Simplex Method

1. History
The Simplex Method is an algorithm which allows us to solve linear programming models (LP)

In 1947 it was first published by George Dantzig, an American mathematician.

2. Standard Form
The Simplex Method's application requires the linear programming model to be in its standard form.

We can assume without loss of generality that a linear programming model results from the standard form.

3. Basic Solution
A basic feasible solution satisfies the standard form's conditions and the decision variables are nonnegative.

A basic feasible solution matches a vertex in domain of a Linear Programming model's feasible solutions

4. Optimality Criterion
The Basic feasible solution is optimal if and only if the reduced costs of all the nonbasic variables are higher or equal to zero.

In this example the optimal basic feasible solution is X=100, Y=350 and S2=400. The nonbasic variables S1 and S3 have nonnegative reduced costs.

5. Infinite Solutions
In this example we observe an optimal basic feasible solution, where the nonbasic variable S2 has a reduced cost equal to zero.

6. Unbounded Problem
This case is seen when, while doing the calculus of the variable which leaves the base, all the elements ykj of the column j in the tableau are negative.

Where j matches the index of a nonbasic variable with negative reduced cost.

7. Infeasible Problem
This is the case when the optimal value of the problem in Phase 1 (in a Simplex Method of Two Phases) is nonzero.

This way we try to get a lower number of iterations to achieve the optimal solution of the LP.

8. Rate of Convergence
This way we try to get a lower number of iterations to achieve the optimal solution of the LP.

9. Postoptimal Analysis
Once we achieve the optimal solution through the Simplex Method, we can analyze the impact of the alteration of the objective function. Add a new variable Add a new restriction

The goal is to analyze the possible changes in the optimal solution and the optimal value of the model with no need to re-optimize.

10. Excel Solver
The Excel complement “Solver” allows us to use the Simplex Method as a solving method (Simplex LP)

Simplex PL turns out to be specially suitable for the resolution of Linear Programming models.

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