2020

STATISTICS — GENERAL

Paper : DSE-A-2

(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.

Day 1

1. Answer ***any ten*** questions from the following : 1×10

(a) Define feasible solution.

(b) Dual simplex method always gives degenerate solution. [Write True / False]

(c) Name various phases of operations research.

(d) Who introduced the simplex algorithm?

(e) A feasible solution to an L.P.P. must satisfy all the constraints simultaneously. [Write True / False]

(f) What do you mean by artificial variable?

(g) Hungarian method is used to solve _____ problems. [Fill in the blank]

(h) An L.P.P. may have infinite solutions. [Write True / False]

(i) Graphical method can be applied when the number of variables is _____. [Fill in the blank]

(j) North-East Corner rule is used in transportation problem. [Write True / False]

(k) Write an area of application of OR.

(l) Assignment is a special type of transportation problem. [Write True / False]

(m) In Charne's M method, M assumes

(i) small positive value

(ii) large positive value

(iii) large negative value.

[Choose the right answer]

(n) A basic feasible solution is always unique. [Write True / False]

(o) Matrix minima method gives optimum solution to a transportation problem. [Write True/False]

2. Answer ***any four*** questions from the following : 5×4

(a) An agricultural farm has 180 tons of nitrogen fertilizers, 250 tons of phosphate and 220 tons of potash. It is able to sell 3 : 3 : 4 mixtures of these substances at a profit of ₹ 15 per ton and 1 : 2 : 1 mixtures at a profit of ₹ 12 per ton respectively. Formulate an L.P.P. problem to show how many tons of these two mixtures should be prepared to obtain the maximum profit.

(b) Define basic feasible solution. When does a basic feasible solution become degenerate? — Explain using an example.

(c) For the following equations, find the basic solution with x_3 as the non-basic variable :

$$x_1 + 4x_2 - x_3 = 3$$
$$5x_1 + 2x_2 + 3x_3 = 4$$

(d) Show that the set of all convex combinations of a finite number of points is a convex set.

(e) What do you mean by dual problem in the context of L.P.P.? Discuss economic interpretation of duality.

(f) Prove that a transportation problem always has a feasible solution.

3. Answer ***any two*** questions.

(a) (i) Discuss different properties of L.P. model.

(ii) Graphically solve the following L.P.P. :

maximize : $Z = 10x_1 + 15x_2$

subject to : $x_1 + x_2 \geq 2$

$3x_1 + 2x_2 \leq 6z$

$x_1, x_2 \geq 0.$ 5+5

(b) (i) Write the first tableau to solve the following L.P.P. using simplex :

maximize : $Z = 2x_1 + 3x_2 + x_3$

subject to : $-3x_1 + 2x_2 + 3x_3 = 8$

$-3x_1 + 4x_2 + 2x_3 = 7$

$x_1, x_2, x_3 \geq 0.$

(ii) Discuss the formulation of a transportation problem as an L.P.P. 6+4

(c) (i) Formulate the dual problem of the following L.P.P. :

maximize : $Z = 2x_1 + 5x_2 + 6x_3$

subject to : $5x_1 + 6x_2 - x_3 \leq 3$

$-2x_1 + x_2 + 4x_3 \leq 4$

$x_1 - 5x_2 + 3x_3 \leq 1$

$-3x_1 - 3x_2 + 7x_3 \leq 6$

$x_1, x_2, x_3 \geq 0.$

(ii) Find the optimal assignment to find the minimum cost for the following cost matrix : 4+6

	1	2	3	4
1	1	4	6	3
2	9	7	10	9
3	4	5	11	7
4	8	7	8	5