Review, First Quiz
Managerial Economics: Eco 685
Quiz Date: Thursday, September 7, 2017

All questions come from the class notes: Introduction, Production Theory, and Cost Theory up to and including section IIIa. Notice that we skipped section VI of production theory. The chapters in the book (version 8) are 1, 5, and 6. You also have the practice problems done at the beginning of class and in the notes.

The questions below cover the material since the last homework. This is because you have also the homework to study for the earlier material. All material is equally likely to appear on the quiz.

You may want to bring a "basic" calculator.

The following equations are provided.

Economic Profits

$$pv = \sum_{t=1}^{n} \frac{\pi_t}{(1+i)^t}, \quad \pi_t = TR_t - TC_t$$

$$\text{Economic Profits} = \text{Revenues} - \text{Opportunity Cost}$$
$$\text{Economic Profits} = \text{Revenues} - \text{Accounting Costs} - \text{Value of Next Best Option}$$

Calculus

$$\frac{dbL^c}{dL} = bcL^{c-1}, \quad \frac{d \text{ objective}}{d \text{ decision}} \approx \frac{\Delta \text{ objective}}{\Delta \text{decision}} = 0 \text{ at the maximum}$$

Marginal Product and Marginal Revenue Product

$$MP = \frac{dQ}{d\text{input}} \approx \frac{\Delta Q}{\Delta\text{input}}, \quad ME = \frac{dTC}{d\text{input}}$$

$$MRP = \frac{dTR}{d\text{input}} \approx \frac{\Delta TR}{\Delta\text{input}} = MR \cdot MP, \quad MRTS = \frac{MP_L}{MP_K}$$

Conditions for Profit Maximization

$$MRP = ME, \quad MRTS = \frac{MP_L}{MP_K} = \frac{P_L}{P_k}, \quad P = MC$$

Returns to Scale

$$Q = K^a L^b \;\rightarrow\; \text{Output Elasticity } = a + b$$

Cost Curves

$$TC = TFC + TVC, \quad ATC = AFC + AVC, \quad ATC = \frac{TC}{Q}, \quad AFC = \frac{TFC}{Q}$$

$$AVC = \frac{TVC}{Q}, \quad MC = \frac{dTC}{dQ} \approx \frac{\Delta TC}{\Delta Q}$$

Question 1

Classify each of the following production functions as increasing, constant, or decreasing returns to scale in both inputs (all real world data except b):

a. Oil pipeline: $Q = 5.298\,(H^{0.37})\,(D^{1.73})$. Here Q is barrels of oil transported through the pipe, H is horsepower of the pump, and D is the diameter of the pipe.

b. Engineers and technicians: $Q = 20E - E^2 + 12T - \frac{1}{2}T^2$. Suppose $E = 1$ and $T = 1$ and consider a doubling of inputs.

c. Blackberry phone production: $Q = 0.0283\,(L^{1.52})\,(K^{0.82})$.

d. Automotive parts industry: $Q = L^{0.27}K^{0.16}M^{0.57}$, here M is energy and materials.

e. Repeat (c), but determine if returns are increasing, decreasing, or constant separately for each input.

Question 2 7 I have found the following information for Delta Airlines (I have rounded the numbers):

- A kiosk can check in 47.5 passengers per hour.
- A ticket agent can check in 9.5 passengers per hour.
- The cost per hour of a kiosk (including cost of the kiosk and maintenance) is \$3.50 per hour.
- Wages for ticket agents are \$35 per hour (wages plus benefits and other labor costs).

a. Calculate the marginal rate of technical substitution.

b. Calculate the price ratio.

c. Give one way to reduce costs while keeping the number of passengers checked per hour constant.

d. Calculate the cost savings per hour from part (c).

e. Give one way to keep costs constant while increasing the number of passengers checked per hour.

f. Calculate the increase in passengers checked in part (e).

Question 3

Give two reasons why returns to scale might be increasing.

Question 4

Econ students (S) and coffee (C) are inputs to the production of economics homework solution sets (Q). The production function is:

$$Q = C \cdot S \tag{1}$$

Suppose the price of coffee is \$3 and econ students earn a wage of \$9.

a. Explain how coffee affects the additional production that results from a small increase in the number of econ students.

b. Compute the optimal ratio of coffee per student (ie. how many cups of coffee should each student consume?).

c. Suppose the operation has a budget of \$36. Compute the optimal amount of coffee, students, and solutions sets.

d. How many students and cups of coffee should be employed to produce 3 homeworks?

Question 5

Suppose Royal Caribbean buys cruise ships which holds 2000 passengers and cost \$20 million each.

a. Suppose the expected number of passengers is 1800-1900. Are ships a fixed or variable cost?

b. Suppose the expected number of passengers is 7000-9000. Are ships a fixed or variable cost?

c. Assuming Royal Caribbean has no other costs, what is the marginal cost of the 2001st passenger?

Question 6

An airline purchases 100 thousand gallons of jet fuel at \$1.50 per gallon for future use. Suppose the price subsequently falls to \$1.40.

a. An offer comes in to buy the fuel at \$1.42 per gallon. A manager argues against selling the fuel, because "we would have to take an 8 cent loss on the fuel we just bought." Is this reasoning correct? Explain.

b. Calculate the total sunk costs, assuming an offer exists to buy the fuel at \$1.42 per gallon.

Question 7

Suppose the total cost of producing engines (Q) is:

$$TC = 250{,}000 + 1000Q + 5Q^2 \tag{2}$$

The price of an engine is \$1,400.

a. What are total fixed costs?

b. What is the average variable cost of the 20th engine?

c. What is the profit maximizing level of production?

Question 8

I have found the following approximate data from the Miami Heat:

Per Game				
Year	Income Source	Ave. Price per game	Quantity per game	home games
2010	Tickets	\$59	16,949	41
2011	Tickets	\$67	16,949	52

Table 1: Estimated Revenue Sources for the Miami Heat

Notice that the Heat have more home games in 2011, as they went farther in the playoffs. Also, the Heat sell out every game. The year 2010 are revenues prior to signing Lebron James, Dwayne Wade, and Chris Bosh. The year 2011 is the first year they played with the team.

a. Given that Dwayne Wade was on the team in 2010, what is the marginal revenue product of signing James and Bosh?

b. Should the owner have hired James and Bosh, given that they earned each an average of \$18.3 million per year? (Note: I am ignoring TV revenue changes, but that doesn't affect the conclusions).

Question 9

Fill in the following table:

Quantity (Q)	TC	TFC	TVC	ATC	MC
0				NA	NA
5				2	
10				3	
15			55	4	