

1) (10 pts.) *Based on material covered in class*, are these True or False? Mark your answer.

- a) T \_\_\_ F \_\_\_ Dairy is by far the most important agricultural sector in Wisconsin, making up about half of the agricultural economy in the state.
- b) T \_\_\_ F \_\_\_ Wisconsin is nationally important not only in dairy and forage production, but also in processing vegetables, cranberries and ginseng.
- c) T \_\_\_ F \_\_\_ Based on USDA definitions, Wisconsin has lots of small farms, but few have enough sales to make a living as full-time farmers.
- d) T \_\_\_ F \_\_\_ Based on class discussion, farms are a relatively unconsolidated part of the food system compared to input suppliers, processors, and grocery stores.
- e) T \_\_\_ F \_\_\_ The farmer's share of money spent on food by consumers is usually small, with most of the spending on food going to other parts of the food system.

2) (10 pts.) You own a farm that sells carrots to local markets. This table reports how many pounds of carrots you can harvest per bed as you vary the inches of irrigation water you apply.

Water (inches)	Carrots (pounds)	Marginal Product	Value of Marginal Product
10	1200	--	--
12	1600		
14	1800		
16	1900		

- a) Using numbers given in this table, show below how to calculate the Marginal Product for one example, and then fill in the Marginal Product column in the table above.
- b) Carrots sell wholesale for \$0.10 per pound. Using numbers from this table, show below how to calculate the Value of Marginal Product for one example, and then fill in the Value of Marginal Product column in the table above.
- c) What optimality condition defines the profit maximizing amount of the input to use? (Be brief and to the point.)
- d) If the fixed and variable cost to apply one inch of irrigation water to a bed is \$15, how much irrigation water should you apply? (You may need to interpolate between entries.)

**3) (12 pts.)** You have a corn field next to a stream and wetland that you want to plant a buffer strip around so field runoff no longer enters the water directly. You plant this buffer area each year in corn, though it yields poorly. You want to examine planting grass and shrubs as a buffer and no longer till and plant corn there. You spend \$900 per acre to grow corn in the area. It yields only 100 bushels per acre on average. You expect a corn price of \$7 per bushel over the next few years. The annualized cost to plant and maintain the buffer strip is \$80 per acre each year. Each year, a USDA program will pay you \$100 per acre to put in the buffer.

a) Use the information given above to conduct a partial budget analysis of this conversion of part of the field from growing corn to a buffer strip by filling in the table below. Do calculations on a \$ per acre basis. Show your calculations in the space provided.

Benefits		Costs	
<u>Additional Revenues</u> What new revenue will be generated?		<u>Additional Costs</u> What new costs will be added?	
<u>Costs Reduced</u> What costs will be eliminated?		<u>Revenues Reduced</u> What revenues will be lost?	
Total Benefits		Total Costs	
Total Benefits – Total Costs = Net Benefit			

b) Based on your results, considering only the money earned, is installing the buffer strip to convert the land from corn a profitable change? Briefly explain.

**4) (3 pts.)** If anhydrous ammonia fertilizer is \$1,400/ton and is 82% nitrogen, how much does it cost per pound of nitrogen?

**5) (18 pts.)** Potato yield as a function of the nitrogen fertilizer rate is  $Q = 300 + 1.3N - 0.002N^2$ , where  $Q$  is total hundredweight (cwt) of potatoes harvested per acre and the nitrogen fertilizer rate  $N$  is pounds of nitrogen applied per acre. The potato price is \$10 per cwt and the price of nitrogen is \$0.90 per pound.

a) What is the economically optimal nitrogen rate ( $N$ ) to apply? Set up and solve this economic problem using calculus and this information. **Check the second order condition.**

a) At the nitrogen rate you derived in part a, what is the potato yield (cwt per acre)?

b) Besides the cost of nitrogen, other costs are \$4000/acre. What are net returns (\$ per acre)?

6) (10 pts.) Turkeys fed these corn and soybean meal rations are at market weight in 120 days.

Corn (lbs)	Soybean Meal (lbs)	Marginal Rate of Technical Substitution
8.0	7.9	---
11.5	5.9	
14.0	4.9	
17.0	4.1	

a) Using numbers from this table, show below how to calculate the Marginal Rate of Technical Substitution between corn and soybean meal for the second row in the table and then fill in the missing entries in the table above.

b) What optimality condition defines the profit maximizing amount of both inputs to use? (Be brief and to the point.)

c) If corn cost \$0.12/lb and soybean meal costs \$0.30/lb, what is the profit maximizing level of each to feed? (Note: if it is between rows in the table, use the average of entries.)

d) If the price of soybean meal increased and the corn price did not change, the economically optimal soybean meal would decrease, but would optimal corn increase or decrease?

7) (21 pts.) soybean yield is  $Y = 30 + 5K - 0.1K^2 + 40S - 0.2S^2 + 0.1KS$ , where  $Y$  is soybean yield in bushels per acre,  $K$  is pounds of potassium fertilizer per acre and  $S$  is thousands of seeds planted per acre. The soybean price is \$14 per bushel, the potassium price is \$0.60 per pound and the soybean seed price is \$0.8 per thousand.

What is the profit maximizing amount of potassium ( $K$ ) and seeds ( $S$ ) to use to grow corn ( $Y$ )?  
(Note: you will not need to convert prices to set up the profit function, nor calculate yield or revenue at the optimal values for  $K$  and  $S$ .)

**Be sure to check the second order conditions.**

8) (16 pts.) ***Based on material covered in class***, are these True or False? Mark your answer.

- a) T\_\_\_ F\_\_\_ Historically, farmers go through multi-year periods of output prices below costs, with below average returns on their management time and assets.
- b) T\_\_\_ F\_\_\_ Based on the dairy budgets discussed, the full cost of production is about \$5,000/year per cow, so a 200 cow dairy has a \$1 million cost.
- c) T\_\_\_ F\_\_\_ Agricultural supply is non-responsive (inelastic) to price declines because farmers lack key information and the technology to respond.
- d) T\_\_\_ F\_\_\_ Over-use of nitrogen on corn is relatively obvious because the corn looks “too good to be true”.
- e) T\_\_\_ F\_\_\_ Each year, U.S. farmers grow about 1/3 of the world’s total corn production and 1/3 of the world’s total soybean production.
- f) T\_\_\_ F\_\_\_ Hypoxic zones in Lake Michigan from excess fertilizer use have caused widespread contamination of drinking water wells in Wisconsin.
- g) T\_\_\_ F\_\_\_ The hypoxic zones in Lake Michigan from excess fertilizer use have caused widespread contamination of drinking water wells in Wisconsin.
- h) T\_\_\_ F\_\_\_ Nitrogen is a key nutrient that plants need to grow, but can also get into surface and ground water and cause environmental and health problems.