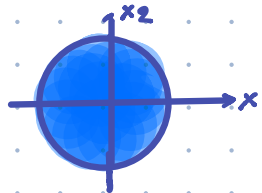


# Class 1 Examples

Which of the following problems is an LP?

$$\begin{array}{ll}\min & x_1 + 5x_2 \\ \text{s.t.} & \\ x_1, x_2 \in & \end{array}$$


$$\begin{array}{ll}\min & 5 \\ \text{s.t.} & \sum_{i=1}^n x_i \leq 1\end{array}$$

$$\begin{array}{ll}\min & 6 - 8x \\ \text{s.t.} & |x| \leq 1 \\ & x \in \mathbb{R}\end{array}$$

$$\begin{array}{ll}\min & 3x + 16 \\ \text{s.t.} & 0 < x < 8 \\ & x \in \mathbb{R}\end{array}$$

**Problem 1** (3 points): The Metalco Company desires to blend a new alloy of 43% tin, 36% zinc, and 21% lead from several available alloys have the following properties:

Property	Alloy 1	Alloy 2	Alloy 3	Alloy 4	Alloy 5
% of tin	70	25	40	20	50
% of zinc	10	15	50	50	40
% of lead	20	60	10	30	10
Cost (\$/lb)	22	18	25	24	27

The objective is to determine the proportions of these alloys that should be blended to produce the new alloy at a minimum cost. Formulate a linear programming problem for this problem.

**Solution:** Let  $x_i$  ( $i = 1, 2, 3, 4, 5$ ) be the proportion of Alloy  $i$  being used to produce the new alloy. Then the LP problem can be formulated as

minimize

$22x_1 + 18x_2 + 25x_3 + 24x_4 + 27x_5$

subject to

$70x_1 + 25x_2 + 40x_3 + 20x_4 + 50x_5 = 43$

$10x_1 + 15x_2 + 50x_3 + 50x_4 + 40x_5 = 36$

$20x_1 + 60x_2 + 10x_3 + 30x_4 + 10x_5 = 21$

$x_1 + x_2 + x_3 + x_4 + x_5 = 1$

$x_i \geq 0, i = 1, 2, 3, 4, 5.$