Summary

- The simplex is an important term in mathematics, one that represents an object in an n-dimensional space, connecting n+ 1 point
    - In one dimension, a simplex is a line segment connecting two points
    - In two dimensions, it is a triangle formed by joining three points
    - In three dimensions, it is a four sided pyramid, having four corners

- The concept of simplex method is similar to the graphical method. In the graphical method, extreme points of the feasible solution space are examined in order to search for the optimal solution that lies at one of these points

- For linear programming problems with several variables, we may not be able to graph the feasible region but the optimal solution will still lie at an extreme point of the many sided, multi-dimensional figure called n-dimensional polyhedron that represents the feasible solution space

- The simplex method examines the extreme points in a systematic manner repeating the same set of steps of the algorithm until an optimal solution is found. It is for this reason that it is called the iterative method

- Since the number of extreme points (corners or vertices) of the feasible solution space are finite, the method assures an improvement in the value of the objective function as we move from one iteration (extreme point) to another and achieve the optimal solution in a finite number of steps. The method also indicates when an unbound solution is reached

Standard Form of Linear Programming Problem:
The use of simplex method to solve a linear programming problem requires that the problem can be converted into its standard form. The standard form of the linear programming problem should have the following characteristics:

1. All the constraints should be expressed as equations by adding the slack or surplus and /or artificial variables
2. The right hand side of each constraint should be made non-negative if it is not already, this should be done by multiplying both sides of the resulting constraint by minus 1
3. The objective function should be of the maximization type

- A **slack variable** represents an unused resource, either in the form of time on a machine, labour hours, money, warehouse space or any number of such resources in various business problems, since these variables don't yield any profit, therefore such variables are added to the original objective function with zero coefficients

- A **surplus variable** represents the amount by which solution values exceed a resource. These variables are also called negative slack variables. Surplus variables, like slack variables carry a zero coefficient in the objective function

Simplex Algorithm (Maximization Case):
The steps of the simplex algorithm for obtaining an optimal solution (if it exists) to a linear programming problem are as follows:

Step 1: Formulation of the mathematical model
Step 2: Set-up the initial solution
Step 3: Test for optimality

Step 4: Select the variable to enter the basis
Step 5: Test for feasibility (variable to leave the basis)
Step 6: Finding the new solution
Step 7: Repeat the procedure