**Simplex Method**

The Simplex method is a technique for solving linear programming models that makes use of slack variables, tableaus, and pivot variables to determine the best answer to an optimization problem. Using a maximum or minimum equation and linear constraints, a linear program is a technique for getting the best result. The steps listed below are required to solve a linear programming model using the Simplex method:

1. Standard form
2. Introducing slack variables
3. Creating the tableau
4. Pivot variables
5. Creating a new tableau
6. Checking for optimality
7. Identify optimal values

**Limitations:**

Since this method uses various assumptions and considerations, there are several limitations to this method. Below are few,

* **Tie for the Entering Basic Variable:**
  + In selecting the pivot column, the largest modulo value is considered but if there are two variables with equal values. For example, consider the equation, **Z = 3x+3y** in this equation both **x** and **y**.
  + In this case, the value is chosen arbitrarily until an optimal solution is obtained but however, we won’t be able to find it in advance which value gets you the optimal solution which ultimately increases computational time.

* **Tie for the Leaving Basic Variable—Degeneracy:**
  + When selecting pivot row, we calculate minimum ratio and then select whichever value is minimum and select that row for finding the leaving basic variable. This leads to an ambiguity where there might be multiple rows with the same minimum ratio.
  + The selection for intersection value for pivot column and pivot row will be made arbitrarily.
  + Though the decision is to select arbitrarily, we might run into loops while solving the problem if wrong value is selected. Each time when value is selected different solutions are obtained

* **No Leaving Basic Variable—Unbounded Z:**
  + Also, there is another problem, if the minimum ratio is found to be undefined or zero, as simplex method only considers coefficients greater than zero.
  + When this happens, simplex method cannot calculate the solution and returns with an error stating **Unbounded Z.**

* **Multiple Optimal Solutions:**
  + Simplex method basically stops when an optimal basic feasible solution (BF) has been found.
  + In real time, as we are omitting several external constraints to get optimal solution. We need more than one optimal solution to choose from based on the external constraints around us.

* Apart from these limitations, there are other limitations that include,
  + Time Consumption as there are lot of iterations included.
  + Complex computation, when there are more decision variables
  + It can give various solutions whose results can be impractical or meaningless when different considerations are considered.
  + There are various assumptions which linear programming problem models make in the values of constraint variables and objective function. The constraint variables can be something like rate of profit. There are chances that these assumptions are incorrect.

**Conclusion:**

Although there are several rules and assumptions are placed in simplex method, it can only provide solutions that are theoretically approved but when it comes to real time there are several factors which can alter the solution. Arbitrarily choosing values will also become time consuming as we don’t know in advance, which value gets you the optimal solution. With the above limitations mentioned, simplex method can only be used within the boundaries of its rules and limitations to get an ideal solution.

**References:**

‘INTRODUCTION TO OPERATIONS RESEARCH’ Tenth Edition by FREDERICK S. HILLIER Stanford University, GERALD J. LIEBERMAN Late of Stanford University