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INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR

Date of Examination:.....-02-2014, FN/AN, Time: 2 Hours, Full Marks: 30

Mid-Spring Semester 2014, Department of Mathematics, Branch: All

**Subject No.:MA30014, Subject Name: Operations Research**

Number of Students: 83, Instructions: Answer all the 7 Questions.

If needed Graph papers will be supplied in the Examination Hall.

Q1. A 24-hour super market has the following minimal requirement for salespersons. Period 1 follows immediately after period 6. A salesperson works eight consecutive hours starting at the beginning of one of the six periods. Formulate a Linear Programming(LP) model for a daily salesperson worksheet which satisfies the requirement with least number of personnel.

Period	1	2	3	4	5	6
24 Hour Clock	24--4	4--8	8--12	12--16	16--20	20--24
Minimum No.	4	6	10	12	16	8

Suggest a suitable method to solve the LP model ( 4 marks)

Q2. Find the all the Basic Feasible Solution(s) of the system:

$$x_1 + 2x_2 - x_3 + x_4 = 10$$

$$4x_1 + x_2 - x_5 + x_6 = 20$$

$$x_1, x_2, x_3, x_4, x_5, x_6 \geq 0$$

State all the Degenerate solution(s) ( 4 Marks)

Q3. Prove that every Basic Feasible Solution is an extreme point of the convex set of the feasible region of a LP Problem. ( 4 marks )

Q4. State the Steps of Graphical Method. Hence solve the LPP:

$$\text{Max: } Z = -3x_1 - x_2$$

$$\text{Subject to } x_1 + x_2 \geq 100, 2x_1 + x_2 \geq 150$$

$$4x_1 + x_2 \geq 205, x_1, x_2 \geq 0 \quad (4 \text{ marks})$$

Q5. Solve the LPP by Simplex method( use condensed Tableau):

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

$$\text{Subject to } x_1 + 2x_2 + 3x_3 + x_4 \leq 125$$

$$x_1 + x_2 + x_3 + 2x_4 \leq 100$$

$$9x_1 + 6x_2 + 6x_3 + 3x_4 \leq 400, x_1, x_2, x_3, x_4 \geq 0 \quad (4 \text{ marks})$$

Q6. Solve the LPP by Big-M method. Then state the values of the basic and non-basic variables. (Use condensed Tableau )

$$\text{Min: } Z = 12x_1 + 13x_2 + 14x_3$$

$$\text{Subject to } 2x_1 + 6x_2 + 5x_3 \geq 120$$

$$4x_1 + 2x_2 + x_3 \geq 100, x_1, x_2, x_3 \geq 0 \quad ( 5 \text{ marks})$$

Q7. State the Steps of Two-Phase Simplex Method to solve a LPP.

Solve one of the problem( Q4./ Q6.) by Two-Phase method. ( 5 marks)

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