AGEC 5403 **PROBLEM SET Three** **SPRING 2019**

I. A small agribusiness plant produces items for its parent company in accordance with the following response function: $y = 6x_1 + 9x_2 - 0.2x_1^2 - 0.3x_2^2 + .4x_1x_2$

where y = units of output, x_1= units of labor, and x_2 = units of capital.

a. Input prices are r_1 per unit for labor and r_2 per unit for capital and the price of product is p and all prices are determined competitively. Derive the ordinary input demand functions, constrained input demand functions, and the expenditure demand functions for both inputs. Derive the supply function, profit function, cost function, and conditional production function.

b. Input prices are r_1 = \$8 per unit for labor and r_2 = \$10 per unit for capital. Output price is \$10. What is the profit maximizing output and input levels?

c. Input prices are r_1 = \$8 per unit for labor and r_2 = \$10 per unit for capital. The parent company has requested that the plant produce 385 units of output. Determine the least cost combination of labor and capital to produce the 385 units of output. Note: You do not have to check second order conditions. If your solution is a multi-optimum, it should be obvious which input combination is least cost.

d. If the parent company increases their request from the plant to 386 units of output, what is the approximate estimated increase in production cost if the firm continues to minimize costs? You need not resolve the problem to answer the question.

e. Assume the parent company can provide only 936 dollars for the cost of the inputs for the profit maximizing level, what is the optimum production and input levels?

f. If the parent company can provide 937 dollars for the cost of the inputs, what is the approximate expected increase in output? You need not resolve the problem to answer the question.

II. In ocean fishing (in a region of the ocean) the number of fishes caught is an increasing (first convex and then concave) function of the number of fishing boats. Assume you can represent the production function for the total number of fishes caught by the following function: $f = 2512b + 180b^2 - 1.5b^3$ where f is the number of fishes caught and b is the number of boats. Assume the price of fish is \$2 and the price (variable cost) of operating a boat is \$2,000. Assume there are no fixed costs.

a. How many fishing boats will one individual use to maximize his or her profits if that individual owned all the fishing rights in the region of the ocean and no one else could fish there?

b. How many fishermen and fisherwomen (fishing boats) will fish in the region if each boat is independently owned and everyone maximized his or her individual profit? Hint: Assume each boat catches the same number of fishes, f/b fish.

c. How many fishing boats will be used if the fishermen and fisherwomen decide to form a cooperative and share equally in the profits? Assume each fisherman or fisherwoman owns one boat. Everyone wants to maximize his or her share of the profit, so the cooperative maximizes profit per boat.

d. Explain your results relative to the stages of production.