Example of Practical Optimization Problem

A butter production company wants to optimize the use of the machineries in its daily production of butter. Two types of butter are made – sweet and raw. One kilogram of sweet butter gives the company a profit of $10 and one of raw a profit of $15. Two machines are used in the production: a pasteurization machine and a whipping machine. The daily use time of the pasteurization machine is 3.5 hours and 6 hours for the whipping machine. The processing times (in minutes) for 1kg of butter are given below:

Machine	Sweet butter	Raw butter
Pasteurization	3	3
Whipping	3	6

Problem Formulation

What to ignore:

For a first attempt at this problem, we shall ignore: (1) ingredients used in the production, (2) production and material costs, and (3) sequencing of the machine usage.

Variables:

Amount of sweet butter to be produced: x_1

Amount of raw butter to be produced: x_2

What type of variables are they?   Continuous / Discrete

Constraints on these variables: $x_1 \geq 0$, $x_2 \geq 0$

Constraints:

Use of pasteurization machine: $3x_1 + 3x_2$

Total minutes allowed per day = 3.5 x 60 = 210

Use of whipping machine: $3x_1 + 6x_2$

Total minutes allowed per day = 6 x 60 = 360

Therefore, the constraints are:

$$3x_1 + 3x_2 \leq 210$$
$$3x_1 + 6x_2 \leq 360$$

Objective Function:

Maximize profit

Profit = $10x_1 + 15x_2$