ENG110 Midterm Exam - SOLUTIONS Fall 2013 Meliha Bulu-Taciroglu

Numeric Problems:

1. (10 points) You have the following information for firm A operating in a perfectly competitive market :

Fixed Cost = 18

Marginal Cost = 2Q+10

You have the following information about the industry firm A operates in:

Price is related to Total Quantity Demanded by: P=(-Q/500)+30

Price is related to Total Quantity Supplied by: P=(Q/500)+10

a) (2 points) What is the equilibrium price in this market (the price at which Quantity Supplied meets Quantity Demanded)?

Equilibrium occurs where Demand and Supply meets, then

(-Q/500)+30=(Q/500)+10
Which gives Q=5,000 and P=20

b) (3 points) What is the profit maximizing quantity for firm A at this price? What is the profit?

Since firm A is operating in a perfectly competitive market, P=MC will give us the profit maximizing level of output.
20=2Q+10, Q=5
To figure out the profit, we need to calculate total revenue and total cost.
Total Revenue = 5x20=100
Total Cost=18+(2+10)+(4+10)+(6+10)+(8+10)+(10+10)=98
Profit=100-98=2

c) (2 points) Government provides a subsidy per item purchased to give incentives for the usage of this product.
Subsidy = 4 for each unit produced. What is the equilibrium price after the provision of subsidy?
(Hint: You can think of the subsidy as a negative tax, instead of taking 4 for each unit sold, government gives 4 to the producer for each unit.)

Since the government is paying 4 to the firm for each unit, effectively the MC of each firm and hence the industry supply will go down by 4 units. Then the new industry supply is

P=(Q/500)+4
The new equilibrium will be: (-Q/500)+30=(Q/500)+6, Q=6,000 and P=18

d) What is the profit maximizing level of production for firm A after the provision of the subsidy? What is the profit?
The new MC is 2Q+6 (if the government is giving me 4 for each unit, it means the cost of each additional unit is reduced by 4).

The new market equilibrium price is 18, then 18=2Q+6, gives Q=6.
To figure out the profit, again, we need to calculate total revenue and total cost.
Total Revenue = 6x18=108
Total Cost=18+(2+6)+(4+6)+(6+6)+(8+6)+(10+6)+(12+6)=96
Profit=108-96=12

Therefore, the profit goes up after the subsidy, because of two factors. Not only the existing sales cost less to the firm but also, firm gets more customers.

Note that For parts b and d, taking the integral of MC to get TVC will work also but will give slightly different answers. They are accepted as correct as well.

The reason for the discrepancy is that, the method above assumes non-continuous MC function.

If we assume it is continuous, than we can take its integral, but this method was not introduced during the lectures.

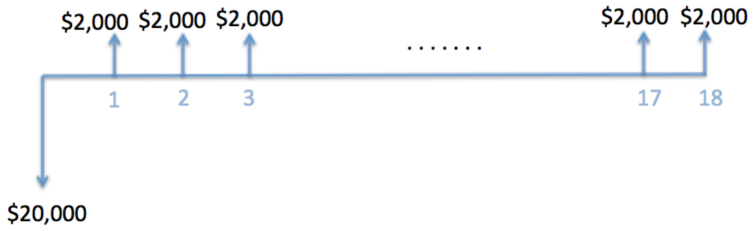
2. (10 points) You invested $10,000 with a bank today at an annual rate of 12% for 5 years. For the first 3 years, the bank compounded interest annually and for the last two years, interest was compounded monthly. Your friend deposited the same amount for the same duration with another bank where compounding is done annually throughout the life of the investment. At he end of five years, both you and your friend ended up with same amount of money in your bank accounts. How much annual interest did your friend get?

10,000(1 + 0.12)^3 (1 + .01)^24 = 10,000(1 + i)^5
i=12.27%

3. (8 points) An investment company is offering the following deal:

"Pay $20,000 today. Get $2,000 per year beginning from a year from today for 18 years."

If the interest rate you can get in the market is 10% per year, would you be willing to accept the above deal?



If the present value of the benefit ($2,000 cash stream) is greater than the cost, then it would mean that you could do better with this investment than what you could do in the market (this opportunity is better than the alternatives).

*Present Value of the Cash Stream = 2,000 (P/A, 10%, 18) = 2,000 * 8.201 = $16,402*

Another way of thinking about this problem is: If I invest $20,000 at the market rate,10%, what kind of a cash stream would this allow me to have over the coming 18 years?

*Cash Stream (per year) = 20,000 (A/P,10%,18) = 20,000*0.1219 = $2,438*

Either way, you should be convinced that this is not a good deal. To be able to accept it, its cost should be at most, $16,402, or its yearly payment should be at least $2,438.

4. (12 points) Total Variable Cost (TVC) of a producer is given by the following equation:

$TVC = 5Q + Q^2/100$

The only fixed cost the company needs to consider is for a machine that costs $30,000.

For this machine, the company is offered two payment plans:

Plan 1: If you pay the price in one installment, there is a 30% discount (30% off of the full price if you pay it now).

Plan 2: Pay nothing now. Pay $4,978 a year from today and $9,600 per year the following 3 years.

a) (6 points) (**Students are said to round the calculations to nearest dollar during the exam**)
If the interest rate in the market is 20%, does the profit maximizing level of production level and the profit depend on the choice of payment plan?

Note that we cannot find the profit maximizing level of output, nor the profit without having more information (about the revenue side). But we can still answer the question.

Profit maximizing level of output can be found by equating marginal revenue to marginal cost, neither of which depend on the total fixed cost. Hence choosing Plan 1 or Plan 2 does not have any effect on the production level (quantity).

The profit is Total Revenue-Total Cost.

Total Cost = Total Fixed Cost + Total Variable Cost

Now, if Plan 1 and Plan 2 is EQUIVALENT at 20%, then we can say that choice of plan does not have any effect on the profit either:

Present Value of Plan 1 = $30,000 (1-30%) = $21,000

Present Value of Plan 2 = 4978/1.2 +9600/1.2^2 +9600/1.2^3+9600/1.2^3 = $21,000

Therefore, Plan 1 or Plan 2 would not make any difference on profit level!

b) (6 points) If, instead, the interest rate is 10%, does the profit maximizing level of production level depend on the choice of payment plan? How about the profit?

Again, the profit maximizing level of output would not depend on the choice of plan.

But the present value of total cost will not be equal for Plan 1 and 2 at 10% interest rate:

Present Value of Plan 1 = $30,000 (1-30%) = $21,000

Present Value of Plan 2 = 4978/1.2 +9600/1.2^2 +9600/1.2^3+9600/1.2^3 = $26,229

Hence, this time, profit DEPENDS on the choice of plan. Profit under Plan 1 will be higher than profit under Plan 2.

5. (5 points) Your company is using a plant of size 10,000 sq. ft. that was constructed 5 years ago for $420,000. If the prices in the construction sector were increasing by 2% per year and the relevant power-sizing exponent is 0.69, how much would it cost to build a 40,000 sq. ft. warehouse today?

Price of 10,000sq. ft. plant today: 420,000(1.02)^5 = $463,714*

Price of 10,000sq. ft. plant / Price of 40,000sq. ft. plant = (10,000/40,000)^0.69

Price of 40,000sq. ft. plant today =1,206,901

6. (5 points) Determine the labor cost of the 2000th item if the first item requires 180 minutes to produce and the learning curve percentage is 92% and labor cost per hours is $12.

b=log(.92)/log(2) = -0.1203

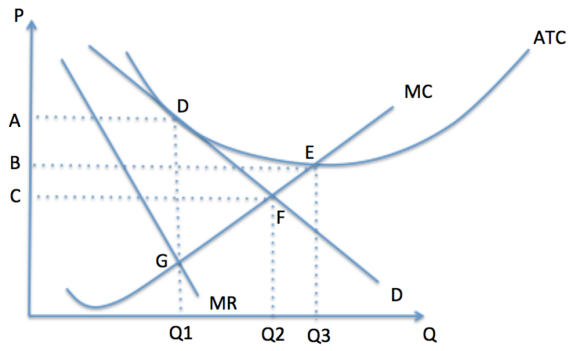
*$T_N = T_{initial} * N^b$=180*2000^(-0.1203) = 72.14 minutes.*

*Labor Cost = (72.14 / 60) * 12 = $14.42*

Discussion Questions (4 points each):

1. a) (2 points) The diagram below represents a monopolistically competitive firm's cost structure as well as the demand (D) it faces for its product and its Marginal Revenue (MR).

Which area represents firm's profit? (You can shade the area on the diagram or you can write down the area defined by its corner points).



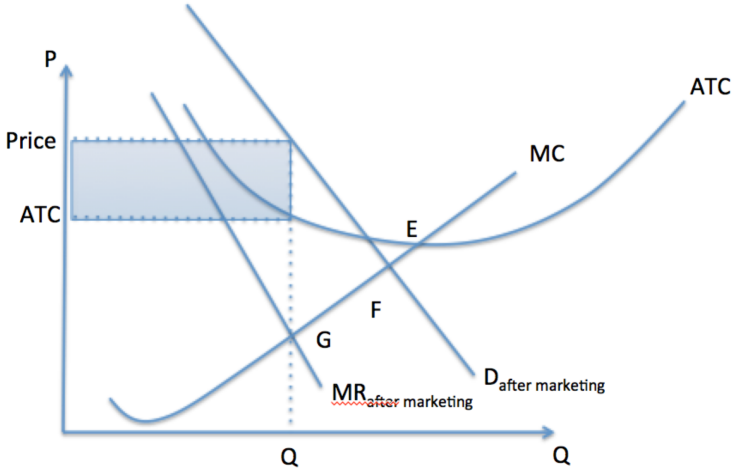
Profit maximizing level of output ,Q_1 ,is determined by the point where MR meets MC.

Price and ATC are the same and equal to A, at that point. Hence the profit is zero.

b) (2 points) Suppose this firm decided to run a marketing campaign after which there was an increase in the demand for the firm's product at every price. Moreover, the new demand curve became less price-sensitive.

Assume that the cost structure of the firm stays the same.

Redraw the above diagram with the new information and indicate the area that corresponds to the profit (loss) of the firm.



2. (4 points) Suppose that there are two companies, A and S, competing in the smartphone market. Each has been producing one type of a phone (expensive) so far.

Next year both are planning to announce a new type of phone (cheap). They will decide simultaneously and each knows that payoffs are going to be as follows:

		Company A	
		Introduce a cheap phone	Do not introduce a cheap phone
Company S	Introduce a cheap phone	20, 30	25, 28
	Do not introduce a cheap phone	18, 35	15, 40

For example, if A introduces a cheap phone and S does not, S gets 18 and A gets 35.

Given the above payoffs, do you think company A will introduce a cheap phone? How about company S?

Since the best response to each move leads us to the upper left cell, the expected outcome is for Company A and Company S, both, to introduce a cheap phone.

3. (4 points) Do you agree with the following statement? Why or why not? Explain in a few sentences:

"Competition in an Oligopolistic market structure always leads to the best usage of resources."

Not necessarily. To be able to compete with the competitor (for example, not to lose market share) a company can divert resources to activities (like advertising) that are less than most productive.

A perfect example discussed in class: Computer software/hardware companies spend more money on patenting the things that they themselves have not achieved yet but that possibly will be put forward by their competitors in the future.

4. (4 points) In terms of the cost structure, what is the difference between the conventional methods of oil production and the recently popularized method of extracting shale oil?

According to the Financial Times "US Shale" article, conventional methods of oil production require higher initial costs per well and can produce more oil per well than the shale oil production.

Therefore, the scale (per well) of conventional method of oil production is bigger, giving way to economies of scale.

5. (4 points) Is the following statement TRUE or FALSE? Why or why not?

"The main revenue source for Google is the advertisements that are displayed next to or above its search result pages. To maximize its profit, Google sets the price (example: $5 for the first slot, for 24 hours, $3 for the second slot for 24 hours) and announces it to the advertisers for each advertisement slot for each web-search result page. "

Google does not post fixed prices per slot.

Every time a search query is entered into Google search box, an auction (automatically with the bids entered earlier by advertisers' machines/softwares) is conducted and winner's ad is displayed above or next to the search results.

Therefore, prices of ad slots are determined by the bids of companies competing for ad slots, rather than directly by Google.

Multiple Choice Questions (3 points each):

1. Economists make a distinction between the short and the long run. The difference is that in the long run, as opposed to the short run,

   A. A monopoly would make zero economic profit.
   B. A firm operating in a perfectly competitive market would make positive economic profit.

C. A firm cannot change its scale.
D. A firm operating in a monopolistically competitive market would make zero profit.
E. An oligopolistic firm will not be able to act strategically.

2. Visiting a brick-and-mortar store to check out the new LCD models but buying an LCD online results in positive externalities. In this case, market is said to fail because,

   A. Free riders are not punished
   B. For LCDs sold in brick and mortar stores, market price and the optimum price differ.
   C. Consumer needs to wait for the online seller to ship, hence his need is not met immediately.
   D. There is a discrepancy between the quantity sold online and in brick-and-mortar stores.
   E. Brick-and-mortar stores are costly to maintain.

3. In an Oligopoly,

   A. There is only one firm
   B. Products have to be differentiated
   C. Products are always homogenous
   D. There are some barriers to entry
   E. There are no barriers to entry

4. In a Monopolistic Competition,

   A. There is only one firm
   B. Products have to be differentiated
   C. Products are always homogenous
   D. There is strategic interaction among firms
   E. There are high barriers to entry

5. Market structure of the automotive industry in US most resembles to a(n),

   A. Monopoly
   B. Oligopoly
   C. Monopolistic Competition
   D. Perfect Competition
   E. None of the above

6. If increasing production by more unit results in per unit total cost to go up, then we can be sure that

   A. Marginal cost is minimized
   B. Average total cost is flat
   C. Average variable cost is falling
   D. Marginal cost is higher than average total cost
   E. Average total cost is higher than marginal cost

7. Without knowing the specifics of the tablet/mobile phone applications industry, which one of the following is most plausible for a firm operating in this industry;

   A. Marginal Cost is a steep increasing curve
   B. Marginal Cost is increasing at an increasing rate
   C. Marginal Cost is always above Average Total Cost
   D. Marginal cost is either flat or is increasing but close to being flat
   E. Average fixed cost is increasing

8. All of the following involves price discrimination except;

   A. Selling hardcover and softcover books at a different price
   B. Selling first class and economy seats for an air trip at a different price
   C. Offering different prices to students and non-students for Walt Disney Concert Hall
   D. Charging a lower per unit price for bulk purchases
   E. Charging a low price for a bottle of water, a need, versus charging a high price for a diamond ring, not necessarily a human need.

9. Opportunity cost, for example, needs to be included in calculating the total costs. Which one of the following cost types should not be included?

   A. variable cost
   B. unskilled labor costs
   C. skilled labor costs
   D. patent cost
   E. sunk cost

10. Consumer Surplus for a consumer

    A. is the difference between the price and the variable cost
    B. is always higher than the price
    C. is the difference between consumer's willingness to pay and the actual price
    D. is the difference between consumer's willingness to pay and the marginal cost
    E. can not be altered by price discrimination

Bonus Questions:

1. (1 point) During a class discussion, your fellow classmates talked about their ideas for new products that would fulfill a consumer need or want. Which of the following was among the proposed products during this discussion?

A. a wireless cat trainer
B. wearable sensors for blind people
C. tableware that cleans itself
D. an airline that would work as a shuttle, collect and drop people off at different airports
E. an online music service that would create instant new songs by combining a few proposed existing songs

2. (1 point) Can you give an example of "creative destruction"?

Any example that shows the cease of usage of a commodity/service, replaced by other will do.

For example, cell phones destroying land lines.

FORMULA SHEET:

I. Cost Structure and Estimation:

$TC=TVC+TFC,$ $ATC = TC/Q$ $MC= \Delta TC / \Delta Q$

$$\frac{Cost_A}{Cost_B} = \frac{Index_A}{Index_B} \qquad Cost_A = Cost_B\left(\frac{Size_A}{Size_B}\right)^x \qquad T_N=T_{initial} \text{ x } N\text{^}b$$

b=log(learning curve rate)/log2

II. Single Payment:

$F = P(1+i)^n$ $F = P(F/P, i, n)$ $P = F(1+i)^{-n}$ $P = F(P/F, i, n)$

III. Effective Rate:

$$i_a = (1+\frac{r}{m})^m - 1$$

$$i_a = e^r - 1$$

IV. Uniform Series:

$$F = A\left[\frac{(1+i)^n - 1}{i}\right] = A(F/A, i, n)$$

$$A = F\left[\frac{i}{(1+i)^n - 1}\right] = A(A/F, i, n)$$

$$A = P\left[\frac{i(1+i)^n}{(1+i)^n - 1}\right] = P(A/P, i, n)$$

$$P = A\left[\frac{(1+i)^n - 1}{i(1+i)^n}\right] = A(P/A, i, n)$$