Assignment #4

Due: 1 pm, Friday, October 29th 2010

1. For question #3 in A3, the **Production of Tiles in Three Styles**.
   a) Set the LP model in Excel; solve it using Solver; and print a one-page Excel output with the model, answer report and sensitivity report.
   b) In the optimal solution, how many tiles of each style will be produced? What is the maximum profit?
   c) In the optimal solution, how much shaping time will be used? How much painting time will be used?
   d) In the LP model, there is a painting constraint, $3y + 5z \leq 1200$, where 1200 minutes (20 hours) are available to the production.

   In each of the following cases, run Solver with a given painting time (all the other parameters in the model remain the same); write down the new profit (the value of the objective function); and find how much the profit has increased (or decreased), that is, $\Delta P = the\ new\ profit\ - original\ Profit\ found\ in\ (b)$.

   (1) RHS = 1201 that is, RHS increases by 1 minute;
   (2) RHS = 1260 RHS increases by 60 minutes;
   (3) RHS = 1199 RHS decreases by 1 minute;
   (4) RHS = 1140 RHS decreases by 60 minutes.

   If we acquire one extra minute, how much will the profit change?

2. For question #4 in A3, **the Great Canadian Coffee Company**.
   a) Set this model in Excel; solve it using Excel Solver and print a one-page Excel output with the model, answer report and sensitivity report.
   b) In the optimal solution, how many kilograms of each type of coffee bean will be used to make 10,000 bags of the Canadian blend? What is the maximum daily profit? How many grams of each type of coffee bean will be used in each 150 gram bag?
   c) A daily supply is set for all the four types of coffee bean. In the optimal solution, are all the daily supplies used up? How many kilograms are left for each type?

3. The Electrontech Corporation manufactures two industrial electrical devices: generators and alternators. Each product can be manufactured in one of the company's two plants. The following table shows the production time (in hours/unit) and cost (in \$/unit) at each plant.

   Each month, the company's management set a budget of \$30,000 for the production of generators, and \$10,000 for the production of alternators. Each month, 500 hours of production time are available in Plant I, and 600 hours are available in Plant II.

	Production Time (hours/unit)		Production Costs (\$/unit)	
	Plant I	Plant II	Plant I	Plant II
Generator	4	3	120	100
Alternator	7	5	150	170

   The company sells each generator at \$350 and each alternator at \$250. Due to market consideration, the company wants to produce at least one alternator for every three generators manufactured. The company has already received an order for 25 generators and 15 alternators.

   How many units of each product should the company produce next month to maximize its profit? **Formulate an LP model for the problem. DO NOT SOLVE IT.**

4. A post office requires different numbers of full-time employees on different days of the week. The number of full-time employees required each day is given in the table below. Union rules state that each full-time employee must work five consecutive days and then receives two days off. For example, an employee who works Monday to Friday must be off on Saturday and Sunday.

Day of the week	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Min employees required	17	13	15	19	14	16	11

a) The post office wants to meet its daily requirements using only full-time employees. Its objective is to minimize the number of full-time employees that must be hired. Formulate the problem as an IP model.

b) Implement your IP model in Excel.

Fill in an initial solution for the problem and see if you can "guess" an optimal solution.

It is not easy! Each worker who starts on a certain day works the next four days as well. When you find a solution that meets the minimum daily requirements, you usually have many more workers available on some days than are needed. Write down how many employees you need to hire.

c) Run Solver to find an optimal solution. What is the optimal schedule? How many employees do you have to hire?

d) In the optimal solution found in part (c), how many employees start working on Saturday?

In general, this group of employees will not be happy because they never have a weekend off. Is it possible to improve the optimal solution and make it "fairer"? That is to treat all employees in an equal fashion.

Part (d) is a bonus question and optional.