**Ag Bus 313 Final**
**Section 2**
**6/10/13**
**Dr. Hurley**

**General Instructions:** This exam is worth **200 points**. You must provide your own paper. You are allowed one 3x5 note card for the exam. This note card can have anything on it but if it is larger than 3x5 you will get a zero on the exam. You are allowed to use a calculator. ***You must show all your work when appropriate to get credit.*** This includes showing all applicable formulas you use. No cell phones, music players (ipods), or other technology devices are allowed to be in your possession during the exam. If you are caught with any of these items, you will receive a zero on the exam. **(Good Luck!)**

**Question 1 (115 Points Total):** Suppose for the last fifty years your family has grown sweet corn out in the Central Valley. This has allowed them to collect very good data on the production response of output to a change in any of the inputs they use. From past data, you have been able to estimate the production function for sweet corn. It can be represented by the following production function: $Q = f(L,W,T,N) = 328W - 4W^2 + 600L^{1/3}T^{1/4} + 220N - 5N^2$, where Q represents the amount of sweet corn you produce in terms of boxes, L represents the amount of labor you use in terms of hours, W represents the quantity of water you use in terms of acre-inches, T represents the amount of tractor time you use in terms of hours, and N represents the amount of nitrogen you apply to the crop in terms of pounds. While land is a necessary input in production, it does not directly come into your production function. You have decided to allocate 100 acres to producing sweet corn which you can consider a fixed input to production that is already embodied in your production function.

Your goal for the year is to maximize your total profit. To do this, you have negotiated with your local supermarket chain a fixed price of $36 per box of sweet corn. You have also locked in prices for the inputs you need to purchase. Your local farm supply store will sell you all the nitrogen you need for $720 per pound. Your local water district has set a price of $288 per acre-inch that you need. The local labor contractor will supply you the labor you need at a price of $600 per hour. A neighbor who rents out one of his tractors will let you use it for $1,200 per hour plus a onetime fix cost of $400 to deliver and pick-up the tractor. Since you do not own the land you would like to produce sweet corn on, you will need to lease from your neighbor the 100 acres at a cost of $40 per acre.

Please answer the following questions making sure to give proper justification:

A) What is the optimal profit that can be achieved for sweet corn this year? **(60 Points)**

B) If labor was fixed at 216 hours and tractor time was fixed at 81 hours, how much profit would you have lost if you chose to maximize revenue instead of profit? **(25 Points)**

C) Suppose that water is fixed at 40 acre inches, nitrogen is fixed at 20 pounds, and labor and tractor time are variable, graph the cost minimizing solution if you had a production goal of 19,920 boxes of sweet corn. ***(Treat fixed cost as 0 when graphing.)*** **(30 Points)**



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**<u>Question 2 (65 Points Total):</u>** Over the last five years, suppose that you have only grown one crop, strawberries. While strawberries use many different inputs, one of the key limited fixed inputs you have available is water. This is because all the water you use for production must come from a well you have on your property. Having reviewed your financial statements for the last five years, you have noticed that you have had wide swings in your profitability due to changing prices. The banker who lends you your money to cover your operating expenses has suggested that you add another crop to your production. Having done some analysis, you have found that the other crop that would work well for your land is broccolini.

Your well has the ability to provide you with a maximum total of 27,216 acre-inches per year that you can use for either crop. It costs you a total of $500 per acre-inch to pump the water you need. Having done more research, you have been able to estimate the input-output production response between water usage and the production of strawberries and broccolini. The production function for strawberries can be represented as $S = f(W_s) = 10W_s^{2/3}$, where S represents the number of trays of strawberries you can produce and $W_s$ represents the amount of water in acre-inches that you apply to your strawberry crop. Your estimated broccolini production function can be represented as $B = f(W_B) = 50W_B^{2/3}$, where B represents the number of boxes of strawberries you can produce and $W_B$ represents the amount of water in acre-inches that you apply to your broccolini crop.

To make the optimal decision, you have employed the services of a consultant to estimate what prices will be for each of the two crops. This consultant charged you a fixed cost of $4,000. Based on her analysis, she suggests that you should be able to get $2250 per tray of strawberries, and $90 per box of broccolini. Based on this knowledge, these are the prices you will utilize for making your production decision when you attempt to maximize profits.

Please answer the following questions:

A) What is the optimal profit at your optimal solution? **(30 Points)**

B) What are the maximum amounts of broccolini and strawberries you can produce? **(10 Points)**

C) What would the trade-off be between strawberries and broccolini at your optimal solution? **(10 Points)**

D) Graph the optimal solution. Be sure to use revenue rather than profit when you are graphing the optimal solution. **(15 Points)**

**<u>Question 3 (20 Points Total):</u>** Suppose you have two major food retailers in a local market, Save-A-Lot and Cheapers. Both are in the process of deciding what advertising strategy each would like to employ in order to maximize their profits for the week. Since these two retailers compete for the same clientele, the adverting decision each makes affects the other. Save-A-Lot has decided it wants to focus on four main strategies for this week. The first strategy for Save-A-Lot, known as Cheap Meats, is to focus on cheap meat prices on front page print ads that get mailed out to everyone in the local area. The second strategy for Save-A-Lot, known as Snack Food Coupons, is to put coupons for snack foods on the front page of its print advertisement. The third strategy, known as Produce Deals, is to run radio ads regarding the great deals on produce. The company's fourth strategy, known as TV Snack Food, is to run TV ads on deals for snack foods.

Cheapers has three strategies that it is deciding upon for this week. Cheapers' first strategy, known as Produce Ads, is to advertise on the first page of its print ads the great deals it has on produce. The second strategy for the company, known as Radio, is to do radio ads regarding the deals it has for snack foods. The company's third strategy, known as TV Meats is to run television ads regarding its great deals on meats.

The table below represents the payoffs for each company based on the strategy they decide to use. Save-A-Lots payoffs are represented first, while Cheapers is listed second.

| | | **Cheapers** | | |
|---|---|---|---|---|
| | | **Produce Ads** | **Radio** | **TV Meats** |
| **Save-A-Lot** | **Cheap Meats** | 213, 918 | 96, 359 | 433, 607 |
| | **Snack Food Coupons** | 912, 969 | 517, 200 | 874, 768 |
| | **Produce Deals** | 324, 694 | 623, 706 | 499, 384 |
| | **TV Snack Food** | 155, 708 | 321, 405 | 132, 350 |

Please answer the following questions:

A) Does a Nash equilibrium exist? If so, what is it or are they? **(5 Points)**

B) Are there any dominant or dominated strategies for Cheapers? If so, what is it or are they? Make sure you examine all smaller games. **(5 Points)**

C) If Cheapers could get advance knowledge of the strategy Save-A-Lot chooses, what would Cheapers decide to do? Please explain. **(10 Points)**



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