IE 375 Recitation 2 Questions

We will review Chapter 3 Supplement 1 (about Linear Programming) and solve case problem 14.5 from Case Set 2. You may find the case problem 14.5 below.

CASE PROBLEM S14.5

Julia's Food Booth

Julia Robertson is a senior at Tech, and she's investigating different ways to finance her final year at school. In her first three years at school she worked a part-time job at a local bar, but she wants more free time during the week in her senior year to interview for jobs after she graduates, to work on some senior projects, and to have some fun with her friends. She is considering leasing a food booth outside the stadium at the Tech home football games which Tech allows for selected students and student groups. Tech sells out every home game, and she knows from going to the games herself that everyone eats a lot of food. She has to pay $1000 per game for a booth and the booths are not very large. Vendors can sell only food or drinks on Tech property but not both. Only the Tech athletic department concession stands can sell both inside the stadium. She thinks slices of cheese pizza, hot dogs, and barbecue sandwiches are the most popular food items among fans, so these are the items she would sell.

Most food items are sold during the hour before the game starts and during half time; thus, it will not be possible for Julia to prepare the food while she is selling it. She must prepare the food ahead of time and then store it in a warming oven. She can lease a warming oven for the home season, which includes six games, for $600. The oven has 16 shelves, and each shelf is 3 ft by 4 ft. She plans to fill the oven with the three food items before the game and before half time.

Julia has negotiated with a local pizza delivery company to deliver 14-inch cheese pizzas twice each game; two hours before the game and right after the opening kickoff. Each pizza will cost her $6 and will include eight slices. She estimates it will cost her $0.45 for each hot dog and $0.90 for each barbecue sandwich if she makes the barbecue herself the night before. She measured a hot dog and

(*Continued*)

found it takes up about 16 $in.^2$ of space, while a barbecue sandwich takes up about 25 $in.^2$ She plans to sell a slice of pizza and a hot dog for $1.50 apiece and a barbecue sandwich for $2.25. She has $1500 in cash available to purchase and prepare the food items for the first home game; for the remaining five games she will purchase her ingredients with money she has made from the previous game.

Julia has talked to some students and vendors who have sold food at previous football games at Tech as well as at other universities. From this she has discovered that she can expect to sell at least as many slices of pizza as hot dogs and barbecue sandwiches combined. She also anticipates that she will probably sell at least twice as many hot dogs as barbecue sandwiches. She believes that she will sell everything she can stock and develop a customer base for the season if she follows these general guidelines for demand.

If Julia clears at least $1000 in profit for each game after paying all her expenses, she believes it will be worth leasing the booth.

a. Formulate and solve a linear programming model for Julia that will help you advise her if she should lease the booth.

b. If Julia can borrow some more money from a friend before the first game to purchase more ingredients, could she increase her profit? If so, how much should she borrow and how much additional profit would she make? What factor constrains her from borrowing even more money than this amount (indicated in your answer to the previous question)?

c. When Julia looked at the solution in (a), she realized that it would be physically difficult for her to prepare all the hot dogs and barbecue sandwiches indicated in this solution. She believes she can hire a friend of hers to help her for $100 per game. Based on the results in (a) and (b), is this something you think she could reasonably do and should do?

d. Julia seems to be basing her analysis on "certain" assumptions that everything will go as she plans. What are some of the uncertain factors in the model that could go wrong and adversely affect Julia's analysis? Given these uncertainties and the results in (a), (b), and (c), what do you recommend that Julia do?