

Econ 001: Midterm 2 (Dr. Stein) Answer Key  
March 27, 2012

**Instructions:**

- **This is a 60-minute examination.**
- **Write all answers in the blue books provided. Show all work. Use diagrams where appropriate and label all diagrams carefully.**
- **Write your name and your Recitation Instructor's name in every blue book that you use.**
- **This exam is given under the rules of Penn's Honor system.**
- **All blue books, blank or filled, must be handed in at the end of this exam. No blue books may be taken from the room.**
- **No calculators are allowed!**

You need 2 blue books. You are required to use the two blue books as follows:

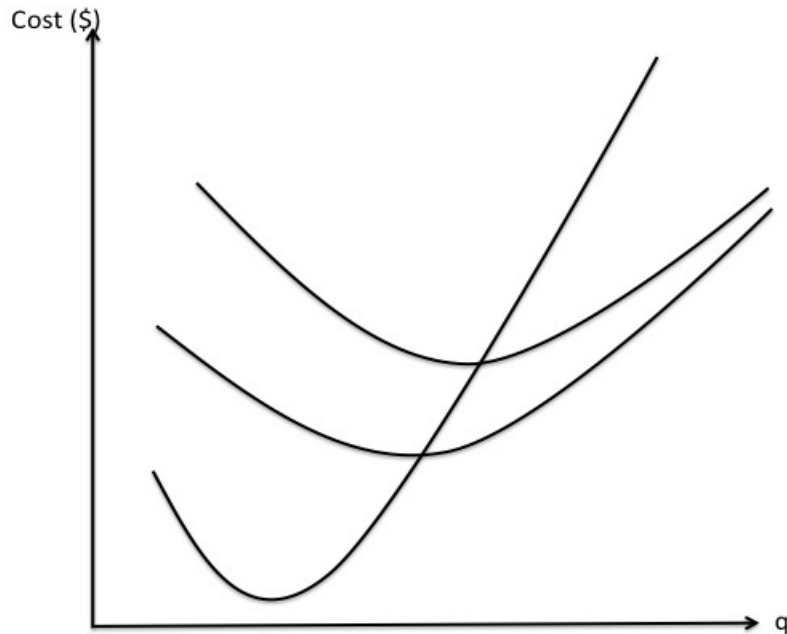
1. **BOOK 1:** write your answers to the **8 multiple-choice questions** on the first page and then write your answers to the **first short-answer question** in the remainder of the book.
2. **BOOK 2:** write your answers to the **second short-answer question**.

**Part I: Multiple Choice Questions (Best 7 out of 8: 5 points each/35 points total):**  
**Please answer all MC questions. Only the best 7 will count towards your grade.**

1. Sheila consumes just two goods: milk and biscuits. Milk is an inferior good. The price of biscuits goes up. Which of the following statements must be true?

- I. Sheila will buy more milk
  - II. Sheila will buy fewer biscuits
- a. Only I is true
  - b. Only II is true
  - c. Both I and II are true
  - d. None of them is true

2. Suppose the market for potatoes is perfectly competitive. Moreover, assume all firms are identical and have the following cost structure. Which of the following statements is correct?



- i. There are gains from specialization in growing potatoes.
  - ii. The law of diminishing marginal productivity holds in this case.
- a. only i
  - b. only ii
  - c. Both i & ii
  - d. Neither
3. Using the information from the previous question. Suppose the market starts in a long run equilibrium. The government introduces a per unit subsidy for potatoes, which of the following statements is TRUE in the long run:
- i. More firms will enter the market.
  - ii. The price of potatoes, to the consumers, will be lower than before.
  - iii. The whole industry will produce more than before.
- a. i & ii
  - b. ii & iii
  - c. i & iii
  - d. i & ii & iii
  - e. none is true.

4. We know that a firm with  $MC=0$  and  $MR=-2Q+10$  is producing at  $Q=5$ . Which of the following must be true?

- I. The firm is profit maximizing.
  - II. The firm is maximizing its revenue.
- a. Only I
  - b. Only II
  - c. Both I & II
  - d. Neither I or II

5. In Neverland, there exists a unique airline which behaves as a single-price monopolist. Peter Pan would like consumers to be better off while Captain Hook wants a more efficient market. Tinker Bell suggests to them: "Why don't you allow price discrimination?" Which of the following is most likely to occur?

- a. Peter Pan agrees but Captain Hook doesn't
- b. They both agree
- c. None of them agrees
- d. Captain Hook agrees but Peter Pan doesn't

6. For profit-maximizing firms, product differentiation in monopolistically competitive markets ensures that, in the short run,

- a. quantity produced is efficient.
- b. price will exceed marginal cost.
- c. profit will be zero.
- d. average fixed cost will be increasing.

7. Which of the following statement is correct?

- i. If a firm is a price taker, then the firm faces a horizontal demand curve.
  - ii. If a firm is a price taker, the market demand curve is perfectly elastic.
- a. i
  - b. ii
  - c. i & ii
  - d. neither

8. Two team members on a crew team, Kate & Pippa, need to decide how much effort to put into a race. Each can choose either effort (E) or shirk (S). The payoff matrix is specified as follows:

		Kate	
		E	S
Pippa	E	Kate: 0 Pippa: 0	Kate: 1 Pippa: 3
	S	Kate: 3 Pippa: 1	Kate: 2 Pippa: 2

Their coach knows that only if they both put in effort will they win and adds a bonus of \$3 each for a win. In this case:

- I. Without the bonus there is no Nash Equilibrium that yields a win.
  - II. With the bonus there is a Nash Equilibrium that yields a win.
- a. I only.
  - b. II only.
  - c. Both I and II
  - d. Neither statement is correct.

### Answers

- 1. c
- 2. c
- 3. d
- 4. c
- 5. d
- 6. b
- 7. a
- 8. c

**Q1. (30 points) Please use bluebook #1 for this question.**

**Note that even if you make arithmetic errors in the calculations on this question, you can earn partial credit for correct set up of the equations.**

In the question below, parts a through d should be solved numerically.

In the notebook industry aggregate demand is given by:

$$Q=7600-200P$$

Where  $Q$  is the quantity of notebooks produced in the industry and  $P$  is the price per unit.

There are a number of identical, perfectly competitive firms active in the industry with the following costs of production:

$$AVC = 10+2q$$

$$FC = 50$$

$$MC = 10+4q$$

Where  $q$  is the number produced by the individual firm.

- a. If the price of one notebook is currently \$18, how many will each firm produce?
- b. How many firms are currently operating in the industry? What is the equation of the short run industry supply curve?
- c. What is the typical firm's economic profit/loss in the short run and in the long run? What will happen to the number of firms in the long run?
- d. What is the long run equilibrium price,  $P$ , and the quantities  $q$ ,  $Q$ . How many active firms,  $N$ , will there be in the long run?
- e. Suppose the market is in a long run equilibrium. Now suppose that Apple laptops, which serve as a substitute for notebooks, have suddenly contracted an incurable computer virus. How would you expect  $P$ ,  $q$ ,  $Q$  and  $N$  to change in the notebook industry in both the short and long run?

Note: You are welcome to use a graph to get the answer, but you do not need to for full credit. It is enough to state what happens to each of the variables in the short run & long run compared to their initial long run values.

**Answer Key:**

**a. Firms produce where  $P=MC$  or  $18=10+4q$ . Solve to get  $q=2$ .**

**Note that at  $q=2$  the firm is losing money, so we should really check to make sure  $P>AVC=14$ , so it is in this case.**

**Points: 2; Set up:1 ; Answer:1;**

**b. Plug  $p=18$  into industry demand to get  $Q=7600-200*18=7600-3600=4000$**

**$N=Q/q=4000/2=2000$**

**$P=MC=10+4q$  or  $q=(P-10)/4$**

**This implies that industry supply curve is  $Q=2000*(p-10)/4=500P-5000$**

**Points: 6; plug P into demand:2 (one for method, one for answer)**

**$N=Q/q$ : 2 (1 for equation, 1 for answer)**

**Short run supply: 2 (1 for method, 1 for answer)**

**c. The firm's profits in the short run:  $Rev-TC=p*q-(FC+AVC*q)=36-(50+28)=-42$**

**In the long run profits are zero.**

**As profits are less than zero, there will be exit from the industry, so the number of firms must fall.**

**Points: 6**

**Profits in LR=zero: 1; Profits here=-42: 3; Entry:2**

**d. In the long run we must have both profit maximization or  $p=MC$  and zero profits which implies  $p=ATC$ . So the firm will be producing at minimum ATC or where  $MC=ATC$ .**

**In this case this is:**

**$10+2q+50/q=10+4q$**

**Solve to get  $q=5$ , which implies  $P=MC=10+4q=10+20=30$**

**At  $P=30$   $Q=7600-200*P=7600-6000=1600$**

**$N=1600/5=320$**

**Points: 8; Set up ( $MC=ATC$ ):2; Q: 1; P: 2 (1 for method, 1 for answer); N: 1**

**Q: 2 (1 for method, 1 for answer)**

**e. The laptop virus will shift the demand for notebooks out increasing both P & Q.**

**In the short run as P would increase, q will increase. N stay the same (by definition).**

**In the long run p must equal min ATC and as the costs have not changed this**

**implies that p returns to the long run equilibrium we found before with q being the**

**same too. At the higher demand this implies Q' is bigger so that the number of firms**

**$n'=Q'/q>n$ .**

**Points: 8; 1 point each.**

**Please note that you were asked to compare both the new SR & the new LR to the original LR !**

**Q2. (35 points) TAs: I have 3 additional pots to assign. Where should we add these?**

**Please show your work using your graphs! Grading depends on the ability of the TA to evaluate whether or not you understand the graphical interpretation of these models.**

We will now return our discussion of Pell Grants and their effect on university tuition. For this exercise, we will model the market for admission to Pennsylvania University as a monopoly with the following equations:

$$\begin{aligned}MC &= 10,000 \\P &= 50,000 - 5Q \\MR &= 50,000 - 10Q\end{aligned}$$

- a) Graph this market, making sure to label all axes and curves. Assuming that Pennsylvania University is a single-price monopolist, calculate and mark the number of students admitted and the tuition price.

After performing a background check on all incoming students, Penn U. is now able to perfectly price discriminate among its incoming students, offering financial aid to those unable to pay the full cost of tuition.

- b) Draw a new graph of MC, D, and MR.
- c) Mark the following 5 items and calculate their values: the stated (highest) tuition; the number of students now admitted; the sum of the financial aid given by the University; the producer surplus; the consumer surplus.

The government, through its Pell Grant program, now provides *each* student who attends Penn U. a subsidy of \$10,000. Assume the University can still perfectly price discriminate.

- d) What does the new demand facing the university look like now? How much will the student with the highest willingness to pay be prepared to pay, if she realizes that the government will pay a subsidy of 10,000? Draw a new graph of MC, D, and MR.

Suppose the university continues to offer financial aid to all incoming students.

- e) Show the effect of the government subsidy graphically. Clearly mark the following 5 items and calculate their value: stated (highest) tuition; the number of students now admitted; the sum of the financial aid given by the University; the producer surplus; the consumer surplus.
- f) Outspoken Congressman Paul Ryan (R-Wisconsin) has claimed that federal Pell Grants do nothing but raise tuition. Using this model, is there validity to his claim?
- g) Using the typical two criteria of evaluation of market outcomes, comment on the effects of Pell Grants in this market.

**Answer Key:**

**a. Typical natural monopoly graph.**

MC should be a horizontal line labeled 10K, Demand (or P) and MR downward sloping with MR inside P.

The firm sets  $MC = MR$  to find  $Q^*$ . So  $Q^* = 4K$  and  $P=30K$ .

$Q^*$  labeled as the quantity where MC and MR intersect.

**Points: 5**

MC constant:1

Demand & MR downward sloping:2

$Q^*$  where  $MR=MC$ :1

P up to demand curve:1

**b. Same graph as before except MR is now the same as the original demand curve.**

**Points: 3**

For understanding that  $MR=Demand$

**c. The number of students now admitted is given by the intersection of MC and the new MR curve (the demand curve). Now happens at  $Q'' = 8K$  students.**

The stated tuition/highest tuition paid = \$50K

Producer Surplus = area between demand and  $MC=0.5*(50K - 10K)*8K = \$160K^2=\$160M$

Consumer Surplus = 0.

Total financial aid given =  $\$160K^2=\$160M$  (since it's a triangle the same size as producer surplus that completes a square from \$50K over to  $Q = 8K$  and above demand).

**Points: 6**

Quantity, highest tuition, CS & financial aid: 1 each

P.S.: 2 (1 if include area under MC)

**d. The demand curve and MR curve shift up by \$10K and are now**

$P = 60K - 5Q$

(MR is given by this equation also assuming the university can still price discriminate)

MC same as before

Highest willingness to pay now \$60K (note that this implies that this student still pays out of pocket 50K as the government pays the rest).

**Points: 5**

Understanding that D shifts up by 10K: 2 points

MR still equals (new) demand: 1

Highest willingness to pay the University is 60K:2



**Note: students who shifted MC down could get full credit if they showed an understanding that the Y axis is now the tuition net of subsidies. In most cases students who shifted MC will get a max of 3 out of 6.**

**e. The stated tuition/highest tuition paid = \$60K**

**The number of students now admitted is given by the intersection of MC and the new MR curve (the new demand curve). Now happens at  $Q''' = 10K$  students.**

**Producer Surplus =  $0.5 * (60K - 10K) * 10K = 250K^2 = \$250M$**

**Consumer Surplus = still 0.**

**Total financial aid given by the University =  $250K^2 = \$250M$ .**

**Aid given by Gov't (not asked for, but worth noting anyway) =  $10K * 10K =$**

**$100K^2 = \$100M$**

**Points: 6**

**1 each for Q, CS, PS, & Ph**

**2 for financial aid**

**f. From the analysis we can see that tuition is raised for each and every student, however this is not the only affect. We also see that enrollment has increased.**

**Points: 4**

**2 for discussion of tuition**

**2 for enrollment.**

**g. the criteria are equity and efficiency. The Pell Grants are inefficient (assuming no externalities to education), however they do allow some students with a lower willingness (or ability) to pay to attend the university which may make society more equal.**

**Points: 6**

**Efficiency & equity: 2**

**NOT Efficient: 3 (1 for not efficient, 1 for there is DWL, 1 for showing DWL or relating to  $MB < MC$ )**

**Discussion of equity: 1**