

Econ Honors: Midterm 2 (Anthony Yuen)
November 14, 2007

Instructions:

- **This is a 60-minute examination.**
- **Show all work. Use diagrams where appropriate and label all diagrams carefully.**
- **This exam is given under the rules of Penn's Honor system.**
- **The use of Programmable Calculators is in violation of Departmental rule. It is strictly forbidden!**

The Midterm has 2 parts.

Part 1 consists of **8** multiple-choice questions.

Part 2 consists of 2 short answer questions.

Write your
MC
answers in
the margin

Part I: Multiple Choice Questions (4 points each/32 points total):

1. Harry spends all of his income on pizza and beer and initially consumes positive quantities of both goods. Subsequently, his income **increases** by 20 percent, price of pizza **increases** by 20 percent and price of beer remains **unchanged**. Comparing the budget lines before and after these changes, we find that his new budget line will:
 - a. Have the same slope as the old budget line.
 - b. Be shifted out on both the pizza & beer axis.
 - c. Be shifted out only on the beer axis
 - d. Both a and b are correct.
2. Using the information from the previous question, which of the following statements is **True**?
 - a. If pizza is a normal good, Harry will always purchase less pizza
 - b. If beer is a normal good, Harry will always purchase more beer.
 - c. If beer is an inferior good, Harry will always purchase more beer.
 - d. If pizza is a normal good, Harry will always purchase more pizza

3. The cost function of a firm is: $TC(q) = 6 + 4q^3 + q$
When the output is 2, which of the following is correct?
- I. Average Total Cost=20,
 - II. Average Variable Cost =17,
 - III. Average Fixed Cost=6
- a. I, II & III
 - b. I & II only
 - c. II & III only
 - d. I & III only
 - e. None of the statements is correct.
4. Rebecca decides to allow Daniel to open and operate a lemonade stand on her front lawn for a flat fee of \$3 that includes the rental of the table as well as an unlimited supply of lemonade and cups. While the lemonade stand is in business, Daniel's total revenues are \$10, and so he pockets \$7. Which of the following is true?
- I. Daniel's economic profits are \$7.
 - II. If Daniel expects the same costs & revenue next week he should open up his stand once more.
- a. Only I is true.
 - b. Only II is true.
 - c. Both I and II are true.
 - d. Neither statement is true.

Honors

5. If a firm's problem is

$$\begin{array}{ll} \max_{\{L,K\}} & PQ - wL - rK \\ \text{subject to} & L^\alpha K^{1-\alpha} = Q, \end{array} \quad 0 \leq \alpha \leq 1$$

then what is its dual problem?

a. A dual problem does not exist

b.
$$\begin{array}{ll} \min_{\{L,K\}} & PQ - wL - rK \\ \text{subject to} & L^\alpha K^{1-\alpha} = Q, \end{array} \quad 0 \leq \alpha \leq 1$$

c.
$$\begin{array}{ll} \min_{\{L,K\}} & L^\alpha K^{1-\alpha} \\ \text{subject to:} & PQ = wL + rK \end{array} \quad 0 \leq \alpha \leq 1$$

d.
$$\begin{array}{ll} \max_{\{L,K\}} & L^\alpha K^{1-\alpha} \\ \text{subject to:} & PQ = wL + rK \end{array} \quad 0 \leq \alpha \leq 1$$

6. Suppose two firms making identical t-shirts compete in quantities: one is managed by Penn graduate (firm P) and another by Princeton (firm d). Since Penn people are better, their firms always get the first-mover advantage because of better information and analysis. If the market demand for t-shirt is $P = 10 - Q$, where $Q = q_P + q_d$, the marginal cost of making t-shirts is a constant c for both firms, then which of the following is true?

- Firm P produces three times as much as firm d.
- Firm P makes three times as much profit as firm d.
- Firm P charges three times as much as firm d.
- The above three answers are all wrong.

Canada and Russia both mine and export diamonds to the U.S. Suppose both countries have the same marginal cost of production, $c = 1$. The U.S. does not have diamond mines. The U.S. demand for diamond is $P = 13 - Q$, where $Q = q_C + q_R$.

7. What is the consumer surplus in the U.S.?
- a. $CS = 16$
 - b. $CS = 32$
 - c. $CS = 64$
 - d. $CS = 128$
8. As was customary, all diamond imports to the U.S. are subject to a per-unit tariff of $t = 1$. But then NAFTA (North America Free Trade Agreement) was enacted, eliminating tariffs on diamonds from Canada. How much improvement in total surplus is there in North America after NAFTA? (ie, difference between having tariffs on imports from both countries and having no tariff on Canadian imports)
- a. No improvement
 - b. \$3.8
 - c. \$5.8
 - d. \$7.8
 - e. None of the above

ANS

1. C
2. B
3. B
4. D
5. C
6. D
7. B
8. B

Answers to 7 and 8:

a	13	13	13
b	1	1	1
cR	1	1	1
cC	1	1	1
tR	1	1	0
tC	0	1	0
qR	3.3	3.7	4.0
qC	4.3	3.7	4.0
P	5.3	5.7	5.0
CS (US)	29.4	26.9	32.0
Tax Rev (US)	3.3	7.3	0.0
Total Surplus (US)	32.7	34.2	32.0
ProfitR	11.1	13.4	16.0
ProfitC	18.8	13.4	16.0
Total Surplus (NA)	51.5	47.7	48.0
Total Surplus (World)	62.6	61.1	64.0

Calculations for 8:

$$CS_{\text{Taxing both}} = (22/3)(22/3)/2$$

$$CS_{\text{No tax for Canada}} = (23/3)(23/3)/2$$

$$T_{\text{Taxing both}} = (22/3)$$

$$T_{\text{No tax for Canada}} = (23/3)$$

$$\pi_{\text{Canada with tax}} = (11/3)^2$$

$$\pi_{\text{No tax for Canada}} = (13/3)^2$$

$$\begin{aligned} \text{Difference in total surplus} &= \text{CS difference} + \text{Tax difference} + \text{Profit difference} \\ &= (23*23 - 22*22)/18 + (10 - 22)/3 + (13*13 - 11*11)/9 \\ &= (23*23 - 22*22 + 6*(10 - 22) + 2*(13*13 - 11*11))/18 \\ &= 3.8333 \end{aligned}$$

Part II: Short Answer Questions:

Q1. (34 points)

George Naylor is an Iowa corn farmer. Corn is a competitive market and is currently in a long-run equilibrium.

- a. Draw a graph depicting George Naylor's marginal, average variable cost & average total costs. Show his profits assuming that the price of corn is currently \$1.45/bushel.
- b. Draw a graph depicting the supply and demand in the corn market as a whole. Make sure this graph is consistent with the one you drew in part a.

An increased demand for ethanol has increased the demand for corn, because ethanol can be made from corn.

- c. Show the effects of the increased demand for ethanol on the market supply and demand graph that you drew in part b. Explain why you shifted the curves that you shifted and clearly mark what happens to the price of corn.
- d. How will these changes affect Mr. Naylor? Show these effects on the graph that you drew in part a. Clearly explain why you shifted any curves that you shifted. What happens to Mr. Naylor's profits? Is this consistent with long run equilibrium? Explain.

Congress is currently debating a farm bill that subsidizes corn production. Senator X claims that these subsidies should be abolished now that the demand for corn is higher. Profits are expected to be larger from this point on.

- e. Using your answer from part d and the model's prediction for the long run price of corn, evaluate Senator X's statement. (Note: we are not looking for an evaluation of subsidies in general, but just a link between the senators claims and the model's predictions).

Q1. (34 points)

George Naylor is an Iowa corn farmer. Corn is a **competitive market** and is currently **in a long-run equilibrium**.

- a. Draw a graph depicting George Naylor's marginal, average variable cost & average total costs. Show his profits assuming that the price of corn is currently \$1.45/bushel.

Answer: typical cost curve graph required here with $p = \min ATC = \$1.45$

Points: 8

Increasing MC: 1

U shaped AVC, minimum intersecting with MC: 2

U shaped ATC, minimum intersecting with MC: 2

Distance between AVC & ATC decreasing: 1

$P = \min ATC = \$1.45$: 1

Profits=zero: 1 point

- b. Draw a graph depicting the supply and demand in the corn market as a whole. Make sure this graph is consistent with the one you drew in part a.

Answer: Upward sloping supply & Downward sloping demand with equilibrium price=\$1.45

Points: 4

S & D graph: 2

$P = \$1.45$: 2

An increased demand for ethanol has increased the demand for corn, because ethanol can be made from corn.

- c. Show the effects of the increased demand for ethanol on the market supply and demand graph that you drew in part b. Explain why you shifted the curves that you shifted and clearly mark what happens to the price of corn.

Answer: Demands shifts out, Equilibrium price increases

Points: 6

Shift out of Demand: 3

Increase in Price: 3

- d. How will these changes affect Mr. Naylor? Show these effects on the graph that you drew in part a. Clearly explain why you shifted any curves that you shifted. What happens to Mr. Naylor's profits? Is this consistent with long run equilibrium? Explain.

Answer: Price increases. q increases. Profits > zero. Not consistent with long run equilibrium. We should expect entry as profits > zero.

Points: 8

Price increase: 2

New q where $P=MC$: 2

Profits market correctly: 2

Not long run, expect entry:2 (1 point if no explanation)

Congress is currently debating a farm bill that subsidizes corn production. Senator X claims that these subsidies should be abolished now that the demand for corn is higher since profits are expected to be larger from this point on.

- e. Using your answer from part d and the model's prediction for the long run price of corn, evaluate Senator X's statement. (Note: we are not looking for an evaluation of subsidies in general, but for a link between the senator's claims and the model's predictions).

Answer: Positive profits will draw new farmers into the market and price will drop. In the long run price will return to \$1.45 a bushel and profits will be zero. Hence a shift in demand does not suggest that subsidies should be abolished.

Points: 8

Entry will lower price: 2

Price in long run back to \$1.45: 2

Profits back to zero: 2

Demand shift has no long run effect on profits (or other correct explanation):2

Q2

A food co-op sells a homogeneous good called groceries, Q . The co-op's cost function is described by $C(Q) = 1000 + 3Q$. At a meeting of the co-op board, a young economist proposes the following marketing strategy: Set a fixed yearly membership fee, M , and a price per unit of groceries, p_M that members pay. In addition, set a higher price p_N , at which the co-op will sell groceries to nonmembers (this should be the monopoly price for low valuation customers. Do not consider any other price for nonmembers). The co-op is the only source of groceries in town. The young economist has also estimated the demand function of two typical consumer types: the inverse demand function for a high valuation customer is $P_H = 29 - Q$, while for a low valuation customer it is $P_L = 23 - 2Q$.

- a. Find the optimal membership charge M , as well as the price of groceries, P_M and P_N , for member and non-members that maximize the co-op's profits. [Hint: This question is somewhat different from the homework question. Consider the alternative that a high value customer has.]
- b. The board finds out that about 35% of the co-op's clientele are high valuation customers and 65% are the low valuation types. Is it a good decision for the food co-op to only sell to the high valuation customers? [Hint: Consider the alternative that the co-op has.]

ANS:

- a. **If only the high-type is considered in this question:**

[8 points] If the high-type becomes members, then $P = MC = 3$ and $Q = 29 - 3 = 26$. The consumer surplus is $CS = (29 - 3) \cdot (26) / 2 = 338$.

[8 points] If they remain non-members, then $MR = MC$: $29 - 2Q = 3 \Rightarrow Q = 13$, $P = 16$. The consumer surplus is $CS = (29 - 16) \cdot (13) / 2 = 84.5$

[8 points] Hence, the membership fee cannot be more than $338 - 84.5 = 253.5$

The full solution is the low-types are taken into account:

Here the low valuation types do not pay any membership fee. Since the co-op is the only supplier of groceries in town, we can find the price that non-members pay by solving a simple monopoly problem with the low demand function. After equating marginal cost ($=3$) to the marginal revenue of low valuation types, we find that non-members purchase $Q_N = 5$ at $P_N = 13$. Since the marginal cost of production is constant, the optimal pricing strategy for members involve pricing at marginal cost, $P_M = 3$, and a membership that extracts as much consumer surplus as possible. Members would buy $Q_M = 26$ at this price, and would enjoy a maximum consumer surplus of $CS_M(26) = 338$. This would be the membership charge if these customers had no alternative. But they can always become non-members. In such case, they would only enjoy a consumer surplus of $CS_M(16) = 128$ (computed with the price that non-members pay but over the high demand function). Therefore $M = 338 - 128 = 210$.

- b. [10 points] The co-op makes just 253.5 (or 210 if both types are considered in a.) in profits from each high valuation customer (members) and 50 ($\pi = PQ_L - 3Q_L = 13*5 - 3*5 = 50$) from low valuation customers (non-members). Thus, if 35% of the clientele are high valuation customers, the expected profits of the membership strategy are $0.35*253.5 + 0.65*50 = 121.23$ (or if both types are considered in (a): $0.35*210 + 0.65*50 = 106$). If the co-op decides to sell only to members, it can increase the membership to 338, but then only 35% of potential customers will become members, and thus, the expected profits of this strategy is $0.35*338 = 118.30$. Thus, the latter strategy is not profitable if the low-type does not exist, but profitable if the low-type exists.