2.3 – symbolic

Input parameters. Let

$$
\begin{aligned}
F &= \text{set of film types} = \{1\text{mm}, 3\text{mm}, 5\text{mm}, 0.5\text{mm}\} & \\
M &= \text{set of machines} = \{1, 2, 3\} & \\
r_i &= \text{revenue for 1 square yard of film type } i & \text{for } i \in F \\
c_i &= \text{cost for 1 square yard of film type } i & \text{for } i \in F \\
d_i &= \text{maximum demand for film type } i\text{, in square yards} & \text{for } i \in F \\
k_j &= \underline{\text{minutes}} \text{ available on machine } j & \text{for } j \in M \\
\ell_j &= \text{variable labor cost per } \underline{\text{minute}} \text{ on machine } j & \text{for } j \in M \\
a_{i,j} &= \text{minutes required on machine } j \text{ to produce 1 square yard of film type } i & \text{for } i \in F, j \in M
\end{aligned}
$$

Decision variables. Let

$$
\begin{aligned}
x_i &= \text{square yards of film type } i \text{ made} & \text{for } i \in F \\
y_j &= \text{minutes machine } j \text{ is used} & \text{for } j \in M
\end{aligned}
$$

Objective function and constraints.

$$
\begin{aligned}
\max \quad & \sum_{i \in F} (r_i - c_i) x_i - \sum_{j \in M} \ell_j y_j & & \text{(maximize profit)} \\
\text{s.t.} \quad & \sum_{i \in F} a_{i,j} x_i = y_j & \text{for } j \in M & \quad \text{(machine time)} \\
& 0 \leq y_j \leq k_j & \text{for } j \in M & \quad \text{(machine availability, nonnegativity)} \\
& 0 \leq x_i \leq d_i & \text{for } i \in F & \quad \text{(maximum demand, nonnegativity)}
\end{aligned}
$$