

CIVE 208 Tutorial 1

Problem 1

LP problem :
1) decision variables
2) objective function
3) constraints

Decision variables : # agents for each shift
 x_1, x_2, x_3, x_4, x_5

Objective function : min cost

$$\min Z = 170x_1 + 160x_2 + 175x_3 + 180x_4 + 195x_5$$

Constraints : $x_1 \geq 48$

$$\left. \begin{array}{l} x_1 + x_2 \geq 79 \\ x_1 + x_2 \geq 65 \end{array} \right\}$$

$$x_1 + x_2 + x_3 \geq 87$$

$$x_2 + x_3 \geq 64$$

$$x_3 + x_4 \geq 82$$

$$x_4 \geq 43$$

$$x_4 + x_5 \geq 52$$

$$x_5 \geq 15$$

$$x_3 + x_4 \geq 73$$

$$x_1, x_2, x_3, x_4, x_5 \geq 0$$

Problem 2

Decision Variables: # units shipped in each lane

$$x_{F1-F2}$$

$$x_{DC-W2}$$

$$x_{F1-DC}$$

$$x_{W1-W2}$$

$$x_{F1-W1}$$

$$x_{W2-W1}$$

$$x_{F2-DC}$$

Objective Function:

$$\begin{aligned} \min Z = & 200x_{F1-F2} + 400x_{F1-DC} + 900x_{F1-W1} + 300x_{F2-DC} \\ & + 100x_{DC-W2} + 300x_{W1-W2} + 200x_{W2-W1} \end{aligned}$$

Constraints:

$$x_{F1-F2} + x_{F1-DC} + x_{F1-W1} = 50$$

$$x_{DC-W2} - x_{F1-DC} - x_{F2-DC} = 0$$

$$x_{W1-W2} - x_{F1-W1} - x_{W2-W1} = -30$$

$$x_{W2-W1} - x_{DC-W2} - x_{DC-W2} = -60$$

$$x_{F2-DC} - x_{F1-F2} = 40$$

net flow constraints

$$x_{W1-W2} + 30 = x_{F1-W1} + x_{W2-W1}$$

$$x_{W2-W1} + 60 = x_{W1-W2} + x_{DC-W2}$$

$$x_{F1-F2} \leq 10$$

$$x_{DC-W2} \leq 20$$

upper-bound constraints

$$x_{F1} \dots x_{W2-W1} \geq 0$$

Problem 3

Decision Variables:

Exterior Paint \rightarrow ~~the~~ x_1 (tons per day)

Interior Paint \rightarrow x_2 (tons per day)

Objective Function:

$$\max Z = 5x_1 + 4x_2 \quad (\$ \text{ thousand } \$ \text{ per day})$$

Constraints:

$$\left. \begin{aligned} 6x_1 + 4x_2 &\leq 24 \\ x_1 + 2x_2 &\leq 6 \end{aligned} \right\} \text{Raw Material}$$

$$x_2 \leq 2 \rightarrow \text{Max Daily Demand}$$

$$x_2 - x_1 \leq 1 \rightarrow \text{Market Survey}$$

$$x_1, x_2 \geq 0$$

Problem 3

Graphical Solution

