the smallest cost and next smallest unused cost in the row

d) none of these.

ix) Which of the following statements about an LP problem and its dual is false ?

a) The dual problem might have an optimal solution, even though the primal has no (bounded) optimum

b) If the primal and the dual both have optimal solutions, the criterion function for both problems are equal at the optimum

c) If one of the variables in the primal has unrestricted sign, the corresponding constraint in the dual is satisfied with equality

d) If the primal has an optimal solution, so has the dual.

x) Introduction of dummy variable in the assignment problem in case of

a) maximization in assignment problem

b) multiple optimal solution

c) unbalanced assignment problem

d) all of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. What do you mean by operation research ? Explain the different phases of OR. 2 + 3

3. Briefly discuss about the essential characteristics of Linear Programming Model.

4. Write the dual of the following primal LP problem :

Max $Z = x_1 + 2x_2 + x_3$

Subject to $2x_1 + x_2 - x_3 \le 2$

$$-2x_1 + x_2 - 5x_3 \ge -6$$

$$4x_1 + x_2 + x_3 \le 6$$

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

5. Explain the principal assumptions made while dealing with sequencing problem.

6. Discuss Kendall's Notation for representing queuing models.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Discuss the basic properties of an LP Model ? 3

   b) Establish the general expression of an LPP. 4

   c) Solve the following by graphical method : 8

   Max $Z = 5x_1 + 8x_2$

   Subject to $3x_1 + 2x_2 \le 36$

   $x_1 + 2x_2 \le 20$

   $3x_1 + 4x_2 \le 42$

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

8. a) Establish the primal-dual relationship with an example. 5

   b) Solve the following LPP by simplex method : 10

   Max $Z = 2x_1 + x_2$

   Subject to $4x_1 + 3x_2 \le 2$

   $4x_1 + x_2 \le 8$

   $4x_1 - x_2 \le 8$

   Where, $x_1, x_2 \ge 0$

9. a) Explain degeneracy in a Transportation Problem and how to resolve it. 4

b) Find the minimum transportation cost. 11

Warehouse

Factory		D_1	D_2	D_3	D_4	**Supply**
	F_1	19	30	50	10	7
	F_2	70	30	40	60	9
	F_3	40	8	70	20	18
	Demand	5	8	7	14	

10. a) Explain the difference between a transportation problem and an assignment problem. 4

b) Give a mathematical formulation of the assignment problem. 4

c) There are five jobs to be assigned, one each to 5 machines and the associated cost matrix is as follows : 7

Machines

Jobs

$$
\begin{array}{c}
 \\ A \\ B \\ C \\ D \\ E
\end{array}
\begin{array}{c}
\begin{array}{ccccc} \mathbf{1} & \mathbf{2} & \mathbf{3} & \mathbf{4} & \mathbf{5} \end{array} \\
\begin{bmatrix}
11 & 17 & 8 & 16 & 20 \\
9 & 7 & 12 & 6 & 15 \\
13 & 16 & 15 & 12 & 16 \\
21 & 24 & 17 & 28 & 26 \\
14 & 10 & 12 & 11 & 15
\end{bmatrix}
\end{array}
$$

11. Write short notes on any *three* of the following : 3×5

a) North West Corner Rule

b) Unbalanced Transportation Problem

c) Hungarian Method

d) Method of processing n jobs through three machines A, B, C

e) Classification of Queueing Models.

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