

INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR

Date of Examination:.....-02-2017, FN/AN, Time: 2 Hours, Full Marks: 30

Mid-Spring Semester 2017, Department of Mathematics, Branch: All

Subject No.:MA30014, Subject Name: Operations Research

Number of Students: 130, Instructions: Answer all the questions(6 x 5=30).

Q1. (a) Find all the Basic Solutions and Basic Feasible Solutions of the system:

$$x_1 + 2x_2 + x_3 + 2x_4 + 3x_5 = 18$$

$$x_1 + 2x_2 + 3x_3 + x_4 + 2x_5 = 24$$

(b) Find the optimal solution of the LPP using the Basic Feasible Solutions.

$$\text{Max: } Z = x_1 + 2x_2 + 3x_3 + 4x_4 + 5x_5$$

Subject to

$$x_1 + 2x_2 + x_3 + 2x_4 + 3x_5 = 18$$

$$x_1 + 2x_2 + 3x_3 + x_4 + 2x_5 = 24, \quad x_1, x_2, x_3, x_4, x_5 \geq 0$$

Q2. Solve the LPP by Simplex method(use condensed Tableau):

$$\text{Max: } Z = 3x_1 + 5x_2 + 4x_3$$

Subject to $x_1 + 2x_2 + 3x_3 \leq 72$

$$3x_1 + x_2 + 2x_3 \leq 66, \quad 3x_1 + 2x_2 + x_3 \leq 60, \quad x_1, x_2, x_3 \geq 0$$

Q3. Solve the LPP by Big-M (Charne's Penalty) method:

$$\text{Min: } Z = 3x_1 + 2x_2 + x_3$$

Subject to $2x_1 + x_2 + x_3 \geq 20, \quad x_1 + 3x_2 + x_3 \geq 30$

$$4x_1 + x_2 + 2x_3 \geq 40, \quad x_1, x_2, x_3 \geq 0$$

Q4. Solve the LPP by Two- Phase Simplex method. Then state the values of the optimal primal variables . Use condensed Tableau only.

$$\text{Min: } Z = 5x_1 + 6x_2 + 8x_3$$

Subject to $2x_1 + 6x_2 + 5x_3 \geq 40$

$$4x_1 + 2x_2 + x_3 \geq 50, \quad x_1, x_2, x_3 \geq 0.$$

Q5. Establish the relationship between a Primal Linear Programming Problem (P) and a Dual Linear Programming Problem (D) using Lagrange multiplier method.

Q6. Prove that minimum value of linear function $Z = C^T X$, defined over a convex region $AX \geq b, X \geq 0$ if exists to be found at the extreme point(s) of the convex region.

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