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 indentity 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 var's (from INITIAL TABLEAU)

c_{NB} negative of the reduced costs of the current non-basic var's (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

[**NB**: if $\underline{a}$ is any column of the initial tableau, $\hat{B}\,\underline{a}$ gives the updated column in the current tableau
ie, $\hat{B}$ acts as a 'record' of the row operations we have carried out to date]

T6 PO

REVISED SIMPLEX METHOD STEPS

STEP 1: Set up initial tableau. Identify I_B and I_{NB}.

STEPS 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 $T = \begin{bmatrix} \hat{B} & 0 \\ c_B\hat{B} & 1 \end{bmatrix}$.

STEP 8: Update the z-row of the non-basic variables by calculating new z-row = final row of T × 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:

$$\underline{a}' = T\underline{a}$$

Update the RHS using

$$b' = Tb$$

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

STEP 11: Specify the optimal solution, using

$$x_B = \hat{B}b$$
$$x_{NB} = (0, 0, \ldots, 0)$$
$$z = c_B x_B$$

(DON'T FORGET: $\therefore x^* = \ldots,\ z^* = \ldots$)