Homework 5
Due Friday 02/08

1. Using the simplex method, determine if the following LPs / tableaus are degenerate, unbounded, or have multiple solutions (or neither of these options). Use Bland's rules for choosing the entering variable.

   (a)

$$\begin{aligned} \max \quad & z = 10x_1 + 5x_2 \\ \text{subject to} \quad & \\ & x_1 + 3x_2 \leq 6 \\ & -2x_1 + x_2 \geq 0 \\ & x_i \geq 0 \qquad \forall i = 1, 2 \end{aligned}$$

   (b)

$$\begin{aligned} \max \quad & z = 10x_1 + 5x_2 \\ \text{subject to} \quad & \\ & x_1 + 3x_2 \geq 6 \\ & -2x_1 + x_2 \leq 0 \\ & x_i \geq 0 \qquad \forall i = 1, 2 \end{aligned}$$

   (c)

$$\begin{aligned} \max \quad & z = 5x_1 + 15x_2 \\ \text{subject to} \quad & \\ & x_1 + 3x_2 \leq 6 \\ & -2x_1 + x_2 \geq 0 \\ & x_i \geq 0 \qquad \forall i = 1, 2 \end{aligned}$$

(d)

$$\begin{aligned} \max \quad & z = 6x_1 + 15x_2 \\ \text{subject to} \quad & \\ & x_1 + 2x_2 \leq 6 \\ & 3x_1 + 2x_2 \leq 2 \\ & x_1 + x_2 \leq 6 \\ & x_1 \leq 3 \\ & x_i \geq 0 \qquad \forall i = 1, 2 \end{aligned}$$

2. **OPTIONAL Cycling Example.** Complete 6 iterations of Simplex using the following rules of selection: Choose most negative variable to enter basis. In case of ratio tie, pick the lowest numbered row with a positive coefficient in the entering column. (The first iteration you select column 1 row 1).

-3/4	150	-1/50	6	0	0	0	0
1/4	-60	-1/25	9	1	0	0	0
1/2	-90	-1/50	3	0	1	0	0
0	0	1	0	0	0	1	1