Solving Linear Programming (LP) Problems with Sensitivity Analysis

Linear Programming (LP) problems are solved to find the optimal value of an objective function subject to constraints. Sensitivity analysis, also known as post-optimality analysis, is used to examine how changes in the coefficients of an LP problem (objective function coefficients, constraint coefficients, or right-hand side values) affect the optimal solution. It helps decision-makers understand the robustness of the solution by answering:

- How much can an objective function coefficient change before the optimal solution changes?
- How much can a constraint's right-hand side (RHS) change before the optimal basis shifts?
- What happens when new constraints or variables are added?

Sensitivity analysis does not solve LP problems from scratch; rather, it evaluates how small modifications impact the already obtained solution.

Comparison with Other LP Solving Methods

1. **Simplex Method:**
   - An iterative algebraic procedure that moves from one vertex (feasible solution) to another in the feasible region until reaching the optimal solution.
   - Provides sensitivity information naturally as part of its output (shadow prices, reduced costs, etc.).
2. **Geometric Method:**
   - Solves LP problems by graphing constraints and identifying the feasible region.
   - The optimal solution is found by checking the objective function at the extreme points of the feasible region.
   - Works only for two-variable problems and lacks scalability for larger problems.

Difference: Sensitivity analysis is an additional step performed after obtaining the LP solution, whereas the simplex and geometric methods are actual solving techniques.