

ISyE 6669 Fall 2002
Home Work Assignment 3
Due: September 6, 2002

Only one of the four problems will be graded.

1. A company is considering opening warehouses in four cities: New York, Los Angeles, Chicago, and Atlanta to serve three different demand regions. Each warehouse can ship 100 units per week. The weekly fixed cost of keeping each warehouse open is \$400 for New York, \$500 for Los Angeles, \$300 for Chicago, and \$150 for Atlanta. Region 1 of the country requires 80 units per week, region 2 requires 70 units per week, and region 3 requires 70 units per week. The cost (including production and shipping costs) of sending one unit from a plant to a demand region is shown in Table 1. The company wants to meet weekly demands at minimum cost, subject to the following additional restrictions:
 - (1) If the New York warehouse is opened, then the Los Angeles warehouse must be opened.
 - (2) At most two warehouse can be opened.
 - (3) Either the Atlanta or the Los Angeles warehouse must be opened.

From	To Region 1	To Region 2	To Region 3
New York	\$20	\$40	\$50
Los Angeles	\$48	\$15	\$26
Chicago	\$26	\$35	\$18
Atlanta	\$24	\$50	\$35

Table 1: Shipping Costs

Formulate an optimization model to determine which warehouses to open and how to service demand at a minimum total cost.

2. A post office requires different numbers of full-time employees on different days of the week. The number of full-time employees required on each day is given in Table 2. Union rules state that each full-time employee must work five consecutive days and then receive two days off. For example, an employee who works Monday to Friday must be off on Saturday and Sunday. The post office wants to meet its daily requirements using only full-time employees. Formulate a linear program that the post office can use to minimize the number of full-time employees required.

Mon	Tue	Wed	Thu	Fri	Sat	Sun
17	13	15	19	14	16	11

Table 2: Number of Full-time Employees Required

3. A monopolist can purchase up to 17.25 oz of a chemical for \$10/oz. At a cost of \$3/oz, the chemical can be processed into an ounce of product 1, or at a cost of \$5/oz, the chemical can be processed into an ounce of product 2. If x_1 oz of product 1 is produced, it sells for a price of $\$30 - x_1$ per ounce. If x_2 oz of product 2 is produced, it sells for a price of $\$50 - 2x_2$ per ounce. Formulate an optimization model to help the monopolist maximize profits.
4. Fruit Computer Company produces Pear and Apricot computers. If they charge a price p_1 \$/unit for Pear computers and p_2 \$/unit for Apricot computers, they can sell q_1 Pear and q_2 Apricot computers, where $q_1 = 4000 - 10p_1 + p_2$, and $q_2 = 2000 - 9p_2 + 0.8p_1$. Manufacturing a Pear computer requires 2 hours of labor and 3 computer chips. An Apricot computer uses 3 hours of labor and 1 computer chip. At present, 5000 hours of labor and 4500 chips are available. Formulate an optimization problem to maximize Fruit's revenue.