Exam. Code: 1017
Sub. Code: 7781

1108

M.E. Electrical Engineering (Power Systems)
1st Semester
EE-8103: Optimization Techniques

Time allowed: 3 Hours Max. Marks: 50

Note: *Attempt five questions in all.*

x-x-x

1. (a) Consider the following linear programming problem and its optimal table below: (5)

$$\min \quad z = -2x_1 - 4x_2 - 2.5x_3$$

subject to $3x_1+4x_2+2x_3 \leq 60$, $2x_1+x_2+2x_3 \leq 40$, $x_1+3x_2+3x_3 \leq 30$, $x_1, x_2, x_3 \geq 0$
Here, x_4, x_5, x_6 are slack variables.

Basic variables	x_1	x_2	x_3	x_4	x_5	x_6	Constant
x_1	1	0	$-6/5$	$3/5$	0	$-4/5$	12
x_5	0	0	3	-1	1	1	10
x_2	0	1	$7/5$	$-1/5$	0	$9/15$	6
$-z$	0	0	$7/10$	$2/5$	0	$4/5$	48

Suppose the coefficient of x_2 in the second constraint is changed from 1 to 2. Use sensitivity analysis to find the new optimal solution.

(b) Using bounded variable technique, solve the following LPP: (5)

$$\max \quad Z = 6x + 2y + 3z$$

subject to $$-2x + 4y + 2z \leq 9, \quad -x - 2y + 3z \leq 10$$

$$0 \leq x \leq 2, \quad 0 \leq y \leq 2, \quad 0 \leq z \leq 2$$

2. Find the optimal solution of following bounded variable transportation problem to minimize the transportation cost: (10)

				availability
	3	7	6	15
Cost	2	4	3	22
	4	3	8	23
Requirement	20	15	25	

such that $x_{ij} \geq 0$ and the upper bounds are given in the following matrix:

$$[u_{ij}] = \begin{bmatrix} 12 & 15 & 20 \\ 13 & 22 & 10 \\ 10 & 11 & 12 \end{bmatrix}$$

3. Use wolfe's method to solve the quadratic programming: (10)

$$\min \quad Z = x^2 - xy + 2y^2 - x - y$$

subject to $$2x + y \leq 1 \quad x, y \geq 0.$$

4. (a) Check whether following problem is a convex programming problem and verity the result graphically: (5)

$$\max \quad y$$

subject to $x^2 + y^2 \leq 1, \quad x^2 \geq y.$

(b) Let for each $i = 1, 2, ..., m$, g_i be a convex function. Then prove that the set S is a convex set: (5)

$$S = \{x \in R^n : g_i(x) \leq 0, (i = 1, 2, ..., m)\}$$

P.T.O.

5. Using Lagrange multiplier method, find the extreme values of $f(x, y, z) = xy + z^2$ on the on the circle in which the plane $y - x = 0$ intersects the sphere $x^2 + y^2 + z^2 = 4$. (10)

6. (a) Let $f(x)$ be differentiable at $x^* \in S$ and $\nabla f(x^*) \neq 0$. Then $\hat{d} = -\nabla f(x^*)$ is a usable feasible direction at x^* provided $\hat{d}$ is a feasible direction. (5)

(b) Consider the NLP: max $Z = ln(1 + x) + y$ subject

$$2x + y \leq 3, \quad x, y \geq 0$$

Write the KKT conditions. Given that the optimal solution of the above NLP lies on the line $y = 3$, use KKT conditions to find its optimal solution. (5)

7. Using conjugate gradient method find the solution of the system: (10)

$$x + y = 8, \quad 2x + y = 10$$

You may take the starting point as $x^{(0)} = (0, 0)^T$.

8. (a) Solve the following linear fractional programming problem by the simplex algorithm (6)

$$\max \quad Z = \frac{2x + y}{x - 2y}$$

subject to

$$x + y \leq 6, \quad 2x + y \geq 4, \quad x, y \geq 0$$

(b) Write the Wolfe dual of the following NLP: (4)

$$\max \quad Z = 2x + 4y$$

subject to $x^2 + y^2 \leq 5, \quad x - y \leq 2.$

x-x-x