ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

Bachelor semester 4-DO

DISCRETE OPTIMIZATION WEEK 1

EXERCISE 1

Solve each of the following linear programs by making a diagram. In each case, specify whether the program is feasible and bounded, feasible and unbounded, or unfeasible. If the program is bounded, specify all optimal solutions. If it is unbounded, give an unbounded ray on which the objective function increases without limit.

1. Find the maximal value (if it exists) of $z = 3x + 4y$ subject to the following constraints

$$\begin{cases} x - y + 1 & \leq & 0 \\ y & \leq & 2 \\ -x & \leq & 2 \end{cases}$$

2. Find the maximal value (if it exists) of $z = 2y - x$ subject to the following constraints

$$\begin{cases} 2y - x - 1 & \leq & 0 \\ y - 2x & \leq & 1 \\ -4y + 3x & \leq & 0 \end{cases}$$

3. Find the maximal value (if it exists) of $z = x + y$ subject to the following constraints

$$\begin{cases} x - y + 1 & \leq & 0 \\ 4x + 2y + 5 & \leq & 0 \\ -x & \leq & 0 \end{cases}$$

4. Find the maximal value (if it exists) of $z = x$ subject to the following constraints

$$\begin{cases} -x - y & \leq & 0 \\ -x + y & \leq & 0 \end{cases}$$

5. Find the maximal value (if it exists) of $z = x + y$ subject to the following constraints

$$\{ \ x + y - 1 \ \leq \ 0$$

EXERCISE 2

A building supply has two locations in town. The office receives orders from two customers, each requiring 3/4-inch plywood.
Customer A needs fifty sheets and Customer B needs seventy sheets.
The warehouse on the east side of town has eighty sheets in stock ; the west-side warehouse has sixty sheets in stock.
Delivery costs per sheet are as follows : 1 CHF from the eastern warehouse to Customer A, 1.10 CHF from the eastern warehouse to Customer B, 0.80 CHF from the western warehouse to Customer A, and 1.05 CHF from the western warehouse to Customer B.
Formulate the Linear Program associated to the problem of minimalizing the cost of shipping.