Optimization Using Graphs

Consider the problem where a company that produces two types of parts wants to maximize its profit. To do this, it will have to select the number of pieces to produce per day of each type, knowing that it makes a profit of €100 for each piece of type 1 and €150 for each piece of type 2. However, you can only transport 14 pieces per day and production takes one hour and two hours to produce one piece of type 1 and one piece of type 2 respectively. Additionally, the company's packing and packaging section only works 12 hours a day and it takes an hour and a half hour to pack type 1 and type 2 pieces, respectively.
Considering x1 and x2 the decision variables, such that x_1≥0 and x_2≥0, the objective function is defined as the sum of the daily profit, i.e., f(x1,x2)=100x1+150x2. The inequality constraints are also functions of x1 and x1, and depend on the fact that a day contains 24 hours. The first transport constraint defines the maximum number of parts to be produced per day, while the second, considering that only one part can be manufactured at a time, limits the number of parts to be produced by the time to manufacture each one. The third constraint also limits the total number of parts to be produced by the time required for packaging. Thus, the problem can be mathematically formulated as follows:

$$\begin{aligned} \text{maximizar} \quad & f(\mathbf{x}) = 100x_1 + 150x_2, \\ \text{sujeito a} \quad & g_1(\mathbf{x}) : x_1 + x_2 \leq 14, \\ & g_2(\mathbf{x}) : x_1 + 2x_2 \leq 24, \\ & g_3(\mathbf{x}) : x_1 + \frac{x_2}{2} \leq 12, \\ & x_1 \geq 0, x_2 \geq 0. \end{aligned}$$

Solution: