**Tute 6: Revised Simplex Method**

- Computationally efficient form of the Simplex Method → used in commercial LP solvers

- **Advantage:** at each iteration, only a small percentage of the elements in the tableau are used

- **Notation:**
  - $B$ refers to basic variables
  - $NB$ refers to non-basic variables
  - $I_B$ index set for the current basis (ORDER IS IMPORTANT → the corresponding columns should form the identity mat.)
  - $I_{NB}$ index set for the current non-basic variables (write in ascending order)
  - $b$ RHS from INITIAL TABLEAU
  - $c_B$ negative of the reduced costs of the current basic vars (from INITIAL TABLEAU)
  - $c_{NB}$ negative of the reduced costs of the current non-basic vars (from INITIAL TABLEAU)
  - $A_{NB}$ columns of the current non-basic variables (from INITIAL TABLEAU)
  - $[A_B]^{-1} = \hat{B}$ the columns of the current tableau corresponding to the basic variables in the initial tableau

**Revised Simplex Method Steps**

**Step 1:** Set up initial tableau. Identify $I_B$ and $I_{NB}$.

**Step 2-4:** Greedy Rule (select new B.V.), Ratio Test (as normal)

**Step 5:** Update $I_B, I_{NB}$. Specify $c_B, c_{NB}$.

**Step 6:** Update $\hat{B}$ by pivoting [only apply the row operations to the columns of the current tableau corresponding to the Basic Var's in the initial tableau]

**Step 7:** Construct $T$, where $T = \begin{bmatrix} \hat{B} & 0 \\ c_B & 1 \end{bmatrix}$.

**Step 8:** Update the z-row of the non-basic variables by calculating new z-row = final row of $T \times$ initial tableau (For a Max problem) If this vector contains all non-negative elements, go to Step 11. Else continue.

**Step 9:** Select most negative element of new z-row as the new B.V.

**Step 10:** Specify the column of coefficients in the updated tableau corresponding to the new basic variable:

$$a' = Ta$$

Update the RHS using

$$b' = Tb$$

Now perform the Ratio Test as normal. Go to Step 5.

**Step 11:** Specify the optimal solution, using

$$x_B = \hat{B}b$$

$$x_{NB} = (0, 0, ..., 0)$$

$$z = c_Bx_B$$

(DON'T FORGET: $x^* = ... \; z^* = ...$)