

**2020**

**COMPUTER SCIENCE — 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**

Answer **question no. 1** and **any four** questions from the rest.

1. Answer **any five** questions :

2×5

- (a) Define a linear programming problem (LPP).
- (b) When is a solution to an LPP called a feasible solution?
- (c) When is a solution to an LPP called an optimal solution?
- (d) What are slack and surplus variables?
- (e) When is a solution to a system of simultaneous equations called a degenerate solution?
- (f) What do you understand by 2-person zero sum game?
- (g) State the primal-dual relationship.
- (h) Name two methods for solving the transportation problem.

2. (a) Obtain all the basic solutions to the following system of linear equations :

$$x_1 + 2x_2 + x_3 = 4$$

$$2x_1 + x_2 + 5x_3 = 5$$

(b) Use Simplex method to solve the following LPP :

$$\text{Max } Z = 7x_1 + 5x_2$$

subject to the conditions,

$$x_1 + 2x_2 \leq 6$$

$$4x_1 + 3x_2 \leq 12$$

$$x_1, x_2 \geq 0.$$

5+5

**Please Turn Over**

3. (a) Obtain the dual problem of the following L.P.P :

$$\text{Max } Z = x_1 - 2x_2 + 3x_3$$

subject to

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

$$2x_1 + 3x_2 + 4x_3 = 1$$

$$x_1, x_2, x_3 \geq 0.$$

- (b) Prove that the dual of the dual of an LPP is its primal. 5+5

4. (a) Prove that a necessary and sufficient condition for the existence of a physical solution to a  $m \times n$  Transportation Problem is

$$\sum_{i=1}^m a_i = \sum_{j=1}^n b_j$$

where  $a_i$  and  $b_j$  denote the availability and requirement at  $i^{\text{th}}$  origin and  $j^{\text{th}}$  destination respectively.

- (b) Solve the following T.P. to obtain the initial basic feasible solution using Vogel's method.

	D	E	F	G	Available
A	11	13	17	14	250
B	16	18	14	10	300
C	21	24	13	10	400
Demand	200	225	275	250	

5+5

5. (a) Give a mathematical formulation of the Assignment Problem (A.P.).

- (b) Solve the following assignment problem

	I	II	III	IV
A	15	14	12	16
B	23	22	25	24
C	31	34	32	33
D	21	32	44	53

where A, B, C, D are 4 jobs assigned to the machines I, II, III, IV.

Find an allocation of jobs to machines so that the total cost of processing is minimum.

5+5

6. (a) Explain the Maxmin principle used in Game Theory.  
 (b) Solve the game whose pay-off matrix is given by :

$$\begin{array}{c} \text{Player B} \\ \text{B}_1 \quad \text{B}_2 \quad \text{B}_3 \\ \text{Player A} \begin{array}{l} \text{A}_1 \\ \text{A}_2 \\ \text{A}_3 \end{array} \left[ \begin{array}{ccc} 1 & 2 & 1 \\ 0 & -4 & -1 \\ 1 & 3 & -2 \end{array} \right] \end{array}$$

5+5

7. (a) Explain the graphical method for solving an LPP involving two variables.  
 (b) Solve graphically the following LPP.

$$\text{Max } Z = 3x_1 + 2x_2$$

subject to

$$-2x_1 + x_2 \leq 1$$

$$x_1 \leq 2$$

$$x_1 + x_2 \leq 3$$

$$x_1, x_2 \geq 0.$$

5+5

8. (a) Briefly mention the steps to solve a T.P. using North-West Corner rule.  
 (b) Obtain the initial basic feasible solution using N.W. Corner rule.

	D	E	F	G	Available
A	7	9	3	2	16
B	4	4	3	5	14
C	6	4	5	8	20
Requirement	11	9	22	8	

5+5