Simplex Method – Linear Programming

The simplex method is the most popular method for solving Linear Programming Problems (LPP). It is a search procedure that shifts through the set of basic feasible solutions, one at a time until the optimal basic feasible solution is identified.

It is an approach to solving linear programming models by hand using slack variables, tableaus, and pivot variables as a means of finding the optimal solution to an optimization problem. A linear program is a method of achieving the best outcome given a maximum or minimum equation with linear constraints.

The simplex method is not used to examine all the feasible solutions. It deals only with a small and unique set of feasible solutions, the set of vertex points (i.e., extreme points/corner points) of the convex feasible space that contains the optimal solution.

1. ***Corner Point Feasible Solutions*** - The corner points (or extreme points) of a feasible region are the points of intersection between two (or more) constraints.

2. ***Optimal Solution*** - An optimal solution to a linear program is the feasible solution with the largest objective function value (for a maximization problem) and least objective function value (for a minimization problem).

The logic behind the simplex method is the same as the logic with which we work out a graphical solution for the LPP. It eliminates some of the steps in the graphical method so that we reach the optimum solution faster.

The number of variables in the equation determines the number of dimensions in the graph. So if the equation has two variables (x,y) we plot a two-dimensional graph with the x & y axis. But what if the problem has 3 or more variables? We cannot draw a 3 or 4-dimensional graph to solve it. This is when the simplex algorithm comes into the scenario.

Limitations:

- Although any CPF solution can be chosen to be the initial CPF solution, ***the simplex method always chooses the "origin" (0,0).***

- The simplex method can choose the origin as the initial corner point only when it is feasible. When the simplex method is ready to choose a new CPF solution to move from the current CPF solution, ***it only considers adjacent CPF solutions because one of them is likely to be an optimal solution***.
- ***One of the adjacent points is likely to be better, not necessarily optimal*** – the word not necessarily clearly states that this is a hypothetical statement which can be true or not true as well.
- ***The simplex method only identifies the rate of improvement, not all the adjacent corner points*** – it only helps in finding the rate of improvement but doesn't take into count all the adjacent corner points, by which there are probabilities of driving towards the incorrect rate of improvement.
- ***Not so great for large problems***, because the cost of pivoting and computerisation rises as the severity of the problem rises.
- ***Use of profound technologies,*** there are many advanced technical tools which are in existence these days wherein we would be getting the answer within minutes, so people would prefer ***ease in usage*** thereby accepting the latest tools over the traditional method of simplex which has many things to define and steps to follow along all the corner points thereby testing them to get the optimal solution.

Conclusion:

Although following the corner point feasible solutions to reach the optimal solution is the best approach which eventually helps in attaining the objective function, it has its limitations which are defined above. For smaller problems, this would be the best approach since it doesn't involve too much cost and computerization, but when it comes to larger problems following the advanced methodologies would be the best thing.

References:

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