Lesson #5: Using Linear Programming to help Solve Real World Linear Applications (Reference: Lesson #54 in book)

Problem

1. **Use what you have learned about linear programing to minimize or maximize profits and costs in the following application problems given the constrants in each of the situations.**

   1. The XYZ corporation produces two types of cereal: Healthy One, which use 4 oz. of wheat, and 1 ounce of sugar, and Rot Your Teeth Out, which uses 3 ounces of sugar and 2 ounces of wheat per box. The profit for Healthy One, is $1.75 a box, and for Rot Your Teeth Out, $2.25 a box. Available are 10,000 ounces of wheat, and 12,000 ounces of sugar. How much of each kind of cereal should the XYZ corporation make to maximize it's profit?

   2. A farmer needs to decide how much corn and soybeans to grow for the next harvest. The cost of corn seed is $80 per bag, while soybeans are $50 per bag. A bag of corn requires 2 acres of farmland, while a bag of soybeans requires 1 acre. The farm's acreage is 5,000 acres. It takes 3 hours to plant a bag of corn and 2 hours to plant soybeans. The farmer expects to need at least 2,500 hours of planting. How can the farmer minimize cost of this seasons crops given that if at all possible he would like to plant and use all 5,000 acres? What would the maximum cost be if he was looking to possibly plant all 5,000 acres this season?

   3. A company makes two models of MP3 players. The M20 takes 3 hours to manufacture and the M25 takes 1 hour. The company has multiple shifts and has a 20-hour day for manufacturing the players. The M20 generates a profit of $12, and the M25 a profit of $7. The M20 uses 15 special chips, while the M25 uses 10. For the next manufacturing cycle, consisting of 18 days, there are 3,000 chips available. How many of each type of MP3 players should the company produce ot maximize its profits? What combination of MP3 players would result in the least amount of profit, assuming they actual product MP3 players?

   4. You need to buy some filing cabinets. You know that Cabinet X costs $10 per unit, requires six square feet of floor space, and holds eight cubic feet of files. Cabinet Y costs $20 per unit, requires eight square feet of floor space, and holds twelve cubic feet of files. You have been given $140 for this purchase, though you don't have to spend that much. The office has room for no more than 72 square feet of cabinets. How many of which model should you buy, in order to maximize storage volume?

   5. In order to ensure optimal health (and thus accurate test results), a lab technician needs to feed the rabbits a daily diet containing a minimum of 24 grams (g) of fat, 36 g of carbohydrates, and 4 g of protein. But the rabbits should be fed no more than five ounces of food a day. Rather than order rabbit food that is custom-blended, it is cheaper to order Food X and Food Y, and blend them for an optimal mix. Food X contains 8 g of fat, 12 g of carbohydrates, and 2 g of protein per ounce, and costs $0.20 per ounce. Food Y contains 12 g of fat, 12 g of carbohydrates, and 1 g of protein per ounce, at a cost of $0.30 per ounce. What is the optimal blend?

6. A transport company has two types of trucks, Type A and Type B. Type A has a refrigerated capacity of $20m^3$ and a non-refrigerated capacity of $40m^3$ while Type B has a refrigerated capacity of $30m^3$ and a non-refrigerated capacity of $30m^3$. A grocer needs to hire trucks for the transport of $3,000m^3$ of refrigerated stock and $4,000m^3$ of non-refrigerated stock. The cost per kilometer of a Type A truck is $30, and $40 for a Type B truck. How many trucks of each type should the grocer rent to achieve the minimum total cost?

7. With the start of school approaching, a store is planning on having a sale on school materials. They have 600 notebooks, 500 folders, and 400 pens in stock, and they plan on packing it in two different forms. In the first package, there will be 2 notebooks, 1 folder, and 2 pens, and in the second one, 3 notebooks, 1 folder, and 1 pen. The price of each package will be $6.50 and $7.00 respectively. How many packages should they put together of each type to obtain the maximum benefit?

8. In Karla's garden shop, she makes two kinds of mixtures for planting: gardening mixture and potting mixture. A package of gardening mixture requires 2 lbs of soil, 1 lbs of peat moss, and 1 lbs of fertilizer. A pacakge of potting mixture requires 1 lbs of soil, 2 lbs of peat moss, and 3 lbs of fertilizer. She has at most 16 lbs of soil, 11 lbs of peat moss, and 15 lbs of fertilizer. A package of gardening mixture sells for $3 and a package of potting mixture sells for $5. Assuming all mixtures made will sell, how many packages of each type of mixture should she make to maximize revenue?

9. A marketing manager is coordinating an ad campaign. TV ads are $2,000 and reach 10,000 people, and radio ads are $500 and reach 5,000 people. The target size of the audience for this marketing campaign is at least 100,000 people. He wants to buy no more than 10 TV ads and no more than 15 radio ads. How can the marketing manager minimize his costs within these conditions?

10. A calculator company produces a scientific calculator and a graphing calculator. Long-term projections indicate and expected demand of at least 100 scientific and 80 graphing calculators each day. Because of limitations on producation capacity, no more than 200 scientific and 170 graphing calculators can be made daily. To satisfy a shipping contract, a total of at least 200 calculators must be shipped each day. If each scientific calculator sold results in a $2 loss, but each graphing calculator produces a $5 profit, how many of each type of calculator should be made daily to maximize net profits?