

I.E. 2001 OPERATIONS RESEARCH (Spring 2020)
(Solutions to Assignment 1)

Question 1

Define R = no. of units of the Orange model to be produced over the next quarter
 T = no. of units of the Tangerine model to be produced over the next quarter

Maximize Revenue = $900R + 600T$

$$\begin{aligned} \text{st} \quad & 2R + T \leq 20,000 && \text{(Limit on disk drives available)} \\ & 4R + T \leq 32,000 && \text{(Limit on hours of assembly time available)} \\ & 2R + 7T \leq 88,000 && \text{(Limit on hours of QA time available)} \\ & R, T \geq 0 \end{aligned}$$

*NOTE: This formulation assumes that all the computers produced can be sold. Also, if you wanted to be more precise, you could restrict R and T to be integers (since you can't make a fractional number of computers...) – this would then make it an **integer** linear program!*

Question 2

Define X_1 = no. of hours per day that we run Line 1
 X_2 = no. of hours per day that we run Line 2

Minimize Cost = $4000X_1 + 1000X_2$

$$\begin{aligned} \text{st} \quad & 3X_1 + X_2 \geq 10 && \text{(Minimum requirements for A)} \\ & X_1 + X_2 \geq 5 && \text{(Minimum requirements for B)} \\ & X_1 \geq 3 && \text{(Minimum requirements for C)} \\ & X_1, X_2 \geq 0 \end{aligned}$$

Question 3

Define W_i = Tons of waste from factory i that are to be processed, $i=1,2,3$

Minimize Processing Costs = $15W_1 + 10W_2 + 20W_3$

$$\begin{aligned} \text{st} \quad & 0.10W_1 + 0.20W_2 + 0.40W_3 \geq 30 && \text{(Required total reduction of Pollutant A)} \\ & 0.45W_1 + 0.25W_2 + 0.30W_3 \geq 40 && \text{(Required total reduction of Pollutant B)} \\ & W_1, W_2, W_3 \geq 0 \end{aligned}$$

Question 4

Define C_1 = Acres of farm 1 devoted to corn
 W_1 = Acres of farm 1 devoted to wheat
 C_2 = Acres of farm 2 devoted to corn
 W_2 = Acres of farm 2 devoted to wheat

Minimize Costs = $100C_1 + 90W_1 + 120C_2 + 80W_2$

$$\begin{aligned} \text{st} \quad & C_1 + W_1 \leq 100 && \text{(Land available: Farm 1)} \\ & C_2 + W_2 \leq 100 && \text{(Land available: Farm 2)} \\ & 500C_1 + 650C_2 \geq 7,000 && \text{(Corn Requirement)} \\ & 400W_1 + 350W_2 \geq 11,000 && \text{(Wheat Requirement)} \\ & C_1, W_1, C_2, W_2 \geq 0 \end{aligned}$$

NOTE: You could also use "=" for the last two constraints – the solution would be the same (WHY?!))