ENG 110 MIDTERM FALL 2014 SOLUTIONS:

NUMERIC PROBLEMS:

1. You have the following total cost function for a firm operating in a monopolistically competitive market :

$TC = 1260 + 10Q^2 + 60Q$

Firm faces the following demand for its product:

$P = -8Q+420$

a) (2 points) What is the profit maximizing level of output?

MC = MR
20Q+60 = -16Q+420
Q = 10*

b) (2 points) What is the price? What is the profit?

P = -80+420 = 340

c) (6 points) If the firm advertises, it will be able to charge $72 more per unit, at any level of production. Calculate the extra profit that will be obtained.

*Profit before advertisement = 340*10-1260-1000-600 = 540*
After the advertisement, new Demand will be given by P = -8Q+420+72 = -8Q+492
MC=MR
20Q+60 = -16Q+492
Q= 12*

P will be -8(12)+492=396
*Profit after the advertisement = 396*12-1260-1440-720 = 1,332*
The extra profit is 1,332-540 = 792 – the money spent on advertisement.
(take off 0.5 points if only 792 is given as the answer)

2. (10 points) Today, Lisa got a loan of $100,000 from a bank. Here are the terms of the loan:

-She will not be charged any interest for the first 6 months. Thereafter, bank will charge an annual rate of 6%, compounded semiannually.
-Lisa will pay back the loan by making 6 equal semiannual payments beginning 6 months from today.

How much is Lisa's each payment?

Explanation: There is no interest for the first six months, then I owe still 100,000 6 months from today, at which I make a payment of X. My remaining balance is 100,000-X and it must be equivalent to the present value of my remaining payments (5 of them) at 3% (since

the compounding and payment periods coincide, I do not need to calculate any effective rates.)

Solution: 100,000-X = X (P/A,3%,5)

*100,000 – X = X *4.580*

X = $17,921.15

3. (10 points) Jim plans to deposit $10,000 each year for 6 years, beginning today. (A total of 7 deposits). One month after his last deposit, he will begin to withdraw $2,000 each month. If the bank offers 12% APR and compounds interest monthly, how many times Jim can withdraw money until his account is depleted (he runs out of money)?

Explanation: We can find the future value of the total deposits at the end of the sixth year and equate it to the present value of the 2000 cash flow for the following n months and solve for n.
Since compounding is done monthly, and deposits are done yearly, we need to find the effective rate that corresponds to the deposit periods. Note that no such adjustment is needed for the withdrawals.

Solution: Effective rate calculation: $i_a = (1.01)^{12}-1=12.68\%$

$10{,}000(1.01)^{72} + 10{,}000(F/A,12.68\%,6) = 2{,}000\ (P/A,1\%,n)$ *, solve for n.*
The following is also correct:

$10{,}000(1.1268)^{6}+10{,}000(F/A,12.68\%,6) = 2{,}000\ (P/A,1\%,n)$ *, solve for n.*

Then,

$20{,}470 + 10{,}000\ (1.1268^{6}-1)/0.1268 = 2{,}000\ (1.01^{n}-1)/(0.01*1.01^{n})$
$(20{,}470 + 82{,}557)*0.01 / 2{,}000= (1.01^{n}-1)/1.01^{n}$

$1.01^{n}=2.062$
$n=72.75$

4. (10 points) When the price is $50, a perfectly competitive firm can only cover its variable costs at the optimal production level, Q*=1,000, making a loss of $200,000.

If the price were to be $100, the firm could make zero economic profit at the optimal production level, Q*=3,000. How much would be the total variable costs then?

Then, Total Fixed Cost must be $200,000.

*When P=100, TC = 100*3,000 = 200,000 + TVC*
TVC = 100,000

5. (10 points) You invested $50,000 five years ago. For the first 2 years, you earned 6% per year, compounded annually. You continued to earn 6% per year but, at the beginning of the 3rd year and 4th year, the bank cut a fee of $500. What was your effective annual rate throughout your investment?

$50{,}000\,(1+i_a)^5 = ((50{,}000(1.06)^2-500)1.06-500)\,1.06^2$

$i_a = 5.63\%$

CURRENT EVENT & SHORT ANSWER QUESTIONS:

1. (4 points) A typical price taker is making production plans at the beginning of the year. He has two options to sell what he produces this year. Either sell everything at a price of $20/unit now or sell everything at a price of $22/unit at the end of the year. Total Cost is given by

$TC(Q) = 10+5Q^2+2Q$

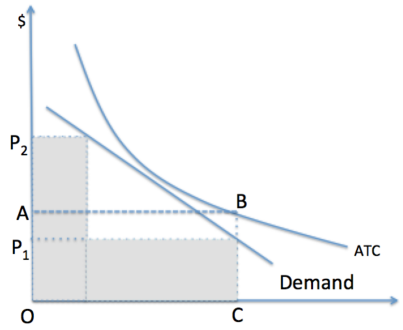
If all costs are due at the beginning of the year and the price taker can borrow and lend at a rate of APR 10%, which price option should he pick?

Both options are the same since the present value of $22 is equal to $20.
$22/1.1 = $20

2. (4 points) Give three reasons for dropping gas prices we have been experiencing in recent months:

1. US producers are supplying more oil via "fracking" "shale oil".
2. Most countries are slowing down or already in recession, therefore, world oil demand is going down.
3. Oil producing countries (OPEC) cannot agree on a plan to reduce production and increase price.

3. Similar to the class discussion on "Google Reader", suppose that a Monopoly is facing a demand and an ATC curve as depicted in the following diagram:



a) (3 points) What can you say about firm's profit?

The firm cannot make a positive profit since ATC is higher than Price (Demand) at every quantity.

b) (3 points) Suppose that the firm can price discriminate and offer the same commodity at different prices to different customers (P_1 to low-willingness to pay customers and P_2 to high willingness to pay customers). Given that the shaded are is greater than the area enclosed by OABC, how would your answer to part (a) change?

If the firm can sell the commodity at a price of P_2 to all those who have a valuation higher than P_2 and at a price of P_1 to all those who have a valuation between P_2 and P_1, then the total revenue would be the shaded area. The total cost would be the area enclosed by OABC. In this case, the firm would be making positive profit.

c) (2 points) Given what you found in part (a) and (b) what would you say to those who pay the high price and are unhappy about the price discrimination?

If the price discrimination is not possible, this product is not produced. This means those who would participate in the market and enjoy a consumer surplus do not get to enjoy it.

4. (4 points) You are producing two different commodities: A and B. You have two types of customers: I and II.
Following table gives information about each type's willingness to pay for a unit of each commodity:

	A	B
Customer Type I	100	20
Customer Type II	20	100

Given the above information and given that you can charge any price for your products, what is the maximum revenue you can obtain if you have 50 customers of type I and 50 customers of type II (but you do not know which person is of which type) ?

Explanation: By setting a price between 20 and 100 for each commodity, you can only get half of the customers. Yet, by bundling the commodities and offering one unit of A and one unit of B together, at a price of 120-epsilon (that is, slightly less than 120), you can get all the customers. This, in effect, becomes price discrimination. Without knowing which customer has a high valuation and which has low, you extract all you can from the consumer surplus.

Solution: Bundle A and B and sell it at 120 or slightly less than 120.
*You maximum revenue is 120*100=12,000 or slightly less.*
Both are acceptable and get full points.

5. (6 points) Why would a firm choose to increase its size, even if increased size does not necessarily decrease its per unit cost? Give three reasons.

1. To capture the rest of the market to be able to have control over the price.
2. To take advantage of state/local government incentives
3. Managerial ambitions (it is well-documented in the literature that owners' and manager's interests are not always aligned. Even if it is not in the best interest of the company, managers increase size, or purchase other companies to have more control))

6. (4 points) *Vestaron* is a startup company producing pesticides derived from spider venom. *Befunky* is a software startup providing an online photo editing platform.
Give one positive and one negative aspect of investing on each company (from a pure financial point of view)?

Vestaron:
Positive: Cannot be easily copied
Negative: Return is expected in the long run
Befunky:
Positive: Short term return opportunities
Negative: Can be easily copied

Multiple Choice Questions (4 points each):

1. Network externalities correspond to

   A. lower per unit costs due to good business relationships with suppliers
   B. Advertising one's business through social network sites
   C. Increased consumer valuation due to increased usage
   D. The difference between social and private costs
   E. None of the above

2. An Oligopolist

   A. does not engage in strategic interaction
   B. produces only differentiated products
   C. has to hold patents

D. can produce homogenous products
E. cannot acquire other firms

3. Which of the following IS correct about positive externalities?

A. Positive externalities do not cause market failure.
B. Positive externalities result in overproduction.
C. Positive externalities may be corrected by a subsidy.
D. Positive externalities do not happen due to missing markets.
E. None of the above.

4. Which of the following statements is NOT correct?

A. A commodity can have both public and private good properties.
B. A lighthouse is a pure public good.
C. Public goods come with positive externalities.
D. Lack of property rights is one of the causes of negative externalities.
E. Internet is a pure private good.

5. For a firm that has a fixed variable per unit cost regardless of the level of quantity, which of the following IS correct?

A. Average variable cost (AVC) curve has a u-shape.
B. Average total cost (ATC) curve has a u-shape.
C. Average fixed cost (AFC) curve cannot be linear.
D. Marginal cost (MC) curve cannot be linear.
E. At the optimal production level, marginal cost must be equal to average variable cost.