

**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 (100 Points Total):** With Saint Patrick's Day arriving very quickly, you have decided that the next crop you are going to produce is red potatoes. Since you have had very little experience growing potatoes, you have asked a crop scientist and an agricultural economist from your local university to give you advice on how to produce red potatoes. The economist explains to you that knowledge of the production function is one of the most important things you must understand to make a profit maximizing decision. Upon hearing this, the crop scientist does some field experiments to test your soil to try to collect data the agricultural economist can use to estimate a production function.

The results from the crop scientist's experiments have indicated that you can keep almost all of your inputs at a fixed proscribed amount. The individual also points out that there are three inputs you will need to decide upon which will have a large effect on the amount of potatoes you produce. The first input that you can change is a fungicide known as Endura (E) which costs \$102 per pint. The second input is a fertilizer known as gypsum (G). This fertilizer costs \$18 per pound. The third input you are able to change is a fertilizer known as APS (A). This fertilizer costs \$8 per ounce. The rest of your fixed input costs are \$511 and you can sell your potatoes for \$3 per pound.

Given the information on inputs, the agricultural economist develops the following estimate for the production function of potatoes:  $P = f(E,G,A) = 48E + 24(G^{1/4}A^{1/6})^2 - E^2$ , where P represents the amount of potatoes you produce in terms of pounds, E represents the amount of Endura you use in terms of pints, G represents the amount of Gypsum you use in terms of pounds, and A represents the quantity of APS you apply to the your crop in terms of ounces.

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

- A) What is the optimal profit that can be achieved for potatoes this year? **(45 Points)**
- B) If gypsum was fixed at 144 pounds and APS was fixed at 216 ounces, how much profit would you have lost if you chose to maximize revenue instead of profit? **(25 Points)**
- C) Suppose that Endura is fixed at 7 ounces, and Gypsum and APS are variable, graph the cost minimizing solution if you had a production goal of 2,015 pounds of potatoes. **(Treat all**

*fixed cost as 0 when graphing including the cost of Endura and make sure you account for the production that occurs because of the fixed input.) (30 Points)*

**Question 2 (80 Points Total):** As Saint Patrick's Day is quickly approaching, you as an entrepreneurial agriculture producer want to take advantage of the holiday and the demand that it creates. Knowing that there is huge demand for corned beef and cabbage, you have decided to take a small parcel of land to devote to these two enterprises to make a quick profit. The land that you have available to devote to these two enterprises is 51,250 square meters. You can consider this land a fixed input that is constraining your ability to produce more of either of the two outputs. You have put a value of \$9 per square meter of land used as the cost of the input.

Since you are a risk averse producer, you have decided that you want to lock in the prices you receive for your beef and for your cabbage. You have been able to negotiate a deal with your local meat processor to deliver the beef at a net revenue of \$30 per cow. You have also contracted with your local supermarket to purchase your cabbage for \$10 per box. It should be noted that the net revenue from your beef enterprise does not take into account the cost of land. You should note that you can treat net revenue as revenue that you receive from each enterprise. You also have \$3,750 that you consider as a fixed cost for doing these two enterprises.

Over the past twenty years, you have gathered a vast knowledgebase on how to produce both beef and cabbage. Having taken AGB 260 and AGB 327 many years ago, you have been able to use Excel to estimate the production relationship between land and beef, and land and cabbage. Your estimated production function for beef can be represented as the following:  $B = f(L_B) = 2L_B^{3/4}$ , where B represents the number of marketable cows you can produce and  $L_B$  represents the amount of land that you allocate to producing beef. The production function for cabbage has been estimated to be  $C = f(L_C) = 18L_C^{3/4}$ , where C represents the number of boxes of cabbage you can produce and  $L_C$  represents the amount of land that you devote to producing cabbage.

Please answer the following questions:

- A) What is the optimal profit at your optimal solution? **(40 Points)**
- B) What would the trade-off be between cabbage and beef at you optimal solution? Please explain. **(10 Points)**
- C) Graph the optimal solution. Be sure to use revenue rather than profit when you are graphing the optimal solution. **(20 Points)**
- D) Now suppose that another meat processor and another supermarket approach you to purchase your beef and your cabbage because they are short on the amount of product they have available. If the meat processor offers you \$60 per cow and the supermarket offers you \$20 per box of cabbage how will your optimal production change and what is the new profit you would receive? Please explain. **(10 Points)**

**Question 3 (20 Points Total):** Suppose that there are two major Irish pubs in town that are preparing for Saint Patrick’s Day festivities. The first pub is named McLangers, while the second pub is called McFluthered. Each pub has a goal of maximizing the number of patrons that come to its establishment which each believes will provide it with the highest profit. To bring people to their drinking establishment, each pub owner believes that she needs to have a strategy that revolves around advertising the bar’s specials for the day.

McLangers pub has decided that it has five strategies for specials that it can offer. The first strategy is to provide special discount pricing on Irish beers. This strategy will be known as the Cheap Beer strategy. The second strategy for McLangers is to have all of its Irish whiskeys discounted. This strategy is known as Cheap Whiskey. The third strategy that McLangers has come up with is to have select drink specials for both its whiskeys and its beers. This strategy is known as Cheap Beer and Whiskey. Another strategy that the bar is interested in trying is to give away a free pub glass for every three purchases of a beer. This strategy is known as the Free Pub Glass strategy. The last strategy McLangers is considering trying is to give away a free shirt every time the patron orders a shot and a beer. This strategy will be known as the free shirt strategy.

McFluthered is an Irish pub located just down the street of McLangers. McFluthered has decided that it is only going to consider three possible strategies for bringing patrons into its bar. Each of these strategies are the same as McLangers first three strategies. Hence McFluthered is considering a strategy of serving cheap beer, cheap whiskey, or cheap whiskey and beer.

The table below represents the payoffs in terms of patrons for each pub based on the strategy they decide to use. McLangers payoffs are represented first, while McFluthered is listed second.

		McFluthered		
		Cheap Beer	Cheap Whiskey	Cheap Beer and Whiskey
McLangers	Cheap Beer	194, 127	672, 159	992, 134
	Cheap Whiskey	662, 813	523, 487	386, 156
	Cheap Beer and Whiskey	116, 949	151, 558	806, 864
	Free Pub Glass	619, 451	428, 784	927, 303
	Free Shirt	802, 636	138, 343	557, 482

Please answer the following questions:

- A) Are there any dominant or dominated strategies for either of the pubs? If so, what is it or are they? **(5 Points)**
- B) Does a Nash equilibrium exist? If so, what is it or are they? **(5 Points)**
- C) If McFluthered could get advance knowledge of the strategy McLangers chooses and McLangers knows this, what would each pub decide to do? Please explain. **(10 Points)**