<u>Recall:</u> The general form of a linear program

For the objective variables $x_1, \ldots, x_n$ find the minimum (or the maximum) of the objective function

$$z = c_1 x_1 + \ldots + c_n x_n$$

subject to the constraints:

$$a_{i1} x_1 + \ldots + a_{in} x_n \begin{array}{c} \leq \\ = \\ \geq \end{array} b_i$$

for $i = 1, \ldots, m$, and possibly $x_j \geq 0$ for $j = 1, \ldots, n$.

The *equality* (or *standard*) form of a linear program:

- we are looking for the maximum;
- all constraints are of the form

$$a_{i1} x_1 + \ldots + a_{in} x_n = b_i$$

- we require that $x_j \geq 0$ for $j = 1, \ldots, n$.

> **Fact**
>
> Every linear program can be converted to the equality form.

Example. Convert the following linear program to the equality form.

Minimize the function
$$z = 6x_1 - 10x_2$$

subject to the constraints:

$$5x_1 + 7x_2 \leq 8$$
$$4x_1 + 2x_2 \geq 10$$
$$x_1 \geq 0$$
$$x_2 \in \mathbb{R}$$

The *inequality* form of a linear program:

- we are looking for the maximum;
- all constraints are of the form

$$a_{i1}x_1 + \ldots + a_{in}x_n \le b_i$$

- we require that $x_j \ge 0$ for $j = 1, \ldots, n$.

Fact

Every linear program can be converted to the inequality form.

Linear programs with Python:

`scipy.optimize.linprog` (looks for the minimum of the objective function).