Problem 1. Write a linear programming program which decides whether a given oriented graph contains an oriented cycle.

Problem 2. Solve the following problem

$$
\begin{array}{rrcrcl}
\text{Maximize} & 3x_1 & + & x_2 & & \\
\text{subject to} & x_1 & - & x_2 & \leq & -1 \\
& -x_1 & - & x_2 & \leq & -3 \\
& 2x_1 & + & x_2 & \leq & 2 \\
& & & x_1, x_2 & \geq & 0
\end{array}
$$

Problem 3. Solve the following problem

$$
\begin{array}{rrcrcl}
\text{Maximize} & 3x_1 & + & x_2 & & \\
\text{subject to} & x_1 & - & x_2 & \leq & -1 \\
& -x_1 & - & x_2 & \leq & -3 \\
& 2x_1 & - & x_2 & \leq & 2 \\
& & & x_1, x_2 & \geq & 0
\end{array}
$$

Problem 4 (Homework A). Solve the following problem

$$
\begin{array}{rrcrcrcl}
\text{Maximize} & 4x_1 & - & 2x_2 & + & 7x_3 & & \\
\text{subject to} & 5x_1 & + & x_2 & - & 2x_3 & \leq & 12 \\
& -x_1 & - & x_2 & + & x_3 & \leq & -1 \\
& 2x_1 & + & x_2 & & & \leq & 4 \\
& x_1 & + & x_2 & & & \leq & 4 \\
& & & x_1, x_2, x_3 & & & \geq & 0
\end{array}
$$

Problem 5 (Homework B). Solve the following problem

$$
\begin{array}{rrcrcrcl}
\text{Minimize} & -2x_1 & + & 4x_2 & - & x_3 & & \\
\text{subject to} & 3x_1 & - & 6x_2 & + & 4x_3 & \leq & 30 \\
& 2x_1 & - & 8x_2 & + & 10x_3 & \geq & 18 \\
& & & x_1, x_2, x_3 & & & \geq & 0
\end{array}
$$