

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): Suppose this year has been a very enlightening because you have found a new passion you would like to embark upon. Having learned the value of animal products that are produced on pasture, you have come up with an idea to produce what you believe will be a hot selling product. This product is rabbits that have been raised on pastures which you are going to sell for meat. Having done an internet search and some cold calling, you have found a buyer, known as Edible Game Products, who is willing to sell your product through its online store as long as you raise them on pasture.

In order to be as profitable as you can, you have done a large amount of research on how to raise rabbits on pasture land. What you have found is that there are three main variable inputs you can use to raise rabbits. These inputs are: pasture land (L) which is measured in acres; hemp seed (S) which is measured in pounds; and leafy greens (G) which are measured in bushels. There are other inputs for producing rabbits, but you can consider them fixed. Having done some research on the cost of these inputs, you have found that the pasture land you will use to grow rabbits is going to cost you \$1,000 per acre. Since the area you want to produce rabbits is located in Mendocino County, you were able to locate a hemp seed distributor who will sell you a pound of hemp seed for \$2. To acquire the leafy greens, you will need to travel to Salinas to pick up the necessary feed. You have estimated that these leafy greens will cost you \$5 per pound. Your fixed cost for the operation is estimated to be \$1,250.

Having done tremendous research on rabbit physiology, you believe you have a good idea on how rabbits grow based on what you feed them. You estimate that the production of rabbits has the following input-output response, i.e., production function: $R = f(L,G,S) = -L^3 + 60L^2 + 100L + 10(G^{1/6}S^{1/12})^3$, where R represents the quantity of rabbits produced, L is the amount of land in terms of acres, G is the number of bushels of leafy greens, and S is the pounds of hemp seed. Edible Game Products has quoted you a price of \$10 per rabbit that you produce.

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

A) What is the optimal profit that can be achieved for producing rabbits? **(Please make sure you choose the inputs that maximizes profits.) (45 Points)**

- B) Suppose you decide not to use any leafy greens and hemp seeds because you want to keep the rabbits to be purely raised on pasture. What are the new optimal input for pasture land, the optimal output of rabbits, and the optimal profit based on this assumption? **(10 Points)**
- C) Using the same assumptions as part B, i.e., using no leafy greens or hemp seeds, what is the minimum average variable cost you can produce at? **(25 Points)**
- D) Using the assumptions in part B, how much profit would you have lost if you were to decide on producing at the minimum average variable cost rather than the profit maximizing input-output combination you found in part B? **(Please note that the way you should calculate the loss is by subtracting the profit you would receive at the optimal input-output combination for the minimum average variable cost from the profit you receive from the profit maximizing solution, i.e., $Loss = \pi_{\pi-max} - \pi_{AVC-Min.}$) (20 Points)**

Question 2 (80 Points Total): Suppose you are a producer in Paso Robles who produces both wine grapes and olives. In the last three years due to the drought in California, you have seen your water allocation decrease to the point that you no longer have what you believe is an abundance of water to grow your two main products. You have been told that for this year, you will only be able to use 20,752 acre-inches of water. This water, which you view as a fixed input, costs you \$3 per acre inch. All of your other fixed costs sum up to \$36,768 for the two operations.

Since you have been in business selling wine grapes and olives for many years, you have developed strong business partnerships with a local winery and a local olive processor. For this coming year, you have been able to negotiate a contract with your winery partner to buy all the grapes you produce for \$192 per hundredweight (cwt). The individual who works at the local olive processor has quoted you a price of \$32 per ton for your olives which is the best offer you can currently find.

Looking at your past production records, you are fairly confident regarding the relationship between the products that you produce, olives and grapes, and the water you use to produce them. Specifically, you have estimated the following production function for your grapes: $G = f(W_G) = 108W_G^{1/4}$, where G represents the amount of wine grapes you produce in terms of cwt, and W_G represents the amount of acre-inches of water you use to produce grapes. Similarly, you have estimates the following relationship between olives and water: $O = f(W_O) = 3W_O^{1/4}$, where O represents the amount of olives you produce in terms of tons, and W_O represents the amount of acre-inches of water you use to produce olives.

Please answer the following questions:

- A) What is the optimal profit at your optimal solution? **(50 Points)**
- B) What would the trade-off be between olives and wine grapes at you optimal solution? Please explain. **(5 Points)**

C) Graph the optimal solution. Be sure to use revenue rather than profit when you are graphing the optimal solution. **(20 Points)**

D) Suppose that before you sign a contract with your current business partners at the winery and the olive processing facility, another winery comes to you who is in desperate need for grapes. This winery is willing to offer you twice what your current winery is willing to pay you. At the same time, you are approached by another olive producer who is also willing to double the price that you receive for your olives. Will these new prices affect your decision on how much to produce? Please explain. **(5 Points)**

Question 3 (20 Points Total): Suppose there are two wineries in Paso Robles, Boredos and Petite Noirs, that are across the street from each other. Both of these wineries have tasting rooms where they each are attempting to sell as many bottles of wine each day to customers that come into their establishments. Since they are across the road from each other, they are both competing for the same customers and they each assume that their decisions affect each other.

Boredos has asked students from Cal Poly's Wine and Viticulture major who are working on their senior project to develop four marketing ideas for bringing customers into its establishment. After the students have done some research, they have proposed four main strategies the winery could utilize to bring customers in who will purchase the company's wine. The first strategy is to offer individuals a 10% discount on its premium wine that it is well known for. This strategy is known as the 10% Discount on Syrah strategy. The second strategy is to bring in a well-known jazz artist to play music. This strategy is known as the Jazz Music strategy. The third strategy the students devised was the Barrel Tasting strategy. This strategy allows individuals who buy a case of wine to get a tour of the facility and an opportunity to taste wine out of the barrel. The fourth strategy the students came up with is the Free Hat strategy. This strategy entails giving a free hat to every individual that comes to the tasting room.

To develop the strategies for Petite Noirs, the head marketer of the organization chooses to ask Cal Poly AGB 406 students to come up with a set of strategies. Have done extensive research, the students have come up with four strategies that they believe cannot fail. The first strategy the students come up with, known as the Comedian strategy, is to bring in a local comedian that was recently showcased on a national TV show. The second strategy, which was inspired by the BRAE club's weekly BBQ, is known as the Cheap BBQ Meal strategy. This strategy entails offering a Santa Maria style BBQ to those who stop at the establishment for a very reasonable price. The third strategy the students have developed is the Free Shirt strategy. This strategy requires the winery to give a free shirt to anyone who comes to the establishment. The fourth strategy is known as the 10% Discount on Zinfandel strategy. This strategy has the winery give a 10% discount on a case of its signature Zinfandel wine that retails for \$35 per bottle.

Since both wineries used Cal Poly students, you can assume that each winery knows the strategies and the payoffs of those strategies of its competitor. The table below provides the strategies and the corresponding payoffs to those strategies that was developed by the students. All payoffs are in terms of bottles sold, and the goal of each individual is to sell as many bottles of wine as possible given the strategy it chooses and the strategy its competitor chooses. Assume that each of these wineries will only play out these strategies once.

		Petite Noirs			
		Comedian	Cheap BBQ Meal	Free Shirt	10% Discount on Zinfandel
Boredos	10% Discount on Syrah	730,70	840,180	240,680	20,80
	Jazz Music	310,110	630,380	570,30	320,320
	Barrel Tasting	700,910	930,780	960,520	650,160
	Free Hat	830,510	460,600	210,280	500,970

Please answer the following questions:

A) Are there any dominant or dominated strategies for either of the wineries? 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 Boredos could get advance knowledge of the strategy Petite Noirs chooses and Petite Noirs knows this, what would each winery decide to do? Please explain. **(10 Points)**