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 2

1. Answer ***any ten*** of the following : 1×10

(a) The dual of the primal maximization LPP having m constraints and n non-negative variables should have n constraints and m non-negative variables. (True / False)

(b) Linear programming models have an objective function to be maximized but not minimized. (True / False)

(c) Slack variables are only associated with maximization problems in simplex method. (True / False)

(d) Alternative solution exists in a linear programming problem when one of the constraints is redundant. (True / False)

(e) MODI's Method is used for testing optimality. (True / False)

(f) Basic feasible solution obtained by North-West corner method always has optimal solution. (True / False)

(g) The simplex method considers both feasible and infeasible solutions. (True / False)

(h) In a solution of a two-dimensional LPP, the objective function can assume same values at two distinct extreme points. (True / False)

(i) Transportation model is basically maximization or minimization model; whereas general linear programming model be only maximization type. (True / False)

(j) The occurrence of degeneracy while solving a transportation problem means that total supply equals total demand. (True / False)

(k) If an artificial variable is present in the basic variable column of optimal simplex table, then the solution is unbounded. (True / False)

(l) If we were to use opportunity cost value for an unused cell to test optimality, it should be equal to zero. (True / False)

(m) A balanced transportation problem always has a feasible solution. (True / False)

(n) The Hungarian method for solving an assignment problem can also be used to solve a transportation problem. (True / False)

(o) Two-phase simplex method can be used to solve the system of linear equations. (True / False)

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

(a) Write the dual of the following problem (dual must contain one unrestricted variable) :

Minimize : $Z = x_1 + x_2 + x_3$,

Subject to

$x_1 - 3x_2 + 4x_3 = 5$

$x_1 - 2x_2 \le 3$

$2x_2 - x_3 \ge 4$; $x_1, x_2 \ge 0$ and x_3 is unrestricted in sign.

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

		Machine				
		1	2	3	4	5
Job	*A*	11	17	8	16	20
	B	9	7	12	6	15
	C	13	16	15	12	16
	D	21	24	17	28	26
	E	14	10	12	11	15

Find the assignment of machines to jobs that will minimize the total cost.

(c) Write the algorithm to solve LPP using Graphical method for maximization of profit.

(d) What do you mean by optimum solution? How multiple optimal solutions are recognized when using the simplex algorithm?

(e) What is the difference between Assignment Problem and Transportation Problem?

(f) Check whether the following system of linear equations has degenerate solutions :

$2x_1 + x_2 - x_3 = 2$, $3x_1 + 2x_2 + x_3 = 3$. If yes, find all the degenerate basic feasible solutions.

3. Answer ***any two*** of the following :

(a) (i) Find all the basic solutions of the following system :

$$4x_1 + 2x_2 + x_3 = 4,\ 2x_1 + x_2 + 5x_3 = 5$$

(ii) Write the steps of the algorithm for solving LPP by the Simplex method. 5+5

(b) (i) Write the LPP model of the following Transportation problems :

		Destination				
		I	II	III	IV	Supply
Source	A	40	25	22	33	100
	B	44	35	30	30	30
	C	38	38	28	30	70
Demand		40	20	60	30	

(ii) Solve the following LPP by the two-phase method and give your conclusions about the solution :

Minimize : $z = 4x_1 + 3x_2$

Subject to

$2x_1 + x_2 \geq 10,$

$-3x_1 + 2x_2 \leq 6,$

$x_1 + x_2 \geq 6;$

$x_1, x_2 \geq 0.$ 4+6

(c) What do you mean by basic feasible solution? Find the initial basic feasible solution for the following transportation problem and test whether this solution is optimal or not. If not, find the optimal solution. 10

		Market				
		A	B	C	D	Available
Plant	I	14	9	18	6	11
	II	10	11	7	16	13
	III	25	20	11	34	19
Requirements		6	10	12	15	