SESSION 15

25 March 2025 06:36

Until mid-term

1. Role of optim.
2. Convex Sets, functions
3. Convex optimization
4. Condition - KKT

End Term

5. Linear programming
6. Quadratic
7. Gradient based method

* Linear Optimization Problem :- (Linear Programming L.P)

A general linear Program

$$\left.\begin{array}{ll} \text{minimize} & C^T x + d \\ \text{Subject to} & Gx \le h \\ & Ax = b \end{array}\right\} \quad (1)$$

where, $G \in \mathbb{R}^{m \times n}$, $A \in \mathbb{R}^{p \times n}$, $x \in \mathbb{R}^n$, $b \in \mathbb{R}^p$, $h \in \mathbb{R}^m$

d can be omitted as it doesn't affect the feasible set.

The feasible set of the L.P is a polyhedron (?) (Is How)

Standard form of L.P

$$\left.\begin{array}{ll} \text{minimise} & c^T x \\ \text{subject to} & Ax = b \\ & x \geq 0 \end{array}\right\} (2)$$

Transformation using slack variable [Ref: Pg no. 146]

1st step : minimise $c^T x + d$

subject to $Gx + s = h$

$Ax = b$

$s \geq 0$

2nd step : minimize $c^T x^+ - c^T x^- + d$

Subject to ($x = x^+ - x^-$) $Gx^+ - Gx^- + s = h$

$Ax^+ - Ax^- = b$

Standard form of LP

$$\left.\begin{array}{ll} \text{minimise} & c^T x \\ \text{subject to} & Ax = b \\ & x \geq 0 \end{array}\right\} (2)$$

Q: Show that standard form of LP and original LP in (1) are equivalent.

(Reference : Exercise 4.10, Pg. no. 193)

A farmer in Punjab owns 10 acres land two crops : wheat and rice.

Resources : Water & Labor

Aim : Maximize profit

Constraints : Land availability = 10 acres

water " = 50000 L

Labors " = 200 hours

Profit wheat = ₹ 20,000 / acre

rice = ₹ 25,000 / acre

water and Labour requirements per acre

wheat : 4000 Litres , 20 hours

rice : 6000 Litres , 25 hours

X : amount of acres for wheat

Y : " " " " rice

Now write down the object function and constraints.

Objective function : Maximize $20000X + 25000Y$

Constraints : water constraint