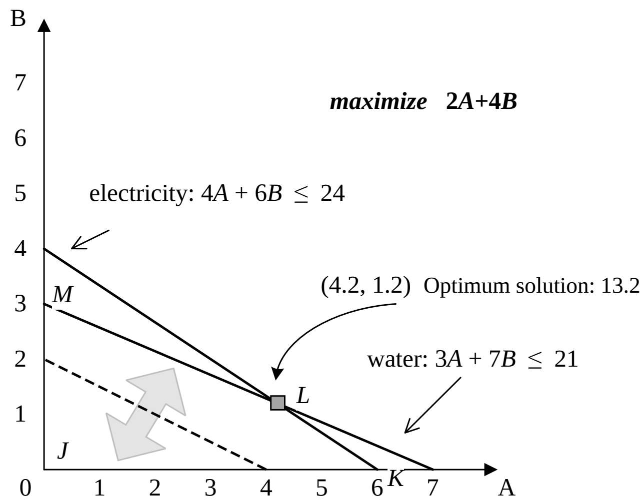
SOLUTIONS TO EXERCISES

[Last updated 7/7/2015]

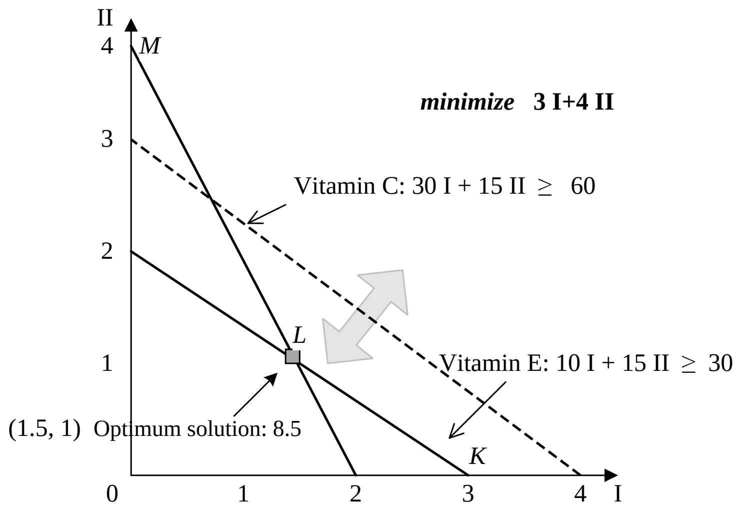
[Problems 7 and 8 do not have solutions written up]

Chapter 1.

1. Draw the solution space graphically for the following problems. Then, determine the optimum fractional solutions using your graph.
   a. The feasible solution space is denoted by $JKLM$. The optimum fractional solution is $\mathbf{13.2}$.



   b. The feasible solution space is the region above KLM. The optimum fractional solution is $\mathbf{8.5}$.



2. We use this notation so that when the relative cost coefficients $\bar{c}_j$ all become non-negative, it indicates that the maximum value of x_0, or the minimum value z is achieved.
3. Use the ratio method to solve the following.
   a. The minimum ratio is $\frac{1}{4}$ when $j = 1$. So, we let $x_1 = \frac{120}{4} = 30$, and the optimum value is therefore $\mathbf{30}$.
   b. The minimum ratio is $\frac{8}{15}$ when $j = 2$. So, we let $x_2 = \frac{90}{15} = 6$, and the optimum value is therefore $\mathbf{48}$.
4. Write linear programs for the following two problems.
   a.
   $$\begin{aligned} \textit{min} \quad & z = 90x_1 + 80x_2 \\ \textit{subject to} \quad & 6x_1 + 6x_2 \geq 25, \\ & 6x_1 + 4x_2 \geq 18, \\ & x_j \geq 0. \end{aligned}$$
   b.
   $$\begin{aligned} \textit{min} \quad & z = 2x_1 + 4x_2 \\ \textit{subject to} \quad & 2x_1 + 3x_2 \geq 10, \\ & 4x_1 + \ \ x_2 \leq 8, \\ & x_j \geq 0. \end{aligned}$$
5. The minimum ratio is 2 when $j = 1$. So, we let $x_1 = \frac{120}{8} = 15$, and the optimum value is therefore 240.
6. The minimum ratio is $\frac{7}{4}$ when $j = 2$. So, we let $x_2 = \frac{120}{4} = 30$, and the optimum value is therefore 210.

7. In Exercises 5 and 6, both constraints are equations. Will the solutions change if the constraints are inequalities? [insert answer here]
8. Prove that the ratio method works correctly for both maximizing and minimizing the objective function. [insert proof here]