Linear Programming with Solver

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In this assignment, we will get some practice with linear optimization using Excel and Solver. You may use either Solver built in with Excel, or OpenSolver (see syllabus).

Readings: Chapter 3, *Practical Management Science.*

1 Setup and Deliverables

You should complete this assignment using Excel and a linear optimization add-in. (If you use a Mac, you must make sure that your file opens fine on a Windows machine *before* submitting.) Your deliverable will be `lastname-m2.xlsx`. **Each problem should appear on its own worksheet tab**, labeled *3.2*, *3.3*, *3.4*, *3.46*, *3.50*, and *Alloy*.

Exercises from Practical Management Science

1. Chapter 3, Exercise 2 (a, b) on page 102
2. Chapter 3, Exercise 3
3. Chapter 3, Exercise 4
4. Chapter 3, Exercise 46 on page 129
5. Chapter 3, Exercise 50 on page 129
6. Jordan Alloy (on page 2 of this document)

Use Excel's "insert textbox" functionality to draw a textbox to answer the questions directly on the worksheet tab with your model. Be sure to label the questions you are answering. For instance: "**2b.** If we round the values the decision variables to the nearest integer. . . "

Jordan Alloy

Metal	W	X	Y	Z
Aluminum	0.30	0.40	0.10	0.15
Copper	0.30	0.10	0.25	0.40
Magnesium	0.40	0.50	0.65	0.45

The Jordan Alloy Corporation produces alloys for aircraft construction. They manufacture four different alloys, denoted W, X, Y, and Z, from three basic metals, namely aluminum, copper, and magnesium. The contribution to earnings of these alloys are \$35, \$47, \$60, and \$140 per ton, respectively, for each of the four alloys W, X, Y, and Z. The monthly supplies of aluminum, copper, and magnesium are 600, 400, and 800 tons per month, respectively. The proportion of the metals in the alloys are shown in the table above. For example, one ton of alloy W consists of 0.30 tons of aluminum, 0.30 tons of copper, and 0.40 tons of magnesium. The company believes that they can sell all of the alloys that they produce. The objective is to maximize the contribution to earnings. [1]

1. Construct a linear optimization model to determine how much of each alloy to produce in order to maximize the contribution to earnings.

   Hint: You may want to start by defining the variables AW, AX, AY, and AZ to be the amount of each alloy that the company produces. Then, for example, the linear optimization model must capture the supply limitations, such that

   $$0.30AW + 0.40AX + 0.10AY + 0.15AZ \leq 600$$

   represents the supply limitation on aluminum.

2. Solve the linear optimization model using Solver. What actions would you recommend based on the optimal solution and the *shadow price* information?

[1] Note: You may find the Chapter 4, page 172 Fundamental Insight helpful, entitled "Clearing Denominators."