2022

STATISTICS — GENERAL

Paper : DSE-A-1

(Operations Research)

Full Marks : 50

The figures in the margin indicate full marks.

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

1. Answer **any five** questions : 2×5
   (a) Define a convex set with an example.
   (b) What do you mean by an artificial variable in an LPP?
   (c) When does a transportation problem become unbalanced?
   (d) Name two areas where Operations Research techniques can be applicable.
   (e) What do you mean by replacement ratio in terms of a simplex tableau?
   (f) Define a slack variable in an LPP with a suitable example.
   (g) What do you mean by extreme point of a convex set?
   (h) How do you convert a maximization assignment problem to a minimization problem?

2. Answer **any two** questions : 5×2
   (a) What do you mean by optimum solution and feasible solution?
   (b) Discuss when you can graphically conclude that an LPP has an unbounded solution.
   (c) Briefly explain the different phases of Operations Research.

3. Answer **any three** questions :
   (a) (i) Write the steps for solving an LPP by Graphical method. State its limitations.
       (ii) Explain Charne's Big-M method for solving an LPP. 5+5
   (b) (i) Write down the standard form of the problem :
           Maximize $z = 5x_1 - 2x_2 + 3x_3$
           subject to $2x_1 + 2x_2 - x_3 \geq 2$
                       $3x_1 - 4x_2 \leq 3$
                       $x_2 + 3x_3 \leq 5$
                       $x_1, x_2, x_3 \geq 0.$
       Mention the different types of variables used in this context.
       (ii) Prove that the dual of a dual problem is the primal problem. 5+5

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(c) Write down the mathematical model of an assignment problem. If in an assignment problem we add a constant to every element of any row or column of the cost matrix, then show that an assignment that minimizes the total cost on one matrix will also minimize the total cost on the other transformed matrix.

6+4

(d) Write down the steps of the algorithm for solving an assignment problem by the Hungarian Method.

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(e) (i) Write the steps involved in the North-West Corner rule for finding an initial basic feasible solution to a transportation problem.

(ii) What is degeneracy in transportation problem? How it can be solved? 5+(2+3)