

Numerical/Analytical Problems:

1. (For this problem, ignore the time value of money!) A company is making plans for constructing an n -story building. The foundation cost, \$320,000, is independent of n . The remaining costs will depend on the number of floors, n , indicated by;

$$TVC(n) = 10,000n^2 + 60,000n$$

The price that can be charged for each floor depends on the market demand in the following way;

$$P = -8,000n + 420,000$$

Additionally, with each floor built, the company will gain expertise that it can use in the following projects. This is worth \$72,000 to the company for each floor it constructs.

a) (5 points) How many floors should there be in the building? (What is optimal n ?)

$$MC = 20,000n + 60,000$$

$$MR = -16,000n + 420,000 + 72,000$$

$$MC = MR$$

$$20,000n + 60,000 = -16,000n + 420,000$$

$$36,000n = 360,000$$

$$n^* = 10$$

$$TR = [-8,000n + 420,000]n + 72,000n$$

$$MR = -16,000n + 420,000 + 72,000 = -16,000n + 492,000$$

$$MC = MR$$

$$\Rightarrow 20,000n + 60,000 = -16,000n + 492,000$$

$$\Rightarrow 36,000n = 432,000$$

\Rightarrow

$$n^* = 12$$

b) (3 points) What should be the price for each floor?

$$P = -8,000n^* + 420,000$$

$$P = -8,000 \times 12 + 420,000 = \$324,000$$

$$= -8,000(10) + 420,000$$

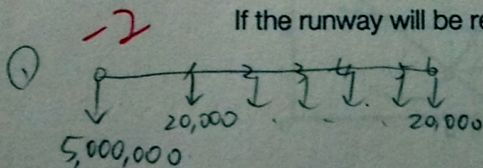
$$P^* = 340,000$$

2. (8 points) Market APR is 12%. We have two options to build a runway in an airport:

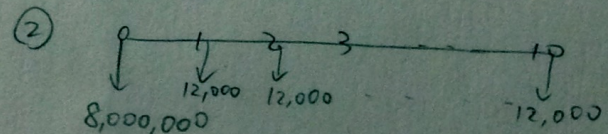
Option I has a \$5 million initial cost, a \$20,000 annual cost and lasts (wears out in) 6 years.

Option II has an \$8 million initial cost, a \$12,000 annual cost and lasts 10 years.

If the runway will be replaced whenever it wears out, which option should we pick?



3045



$$NPC_1 = 5,000,000 + (20,000)(P/A, 12\%, 6)$$

$$= 5,000,000 + 20,000 \times 4.111$$

$$= 5,082,220$$

$$NPC_2 = 8,000,000 + (12,000)(P/A, 12\%, 10)$$

$$= 8,000,000 + 12,000 \times 5.650$$

$$= 8,067,800$$

Find EVAC:

$$EVAC_I = 20,000 + 5M(A/P, 12\%, 6) = \$1,236,000$$

$$EVAC_{II} = 12,000 + 8M(A/P, 12\%, 10) = \$1,428,000$$

\Rightarrow pick 1st option.

$NPC_1 < NPC_2 \Rightarrow$ We pick option I

3. (7 points) Suppose that there are two firms, A and B, each introducing a new product to the market. They will simultaneously decide on whether to charge a high(H), a medium(M), or a low(L) price for their new product, without knowing what the other will charge. The information summarized in the following table is common knowledge:

		(A,B)		
		Firm B		
Firm A	H	16,40	40,28	36,20
	M	18,10	38,50	20,20
	L	10,10	10,30	38,60

TURN	Firm	Choose	Result
1.	A	L	-
2.	B	L	38,60
3.	A	L	38,60

Equilibrium at Firm A gets 38, Firm B gets 60.

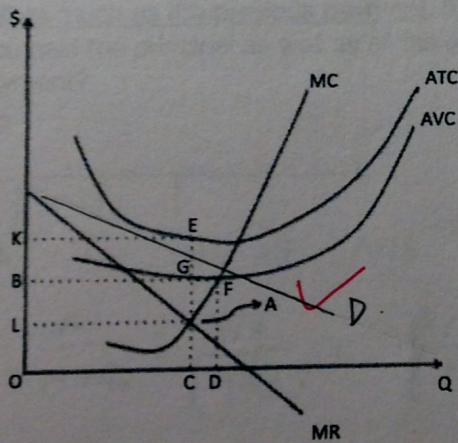
For example, if A charges a high price and B charges a medium price, A gets 40 and B gets 28. Given the above payoff structure, under which outcome no firm has any incentive to deviate?

TURN	Firm	Choose	Result
1.	A	H	-
2.	B	H	16,40
3.	A	M	18,10
4.	B	M	38,50
5.	A	H	40,28
6.	B	H	16,40

TURN	Firm	Choose	Result
1.	A	M	-
2.	B	M	38,50
3.	A	H	40,28
4.
	Infinity		

4. (6 points) The diagram below represents a monopolistically competitive firm's cost structure as well as its marginal revenue (MR). You know that at the optimal level of production, this firm is making a loss such that it makes sense to produce in the short run but not in the long run. Given this information, where should the demand be located on the following graph? (Draw the demand on the following graph.)

Infinity



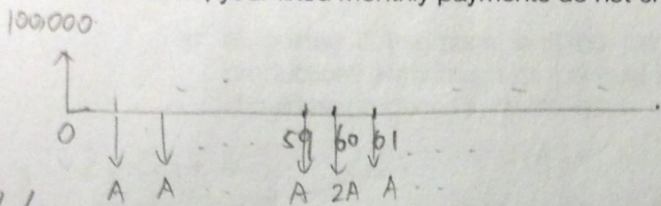
Short Run:

$P > AVC \rightarrow$ produce

Long Run:

$P < ATC \rightarrow$ shut down

5. (8 points) You started a company five years ago by taking a loan of \$100,000. The APR on the loan is 12%. You agreed to make fixed payments every month for 10 years. Today, your 60th payment is due and you decided to make a double payment. (You paid twice what you were paying each month). You will continue to make single payments to pay the rest of the loan. By how many months your loan term shortened? (According to the contract you signed with the bank, you can make double payments, your APR stays the same, your fixed monthly payments do not change, therefore, your loan term shortens.)



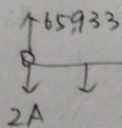
$$\bar{i} = 12\% / 12 = 1\%$$

$$A = P(A/P, 1\%, 120) = 100,000 \frac{1\% (1+1\%)^{120}}{(1+1\%)^{120} - 1} = 1434.7$$

At 59th, I still own the bank R amounts:

$$R = 100,000 - 1434.7 (P/A, 1\%, 59) = 100,000 - 1434.7 \frac{(1+1\%)^{59} - 1}{1\% (1+1\%)^{59}} = 36,293$$

$$R' = 36,293 (1+1\%)^{60} = 65,933$$



$$\text{New } P' = 65,933 - 2 \times 1434.7 = 63063.6 (*)$$

Continue from (*):

$$P' = A (P'/A, 1\%, n)$$

$$63063.6 = 1434.7 \frac{(1+1\%)^n - 1}{1\% (1+1\%)^n}$$

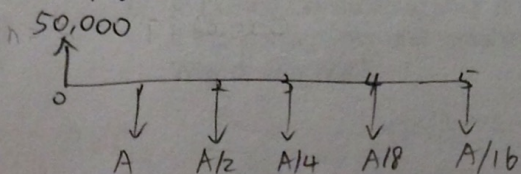
$$\Rightarrow n = \log_{1.01} \left(\frac{1}{1 - \frac{63063.6}{1434.7}} \right)$$

$$\Rightarrow n = 58$$

$$\Delta n = 60 - 58 = 2 \text{ months}$$

∴ 2 months shortened.

6. (8 points) You got a loan for \$50,000 today at APR 10%. You will pay it in 5 installments in the coming 5 years. The first payment is due exactly a year from today. Each payment is half as much as the previous payment. If at the end of your fifth payment your balance is \$0 (you paid the principal as well as all the accumulated interest), how much was your first payment?



$$50,000 = \frac{A}{1+10\%} + \frac{A/2}{(1+10\%)^2} + \frac{A/4}{(1+10\%)^3} + \frac{A/8}{(1+10\%)^4} + \frac{A/16}{(1+10\%)^5}$$

$$\Rightarrow 50,000 = A \left(\frac{1}{1.1} + \frac{1}{2 \times 1.1^2} + \frac{1}{4 \times 1.1^3} + \frac{1}{8 \times 1.1^4} + \frac{1}{16 \times 1.1^5} \right)$$

$$\Rightarrow A = \$1083.8$$

$$A = \$30593$$

7. (For this question, ignore time value of money!) A perfectly competitive firm rented two production facilities, A and B, at a total cost of \$400. The facilities differ in their productivity levels represented by their respective Total Variable Cost functions.

$$TVC_A = 10(Q_A)^2 + 6Q_A$$

$$TVC_B = 12(Q_B)^2 + 4Q_B$$

- a) (5 points) If the price is \$100 per Q, what is the profit maximizing level of production? How much of it should be produced in facility A and how much of it should be produced in facility B?

$$MC_A = 20Q_A + 6$$

$$MC_B = 24Q_B + 4$$

$$P = MC_A$$

$$100 = 20Q_A + 6$$

$$Q_A = 4.7$$

$$Q_A = 4$$

$$Q = Q_A + Q_B = 4 + 4$$

$$Q = 8$$

$$P = MC_B$$

$$100 = 24Q_B + 4$$

$$Q_B = 4$$

- b) (3 points) At the optimal level of production, what is the average variable cost (per unit variable cost) for each facility?

$$AVC = \frac{TVC}{Q} = \frac{TVC_A + TVC_B}{Q} = \frac{10 \times 4^2 + 6 \times 4 + 12 \times 4^2 + 4 \times 4}{8}$$

$$AVC = 49$$

$$AVC_A = \frac{TVC_A}{Q_A} = \frac{10Q_A^2 + 6Q_A}{Q_A} = 10Q_A + 6 = 10(4.7) + 6 = 53$$

$$AVC_B = \frac{TVC_B}{Q_B} = \frac{12Q_B^2 + 4Q_B}{Q_B} = 12Q_B + 4 = 12(4) + 4 = 52$$

- c) (3 points) Considering your answer in part (b), would you want to use both facilities if the average per unit variable cost is higher in one facility compared to the other? Why or why not?

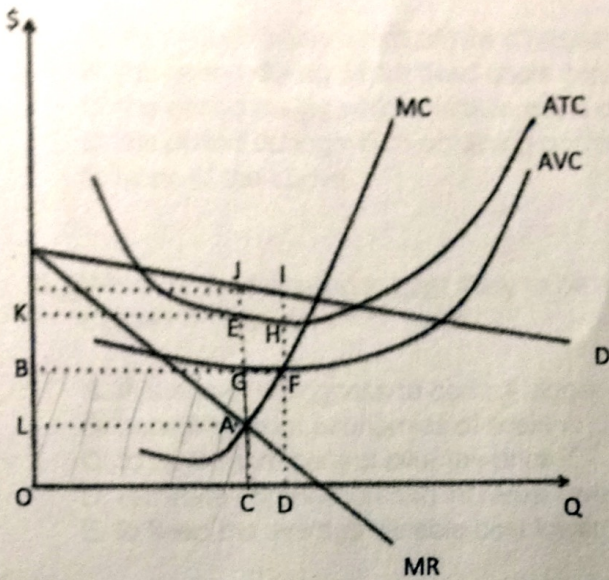
$$AVC_A = \frac{TVC_A}{Q_A} = \frac{10Q_A^2 + 6Q_A}{Q_A} = 10Q_A + 6$$

$$AVC_B = \frac{12Q_B^2 + 4Q_B}{Q_B} = 12Q_B + 4$$

I will use both. Because $AVC < AVC_A + AVC_B$

We would use both facilities b/c the marginal costs are the same even though average variable costs are different.

Multiple Choice Questions (4 points each):



A-

1. For a firm whose cost and revenue structure are represented in the above diagram, which of the following is not correct?

- A. Average fixed cost at the profit-maximizing quantity is equal to the difference between K and L. ~~X~~
- B. Total Fixed Cost cannot be zero. ✓
- C. D is higher than the profit maximizing level of quantity. ✓
- D. Marginal cost (MC) crosses ATC at its minimum point. ✓
- E. As Q goes up marginal revenue decreases at a higher rate than price does. ✓

D

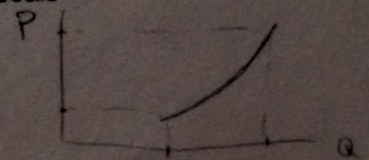
2. For a firm whose cost and revenue structure are represented in the above diagram, which of the following represents the Total Variable Cost at the profit maximizing level of output?

- A. Area defined by BGLA ~~X~~
- B. Area defined by KECO ~~X~~
- C. Area defined by ALCO ~~X~~
- D. Area defined by BGCO. ✓
- E. It cannot be determined with the given information.

C

3. If a firm reduces its size by half and its total costs are reduced by more than a half, then:

- A. firm is experiencing economies of scale ~~X~~
- B. firm is experiencing constant returns to scale ~~X~~
- C. firm is experiencing diseconomies of scale ✓
- D. firm is expected to go out of business
- E. firm would be better off increasing rather than decreasing its scale



B

4. In economics terms, short run refers to

- A. the period during which all raw material going into the production is depleted.
- B. the period during which fixed costs cannot be changed. ✓
- C. the period during which variable costs cannot be changed. ✗
- D. the period during which obtaining positive economic profit is not possible. ✗
- E. None of the above.

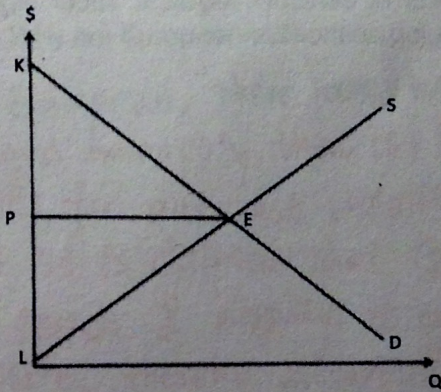
E

5. Which of the following is least likely to be a reason for firms to be willing to get bigger?

- A. managers' willingness to control bigger firms ✓
- B. benefiting from economies of scale ✓
- C. to have more control over the price ✓
- D. eliminate competition and increase revenue ✓
- E. to keep the average variable cost lower than average fixed cost

B

6. Which of the following statements is correct about a market represented by the following graph?



- A. Total Consumer Surplus is equal to the area represented by PEL. ✗
- B. Total Consumer Surplus is equal to the area represented by KPE. ✓
- C. Total Consumer Surplus equal to by the area represented by KLE. ✗
- D. Total Consumer Surplus is equal to the area represented by KLE minus total revenue. ✗
- E. None of the above.

Current Event Questions (4 points each):

The following questions are drawn from the class discussions on current events. Please give a short answer for each (2 to 3 sentences) within the context they were discussed in class.

1. Major oil producers of the world are finding themselves in a challenging marketplace due to increasing production via fracking and horizontal drilling undertaken by relatively smaller companies. Oil supply has been increasing leading to a price decline in the market. (per barrel oil fell from \$105/barrel to as low as \$40/barrel in less than a year.)

Why would a declining price be strategically beneficial to major oil producers?

Low prices may be hurtful to the major oil producers in the short run, however, it is more hurtful to small producers that have higher MC.

In the long run, low prices can eliminate existing competition, further, they provide a disincentive to enter by others.

2. Google faces antitrust inquiries in Europe where it holds 92% of the online search market. Why are European authorities going after Google?

In European, there are not a lot of big website companies. Being a monopoly, that is, having a high market share doesn't constitute grounds for antitrust violations, but engaging in anti-competitive behavior does. It is claimed that Google is bundling its service websites w/ its search & displays its own websites above other companies' websites thereby distorting rankings of search query results.

3. Freemium business model is used by an increasing number of online companies. What is freemium business model? What are the two ways in which it increases companies' profits?

Businesses like DropBox that provide free and limited products for some users, and charge different prices on different amounts of access to the product. ✓

ways: ①. Price discrimination ✓

②. More users, more advertise ✓

②. The valuation of each customer is further ↑ by usage by others (network externalities).

✓ 4. Whatsapp, which is recently acquired by Facebook for \$22 billion, is an instant messaging app for smartphones. Other than eliminating a potential competitor, what did Facebook get by purchasing Whatsapp?

Facebook gets users' data from Whatsapp.

For example, the big data can be used to estimate the demand of certain product, so Facebook can sell this information to other companies that need big data.

5. Suppose a company produces two products, A and B, and sells them by bundling. That is, company sets a price for the pair and sells A and B as a pair. What does the company achieve by bundling? Why not sell each product separately?

Some consumers have higher willingness to pay for product A, and some others have higher willingness to pay for B. However, the company doesn't know which type of consumer like which product.

By bundling two products together, the company can get both type of consumers and charge at the highest price.

BONUS (2 points): We post various articles from well-established online news sources such as NYTimes and The Economist. You can read these articles without having to subscribe to the respective sites. Which pricing practice allows you to do that?

If you don't subscribe, you can't read the whole article at the first time. Then you can search the title of the article and open a new one. These companies allow users doing this because they can gain more users amount. Then they can attract more Ads companies in order to get profit.

price -
disc. both