Series of Exercises # 2

1. Solve the following LP problem using the simplex method

$$\begin{array}{lrcrcrcrcl} \text{maximize} & 5x_1 & + & 6x_2 & + & 9x_3 & + & 8x_4 & & \\ \text{subject to} & x_1 & + & 2x_2 & + & 3x_3 & + & x_4 & \leq & 5 \\ & x_1 & + & x_2 & + & 2x_3 & + & 3x_4 & \leq & 3 \\ & x_1 & & & & & & & \geq & 0 \\ & & & x_2 & & & & & \geq & 0 \\ & & & & & x_3 & & & \geq & 0 \\ & & & & & & & x_4 & \geq & 0 \end{array}$$

2. Solve the following LP problem using the simplex method

$$\begin{array}{lrcrcrcl} \text{maximize} & 2x_1 & + & x_2 & & & \\ \text{subject to} & 2x_1 & + & 3x_2 & \leq & 3 \\ & x_1 & + & 5x_2 & \leq & 1 \\ & 2x_1 & + & x_2 & \leq & 4 \\ & 4x_1 & + & x_2 & \leq & 5 \\ & x_1 & & & \geq & 0 \\ & & & x_2 & \geq & 0 \end{array}$$

3. Consider the following LP

$$\begin{array}{lrcrcrcl} \text{maximize} & 3x_1 & + & 2x_2 & + & 4x_3 & & \\ \text{subject to} & x_1 & + & x_2 & + & 2x_3 & \leq & 4 \\ & 2x_1 & & & + & 3x_3 & \leq & 5 \\ & 2x_1 & + & x_2 & + & 3x_3 & \leq & 7 \\ & x_1 & & & & & \geq & 0 \\ & & & x_2 & & & \geq & 0 \\ & & & & & x_3 & \geq & 0 \end{array}$$

   (a) Solve the previous LP problem using the simplex method with dictionaries

   (b) Solve the previous LP problem using the simplex method with tableaux

4. Solve the following LP problem using the simplex method

$$\begin{array}{lrcrcl} \text{maximize} & x_1 & + & x_2 & & \\ \text{subject to} & 2x_1 & + & 3x_2 & \leq & 1 \\ & x_1 & & & \leq & \frac{1}{3} \\ & & & x_2 & \leq & \frac{1}{4} \\ & x_1 & & & \geq & 0 \\ & & & x_2 & \geq & 0 \end{array}$$

5. Solve the following LP problem using the simplex method

$$
\begin{array}{lrcrcrcl}
\text{maximize} & x_1 & + & 3x_2 & - & x_3 & & \\
\text{subject to} & 2x_1 & - & x_2 & + & x_3 & \leq & 10 \\
& 3x_1 & - & 2x_2 & + & x_3 & \leq & 10 \\
& x_1 & - & 3x_2 & + & x_3 & \leq & 10 \\
& x_1 & & & & & \geq & 0 \\
& & & x_2 & & & \geq & 0 \\
& & & & & x_3 & \geq & 0
\end{array}
$$

6. Solve the following LP problem using the simplex method with tableaux

$$
\begin{array}{lrcrcrcl}
\text{maximize} & x_1 & + & 3x_2 & - & x_3 & & \\
\text{subject to} & 2x_1 & + & 2x_2 & - & x_3 & \leq & 10 \\
& 3x_1 & - & 2x_2 & + & x_3 & \leq & 10 \\
& x_1 & - & 3x_2 & + & x_3 & \leq & 10 \\
& x_1 & & & & & \geq & 0 \\
& & & x_2 & & & \geq & 0 \\
& & & & & x_3 & \geq & 0
\end{array}
$$

7. Find all the optimal solutions to the following LP problem using the simplex method

$$
\begin{array}{lrcrcrcrcl}
\text{maximize} & 2x_1 & + & 3x_2 & + & 5x_3 & + & 4x_4 & & \\
\text{subject to} & x_1 & + & 2x_2 & + & 3x_3 & + & x_4 & \leq & 5 \\
& x_1 & + & x_2 & + & 2x_3 & + & 3x_4 & \leq & 3 \\
& x_1 & & & & & & & \geq & 0 \\
& & & x_2 & & & & & \geq & 0 \\
& & & & & x_3 & & & \geq & 0 \\
& & & & & & & x_4 & \geq & 0
\end{array}
$$