Summary of Simplex Algorithm (MAX)

1. Convert to a form with all positive right-hand sides, non-negativity constraints and a max objective:
   (a) If the objective is min, negate the objective
   (b) If a variable $x_i$ is unrestricted, replace it with $x_i' - x_i''$
   (c) If the right hand side of a constraint is negative, multiply the constraint by $-1$.

2. Add variables to convert to equality constraints
   (a) In each $\leq$ constraint, add a slack variable.
   (b) In each $\geq$ constraint, add an excess and an artificial variable.
   (c) In each $=$ constraint, add an artificial variable.
   (d) For each artificial variable $a_i$, add $-Ma_i$ to the objective, where $M$ is a large number.

3. Set up initial tableaux
   (a) Place, on the left hand side of each equation, either a slack or artificial variable.
   (b) Use the equations for the artificial variables to remove the artificial variables in the objective function.

4. We now have a tableaux and a basic feasible solution in which all the right-hand-side variables are zero.

5. Repeatedly pivot, choosing a variable with positive objective function coefficient as the entering variable and the most limiting (ratio test) variable as the leaving variable.

6. Stopping conditions
   (a) If at some point, no constraint limits the increase in the entering variable, return unbounded
   (b) Stop when no non-basic variable has positive coefficient in the objective function.

7. Obtaining a solution
   (a) If an artificial variable is non-zero, return infeasible.
   (b) Else, return the basic feasible solution and optimal objective function value.