Linear Programming (LP) Theory Summary

1. Introduction to LP

Linear Programming (LP) is a method to achieve the best outcome in a mathematical model whose requirements are represented by linear relationships. It's widely used in operations research for optimization problems.

2. LP Problem Structure

A typical LP problem includes:
- Objective Function: Maximize or minimize a linear function.
- Constraints: Linear inequalities or equations.
- Decision Variables: Variables that determine outputs.

3. Graphical Method (2 Variables)

The graphical method solves LP problems with two variables. It involves:
- Plotting constraint inequalities.
- Identifying the feasible region.
- Evaluating the objective function at corner points.

4. Slack, Surplus & Artificial Variables

- Slack Variable: Added to 'less-than-or-equal-to' constraints to convert to equations.
- Surplus Variable: Subtracted from 'greater-than-or-equal-to' constraints.
- Artificial Variable: Added for starting simplex when slack/surplus is not enough.

5. Simplex Method (Overview)

The Simplex Method is an iterative algebraic technique to find the optimal solution. It uses:
- Simplex Tableaux
- Pivot Operations
- Optimality & Feasibility Tests

6. Duality in LP

Every LP problem (the primal) has a corresponding dual. The dual provides insight into the value of resources and helps in sensitivity analysis.