

Digital Technologies and Value Creation (Lecturer: Philippe Blaettchen) – Integer Programming Exercise Solutions

Situation 1

Our variables here are the number of advent calendars of each brand to feature in the display x_1, x_2, x_3 (they are all integers). The objective is to maximize the margin of the supermarket. The constraints are on the weight, the surface, and the minimum number we need to expose. The problem is then:

$$\begin{aligned} \max \quad & 1.2 x_1 + 0.8 x_2 + 1.8 x_3 \\ \text{s.t.} \quad & 0.0875 x_1 + 0.104 x_2 + 0.12 x_3 \leq 5 \\ & 0.15 x_1 + 0.9 x_2 + 0.5 x_3 \leq 15 \\ & x_1 \geq 5, x_2 \geq 10, x_3 \geq 5 \\ & x_1, x_2, x_3 \in \mathbb{Z} \end{aligned}$$

Situation 2

We let x_j be whether the VC should invest in project j or not. This is a binary variable (i.e., it can be either 0 or 1). The constraints are on the initial investment which should be less than 4M and the average failure risk which should be below 5%. The objective is to maximize total expected profit.

$$\begin{aligned} \max \quad & 0.1 x_1 + 0.2 x_2 + 0.2 x_3 + 0.1 x_4 + 0.1 x_5 + 0.1 x_6 \\ \text{s.t.} \quad & 0.06 x_1 + 0.04 x_2 + 0.06 x_3 + 0.05 x_4 + 0.05 x_5 + 0.04 x_6 \leq 0.05 \cdot (x_1 + \dots + x_6) \\ & 1.3 x_1 + 0.8 x_2 + 0.6 x_3 + 1.8 x_4 + 1.2 x_5 + 2.4 x_6 \leq 4 \\ & x_1, \dots, x_6 \in \{0,1\} \end{aligned}$$