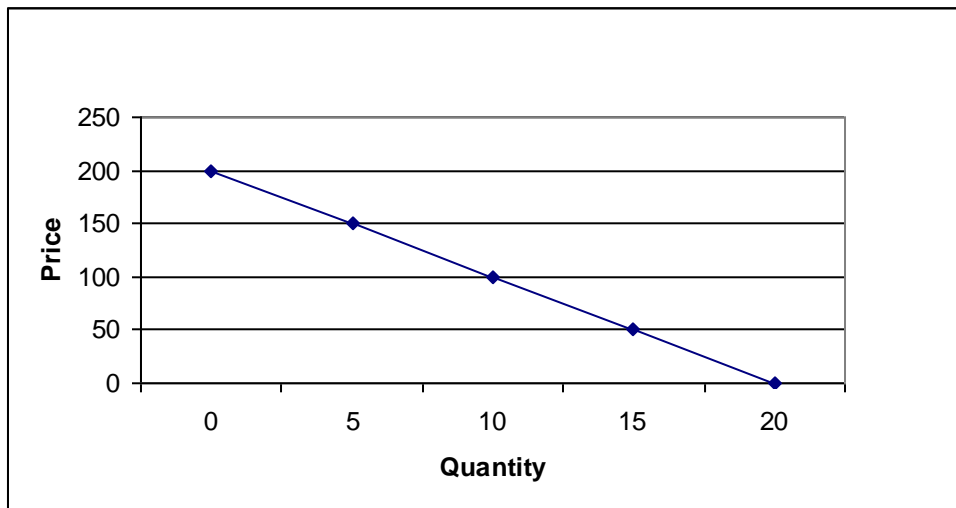


Practicefinalanswerkey  
 PPA 723  
 Professor John McPeak  
 Not due – practice for final

- 1) The demand curve is given to you as  $Q=200-10*p$ .
- a. Fill out the following table. (Use the relatively higher price / relatively lower quantity pair in the elasticity calculation.)

| P  | Q   | Elasticity                 |
|----|-----|----------------------------|
| 0  | 200 | -----                      |
| 5  | 150 | $(-50/5)*(5/150) = -0.333$ |
| 10 | 100 | $(-50/5)*(10/100)=-1.0$    |
| 15 | 50  | $(-50/5)*(15/50)=-3.0$     |
| 20 | 0   | $(-50/5)*(20/0)=-\infty$   |

- b. Draw this demand curve with price on the y axis and quantity on the x axis. Identify on this graph the range over which the demand curve is inelastic, and over which it is elastic. Identify the unit elastic point.



The unit elastic point is at (P,Q) pair (10,100). (P,Q) pairs to the left of this point on the demand curve are elastic (such as 15,50). (P,Q) pairs to the right of this pair on the demand curve are inelastic (such as 5,150).

- 2) Suppose you are setting tolls for the Tappan Zee Bridge.
- a. The current toll is \$3.00. Approximately 135,000 vehicles cross the bridge per day. If the price elasticity of demand for Tappan Zee Bridge crossings is estimated to be -1.25, what percent change in the number of crossings do you predict if the toll rises to \$4.00 (use the current toll and crossing information in your calculation)?

Elasticity is percentage change in quantity divided by percentage change in price. The percentage change in price is 33% and the elasticity is -1.25 which implies that the percentage change in quantity is -41.66%.

- b. What is the predicted number of crossings per day after the toll is raised?

The percentage change in quantity derived in (a) implies that the new quantity is 78,750.

- c. Which toll level offers the higher level of revenue?

At a toll of 3, you are earning 3 times 135,000 = 405,000

At a toll of 4, you are earning 4 times 78,750 = 315,000

You get more revenue at a price of 3.

Say you are given that  $Q = 20 - 2 * p$  is the demand curve.

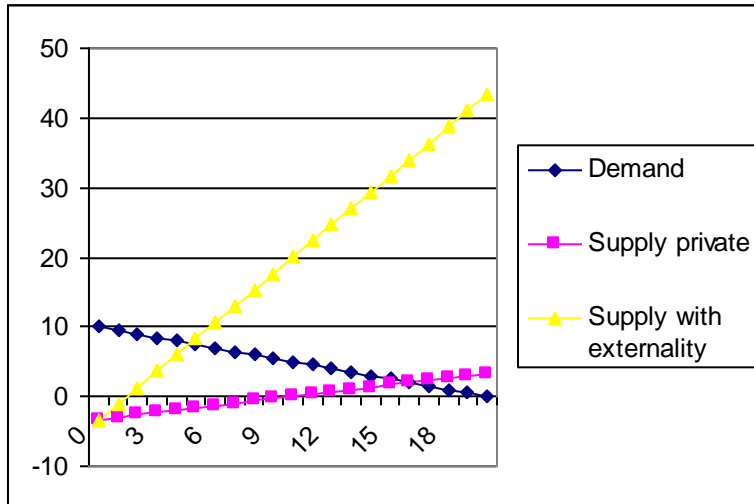
d. What is the inverse demand curve?

$$p = 10 - (1/2) * Q$$

e. If you know that  $Q = 10 + 3 * p$  is the supply curve, what is the equilibrium price-quantity pair?

$$20 - 2p = 10 + 3p \text{ implies that } p = 2, q = 16.$$

f. Illustrate the price quantity pair that is socially optimal if you know that production of the good in question imposes an externality equal to  $2 * Q$ . You don't have to calculate, just draw it.



3) If we put quantity produced by firm A on the y axis and quantity produced by firm B on the x axis, illustrate the relative positions in quantity space of the following market structures:

- Monopoly by firm A
- Cartel collusion between firm A and firm B
- Oligopoly competition
- Firm A and B operate in a competitive market.

Your graph should have quantity produced by a on one axis and quantity produced by b on the other. Monopoly is all A, no B. Cartel collusion is the same total output as the monopoly level, but split between A and B. Oligopoly competition is quantity for each above this cartel line (we are going to make it simple here and assume collusion is either perfect or not – that way we don't have to get into the whole best response curve graph). Finally, perfect

competition is a quantity greater for both A and B than was implied by the oligopoly solution.

4) Deriving demand.

- e. Derive a price-consumption curve from the underlying budget constraint and consumer preferences.

Did in class

- f. Derive an income-consumption curve from the underlying budget constraint and consumer preferences.

Did in class

- g. Contrast these two in order to illustrate the difference between movement along a demand curve and a shift in demand.

Did in class

4) Fill in the following table. What is the technical term associated with the slope of the following curves?

| <b>Curve</b>        | <b>Slope</b>                            |
|---------------------|---|
| Cost                | Marginal cost                           |
| Indifference Curve  | Marginal rate of substitution           |
| Production function | Marginal product                        |
| Isoquant            | Marginal rate of technical substitution |
| Budget constraint   | Marginal rate of transformation         |

5) If I double the size of capital and labor (the only two inputs) in my long-run production function, and my output increases by more than 2 times the output I had before I doubled my inputs,

a. What type of returns to scale does my production function exhibit?

Increasing returns to scale

b. Is this type of returns to scale more common for low, medium, or higher levels of output? Why?

Increasing returns to scale are most common over low levels of output. This is when there are gains to specialization, or tasks that are more efficiently completed by more workers than the current number of workers.

c. Does this imply that I do not have diminishing marginal returns to both capital and labor? Why or why not?

No, different concepts. Returns to scale is a statement about the whole production function. Diminishing marginal returns is a statement about the incremental returns to increasing any one input. You can have increasing returns to scale and diminishing marginal returns at the same time and there is no contradiction.

8) Describe how the process of deriving the market demand for a private good differs from the process for deriving the total demand for a public good, noting how non-rivalry and non-exclusion factor into the difference.

When we have a private good, we have rivalry. Either you get it or I get it. Therefore we sum up horizontally the amount of the good each individual demands at a given price.

With a public good, we do not have rivalry. For a given level of provision, we both benefit from having the good, so we sum up individuals' willingness to pay vertically.

When we have a private good, we have exclusion so we are only adding up over the people who have positive quantities demanded at that price level.

When we have a public good, we have non-exclusion, so we have to add up the willingness to pay for all the individuals who are benefiting from the public good, which in some sense is all the individuals in the relevant population.

9) Assume you are given the following matrix of payoffs for two firms. The numbers are level of production that can be adopted by the firm in question, the left hand side payoff is to the coal burning plant, the right hand side payoff is to the laundry.

|                    |   | Laundry that uses clotheslines |        |       |
|--------------------|---|--------------------------------|--------|-------|
|                    |   | 0                              | 1      | 2     |
| Coal burning plant | 0 | 0, 0                           | 0, 12  | 0, 14 |
|                    | 1 | 10, 0                          | 10, 10 | 10, 8 |
|                    | 2 | 14, 0                          | 14, 2  | 14, 1 |

a) Is one firm imposing an externality on the other? If so which one and how do you know this? If not, how do you know this?

Yes, the coal burning plant is imposing an externality on the laundry, since the payoffs to the laundry are decreasing in the production level of the coal burning plant. The laundry on the other hand is not imposing an externality on the coal burning plant since the payoffs to the coal plant are invariant to the decision made by the laundry.

b) What is the outcome of this game in terms of levels of production and payoffs if each firm plays their best response strategy?

Coal burning plant will always choose 2 as a best response to any choice by the Laundry. Laundry will choose 2 if coal burning plant chooses 0, 1 if coal burning plant chooses 1, and 1 if coal burning plant chooses 2. The outcome with thus be coal burning plant chooses production level 2, Laundry chooses production level 1, coal earns a payoff of 14, Laundry earns a payoff of 2.

c) If the laundry approaches the coal burning plant and offers to pay them 5 dollars if they produce at level 1 rather than level 2, does this improve on the result in (b) in the Pareto sense?

Yes, since the payoff to the coal firm will now be 10+5, and the payoff to the Laundry will be 10-5, or (15,5), which Pareto improves on the (14,2) payoff we found in (b) since both are made better off and neither is made worse off.

d) According to the Coase Theorem, does the efficient outcome vary whether we assign the property right to the use of the air to the laundry or the coal burning plant?

No it does not vary. All that matters is that one or the other gets the property right.



10) Defining elasticities. Provide the formula for calculating the following, and answer all follow up questions.

a) Define a supply elasticity.

$\% \text{ change in quantity supplied} / \% \text{ change in price}$

b) Define an own-price demand elasticity.

$\% \text{ change in quantity demanded} / \% \text{ change in price}$

c) Define a cross price demand elasticity.

$\% \text{ change in quantity demanded} / \% \text{ change in the price of a related good}$

i) Is this positive or negative if the two goods in question are substitutes?

It is positive if they are substitutes.

d) Define an income elasticity of demand.

$\% \text{ change in quantity demanded} / \% \text{ change in income}$

i) Is this positive or negative for a normal good?

It is positive for a normal good.

11) If we know the quantity demanded is defined by  $Q=16-2*p$ , and the quantity supplied is defined by  $Q=4+2*p$ ,

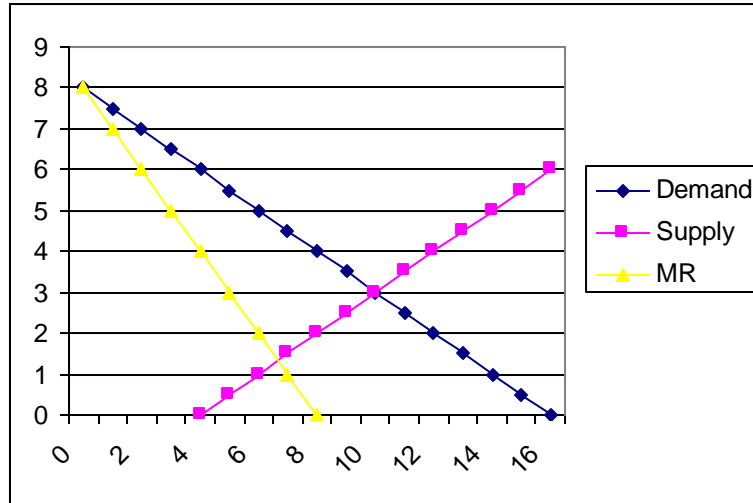
a. What is the equilibrium output if the firm is a monopoly?

$P=8-.5Q$ , so  $MR = 8-Q$ . Supply equals  $.5Q-2$ ,  $q=20/3$  is the equilibrium quantity.

b. What is the equilibrium price?

If  $20/3=16-2*p$ , then  $p=14/3$ ,

c. Illustrate on a graph the deadweight loss of a monopoly market structure compared to a competitive market structure.



The triangle from the  $q=6.66$  meeting the MR curve at  $MR=1.33$  up to the  $q=6.66$  meeting the Demand curve at  $4.66$  and the point  $p=3, q=10$  where supply and demand meet.

- d. If there is a production externality, does your calculation in (c) overstate or understate the size of the deadweight loss?

It will overstate it since there is a negative cost imposed on society that is not reflected in the private cost curve as represented by the supply curve. From a societal point of view, less production is socially optimal in the presence of an externality than the perfectly competitive market produces.

Discounting.

e. Why do we discount?

To reflect the full economic cost of resources allocated to the project. Partially, it reflects the presence of inflation, but also the real rate of return on capital allocated to the project should be reflected here as well.

f. Is there any difference between stating a future expense in real dollars or stating it in net present value? If so, what is the difference? If not, why not?

Yes there is a difference. Real is in inflation adjusted dollars, but we still need to discount this value to arrive at the present value of this figure. The real dollar expression does not account for the fact that by allocating a unit of capital to that project now, we do not allocate the unit of capital to some other project that could return a positive rate of return.

g. Does a higher discount rate place a greater or lesser weight on future expenses?

A higher discount rate places a lower weight on future expenses.

12) Fill in the missing information in the following table.(a)

| Labor Units | Total Product | Marginal Product | Average Product |
|-------------|---------------|------------------|-----------------|
| 0           | 0             | -----            | -----           |
| 1           | 5             | 5                | 5               |
| 2           | 15            | 10               | 7.5             |
| 3           | 21            | 6                | 7               |
| 4           | 25            | 4                | 6.25            |
| 5           | 28            | 3                | 5.6             |
| 6           | 30            | 2                | 5               |

b) Is this likely to be a short run or a long run production function? Why?

Likely to be a short run production function since the only variable input is labor.

c) Is this enough information to identify economic efficiency? Why or why not.

No. For economic efficiency we need to know the cost of the labor input. Here we can only identify technical efficiency.

14) Say there is a community owned plot of land. We are deciding whether to put up a swingset or a duck pond on the plot of land. Assume a discount rate of 10% is applicable in this case and that the project time horizon is three years (construction year, use year 1, use year 2).

- a. If the cost of building the swingset is \$15,000 right now, and the annual upkeep costs next year and the year after are estimated to be \$1,500 per year, what is the present value of costs for the swingset project?

$$15,000 + 1,500/(1.1) + 1,500/ (1.1)(1.1) = 17603$$

- b. If the cost of building the duck pond is \$20,000 right now, and the annual upkeep costs next year and the year after are estimated to be \$500 per year, what is the present value of costs for the duck pond project?

$$20000+500/1.1+500/(1.1)*(1.1)=20868$$

15) Continue the example from the problem above. Three families live in this community, and will share the costs of the project selected equally. They are meeting to vote on the project tomorrow morning. Assume you know that the three households have **present value benefits** represented by the numbers described in the following table.

|           | Household A | Household B | Household C |
|-----------|-------------|-------------|-------------|
| Swing set | 4000        | 8000        | 6000        |
| Duck pond | 11000       | 5000        | 6000        |

- a. What is the net present value for each project? Show how you arrived at this conclusion.  
 Swing set PV benefits = 4000+8000+6000=18000 Swing set PV costs= 17603, so NPV=397.  
 Duck Pond PV benefits = 11000+5000+6000=22000 Duck pond PV costs = 20868, so NPV=1132

- b. Which project will pass in the vote tomorrow? Show how each household will vote for each project, and explain why they will vote this way.

PV costs of swingset per hh = 5868  
 PV cost of duck pond per hh = 6956

|           | Household A   | Household B  | Household C  |
|-----------|---------------|--------------|--------------|
| Swing set | 4000-5868 N   | 8000-5868 Y  | 6000-5868 Y  |
| Duck pond | 11000- 6956 Y | 5000- 6956 N | 6000- 6956 N |

No if PV benefits per at the HH level are less than the PV costs at the hh level.

## EXTRA PRACTICE QUESTIONS

EXTRA1) Draw an indifference curve where the two goods in questions are perfect complements, and then draw one where the two goods in question are perfect substitutes.

Substitutes give you a straight line, complements give you a right angle.

EXTRA 2) Note the letter from the list of the minimum set of information you need to identify the following conditions.

- A. Market Prices
- B. Consumer Preferences
- C. Consumer Income
- D. Production Function
- E. Producer Surplus
- F. Presence or Absence of Externality
- G. Market Structure
- H. Input costs

| <b>Condition</b>            |   |
|-----------------------------|---|
| Indifference Curve          | B   |
| Profit Maximizing Point     | A,D,H,G   |
| Cost Minimizing Point       | D,H (could say A if market price is what you meant by input cost. It is clearer if I make A output price) |
| Technically Efficient Point | D   |
| Optimal Bundle              | B,C,A   |
| Budget Constraint           | A,C   |

EXTRA 3) Complete the following table.

| a) Quantity of Output | Fixed Cost | Total Cost | Average Cost | Marginal Cost | Variable Cost | Average Variable Cost |
|-----------------------|------------|------------|--------------|---------------|---------------|-----------------------|
| 0                     | 5          | 5          | -----        | -----         | -----         |                       |
| 1                     | 5          | 17         | 17           | 12            | 12            | 12                    |
| 2                     | 5          | 26         | 13           | 11            | 21            | 21/2                  |
| 3                     | 5          | 38         | 12.666       | 12            | 33            | 11                    |
| 4                     | 5          | 51         | 51/4         | 13            | 46            | 46/4                  |
| 5                     | 5          | 65         | 13           | 14            | 60            | 12                    |
| 6                     | 5          | 80         | 80/6         | 15            | 75            | 75/6                  |
| 7                     | 5          | 97         | 97/7         | 17            | 92            | 92/7                  |
| 8                     | 5          | 117        | 117/8        | 20            | 112           | 112/8                 |

b. If the market price for the output produced is 12, what level of output is the profit maximizing level of output? Explain your answer.

MR=MC, and MR=p. MC=12 at a quantity of 1, but AC=17 (and AVC=12), so I am operating there at a point where I am indifferent between shutting down and producing.

It is also the case that MR=MC at a quantity of 3. There I am operating at a loss, but better off than not producing anything at all, since I am above AVC.

EXTRA 4) The Children’s Mental Health Network of CNY and The United Way of CNY are both considering launching fund raising drives in January in the Central New York (CNY) region. They are faced with the following options for level of fundraising effort and anticipated payoffs.

|      |        | United Way    |               |               |  |
|------|--------|---------------|---------------|---------------|--|
|      |        | Low           | Medium        | High          |  |
| CMHN | Low    | 5,000 50,000  | 5,000 100,000 | 4,000 120,000 |  |
|      | Medium | 10,000 50,000 | 8,000 80,000  | 6,000 90,000  |  |
|      | High   | 12,000 40,000 | 9,000 60,000  | 7,000 70,000  |  |

a) Describe the full set of best response strategies for each player.

- If CMHN chooses low, UW should choose high.
- If CMHN chooses medium, UW should choose high.
- If CMHN chooses high, UW should choose high.
- If UW chooses low, CMHN should choose high.
- If UW chooses medium, CMHN should choose high.
- If UW chooses high, CMHN should choose high.

b) What is the Nash Equilibrium outcome of this game?

UW chooses high, CMHN chooses high, UW gets 70,000, CMHN gets 7,000.

c) What is “the commons” in this game, and how can we think of the common resource in terms of rivalry and exclusion?

The commons in this game is the pool of donations out there in the population. It is rival in the sense that there is only so much money people are going to give to charity, and if one charity gets it, the other can not. It is non exclusive in that I can’t keep another non-profit from soliciting people in the community.

d) Does being relatively large provide any market leader (in the Stackelberg sense) advantage to the United Way? If so, how? If not, why not?

No, it provides no leader power. No matter what the United Way does, the best response of the CMHN is to choose high. I can’t as the United Way force another decision by moving first and getting them to respond to an accomplished fact. There is no advantage to moving first since there is no difference in response.

- e) Describe some policy options open to a benevolent social planner to address the tragedy of the non profit fundraisers.

The basic tools are: privatize (assign property rights to one side or the other-January is United Way's turn, July is CMHN ), quantity restriction (limit the amount of fundraising effort), or quantity fee (reduce fundraising effort by imposing some kind of per fundraising effort tax).