Final Review Practice Problems

Consumer theory

1. The market for beer is represented by the following demand and supply functions, where Q is barrels of beer and Y is income:

\[ Q_d = 200 - 4P_d + 0.1Y \]
\[ Q_s = -50 + 6P_s \]

a. Is beer a normal or an inferior good? Explain.

*Normal. Increases in income (Y) lead to an increase in Q.*

b. If income is $500, what will be the equilibrium price and quantity?

\[ P = 30, \quad Q = 130 \]

c. A $10 tax per barrel is introduced. What will be the effect on the supply price, the demand price and the traded quantity?

\[ \text{Tax Equation: } P_d = P_s + 10 \]
\[ Q_d = Q_s \]
\[ 200 - 4(P_s + 10) + 50 = -50 + 6P_s \]
\[ 200 - 4P_s - 40 + 50 = -50 + 6P_s \]
\[ Ps = 26, \quad Pd = 36, \quad Q = 106 \]

d. Use a diagram to illustrate the effects of the tax on consumer surplus, producer surplus, and taxpayers. Indicate any deadweight losses.
This question is asking for the basic graph that looks like this:

Before tax:
CS: A+B+E
PS: C+F+D

After Tax:
CS: A
PS: D
Government Revenue: B+C
Deadweight loss: E+F

You should also be able to graph the specific equations for this problem and find the areas of all of those shapes. Remember to convert the demand and supply questions into inverse demand and inverse supply forms to graph (P as the “y” variable.)

2. Jane Austin has a fixed income each month and cannot borrow or save. In May, Jane buys 4 crumpets and 6 cucumber sandwiches. She pays six farthings for each crumpet and 1 farthing for each sandwich.
a. Draw a graph of her budget constraint, labeling the INTERCEPTS and SLOPE carefully. Draw an indifference curve through her optimal choice.

First, figure out income. To do this, see how much she is spending to buy her current bundle:

Price of crumpets \( P_c = 6 \)

Price of sandwiches \( P_s = 1 \)

\[
\text{Income} = P_c \times C + P_s \times S = 6 \times 4 + 1 \times 6 = 30 \text{ farthings}
\]

Then figure out how many crumpets she could buy if she spent all income on crumpets (\( \text{Income}/P_c = 30/6 = 5 \)) or how many sandwiches she could buy if she spent all her income on sandwiches (\( \text{Income}/P_s = 30/1 = 30 \)). These are the intercepts. Then plot her choice of 4 crumpets and 6 sandwiches with an indifference curve.

b. Alastair buys both crumpets and cucumber sandwiches at the same store as Jane. However, he likes crumpets more and buys 7 crumpets but only 1 sandwich. How does the size of his marginal rate of substitution (his marginal value of crumpets in terms of cucumber sandwiches) compare to Jane's?

Because he shops at the same store, he faces the same prices as Jane. Therefore his price ratio is the same, implying that if he is behaving optimally, his marginal value of crumpets in terms of sandwiches will be the same as Jane's.

3. Sandra’s consumption of bread fell last year. Which of the following are potential explanations? (More than one answer may be correct.)

   c. The price of bread rose and Sandra’s demand for bread is elastic.
d. The price of bread rose and Sandra’s demand for bread is inelastic.

e. Sandra’s income fell and bread is a normal good.

f. Sandra’s income fell and bread is an inferior good.

g. The price of cheese rose and cheese and bread are complements for Sandra.

h. The price of cheese rose and cheese and bread are substitutes for Sandra.

The answers are c, d, e, and g. Why both c and d? Because demand elasticities are negative—when the price rises, demand falls. The question is HOW negative—a price elasticity with an absolute value of less than 1 represents inelastic demand. For example, if the price elasticity is \(-1/2\), a one percent increase in the price of bread leads to a half percent decrease in the quantity demanded. On the other hand, a price elasticity with an absolute value greater than 1 represents elastic demand. For example, if the price elasticity is \(-3\), a one percent increase in the price of bread leads to a three percent decrease in the quantity demanded. In either case, demand will fall. See the handouts posted on the website under consumer theory for more details on elasticities.

Producer theory

4. You own a firm in a competitive industry, where all firms are identical. Other firms may enter and exit, and the cost functions for firms in the industry will not change. The government is considering one of two policies:

A: A tax of $500 per firm per year for all firms in the industry.

B: A tax of $1000 per firm per year for all firms except yours

Which policy will you prefer? Consider only the long run effects. Explain your answer.

You will prefer a tax of $1000 per firm for all firms but yours. This will increase the FIXED COSTS for all other firms, raising their AC and therefore the price at which they will earn zero profits (the break even price). This causes some firms to exit, shifting the supply curve up. The price in the industry will therefore rise, raising the price your firm can charge as well. This will cause your firm to produce a higher quantity if your MC slopes upward, and your firm will receive higher profits.

A tax of $500 per firm per year will raise AC for everyone, including you. This would cause some firms to exit, shifting up the industry supply curve and raising the industry price until it is at the new break even, zero profit price. In the long run, surviving firms will again be indifferent between exiting the industry and staying in, again implying zero economic profits.

5. A firm is currently producing 600 units of output using 150 hours of labor and 50 hours of capital. The marginal product of labor is 10 units of output per hour, the
marginal product of capital is 30 units of output per hour. If the wage rate for labor is $5 per hour and the rental rate for capital is $10 per hour then

a. the firm’s use of labor and capital is cost efficient  

b. the firm can produce more output for the same total cost by using more labor and more capital  

c. the firm can produce more output for the same total cost by using more labor and less capital  

d. the firm can produce more output for the same total cost by using less labor and more capital

The key equation here is that efficient, profit maximizing firms choose inputs so that 

\[
\frac{\text{Marginal Product of Labor}}{\text{Marginal Product of Capital}} = \frac{\text{Price of Labor}}{\text{Price of Capital}}
\]

Or alternatively 

\[
\frac{\text{Marginal Product of Labor}}{\text{Price of Labor}} = \frac{\text{Marginal Product of Capital}}{\text{Price of Capital}}
\]

At the firm’s current operations, \( MP_L/P_L = 10/5 \) and \( MP_K/P_K = 30/10 \)  

In other words, capital is three times as productive as labor at the margin, but only twice as expensive. The answer is D—the firm should use less labor and more capital.

6. Dr. Aspen is a doctor who has identical costs to all other doctors in town. Like all other doctors, she has 500 appointments a year, and she charges patients $100 for each. Assume that doctors are free to exit the profession and that a large group of similar doctors could also move to town and enter the profession. Entry or exit would not change the cost functions of any doctor (Constant cost industry). Assume all of the usual assumptions about shapes of cost curves apply.

e. Medical malpractice rates are increasing next year to $10,000 a year for all doctors. How will this affect the price Dr. Aspen charges and the number of patients that she sees in the long run?  

f. Instead of (a), assume that Dr. Aspen just lost a medical malpractice case and must pay $10,000 in damages every year, regardless of whether or not she stays in business. Assume that malpractice insurance rates do not change for her or for any other doctor. How will this affect the price she charges and the number of patients that she sees in the long run?
For E, this is an increase in fixed costs for all doctors. AC will rise. This would cause some doctors to exit, shifting up the industry supply curve and raising the industry price until it is at the new break even, zero profit price. In the long run, surviving firms will again be indifferent between exiting the industry and staying in, again implying zero economic profits. See the graph below:

Equilibrium

7. You turn on the radio and hear about new government policy in the gasoline market. Unfortunately, you were too late to find out what the policy is. You do hear that there are reports of long lines at the pump and of drivers bribing convenience store owners to get gasoline. Your friend tells you that the problems must be that the government has limited the quantity of gasoline that may be sold. Is your friend right? If not, what do you think the new policy might be?

No, this cannot be a quota or quantity limitation, because then the price would rise. It must be a price ceiling, leading to a higher quantity demand than quantity supplied.

8. Which of the following are potential results of a price floor for wages? (More than one answer may be correct.)
   h. Shortages in the labor market, with firms engaging in costly search activities and head-hunting.
   i. Unemployment in the labor market, with potential workers competing engaging in costly search activities.
   j. Firm discrimination on the basis of characteristics like personal connections or appearance.
k. A deadweight loss.
l. A reduction in producer surplus
m. An increase in producer surplus

*Price floors for wages, like minimum wages, can lead to h, i, j, k AND l.* “Producer surplus”—which here means the surplus workers get—could increase due to the higher wages or it could decrease due to the lower number of workers hired and more costly activities requires to find a job. It depends on the elasticities which effect will dominate.

9. Suppose demand for apples is represented by

\[ Q_D = 40 - 2P \]

Supply of apples is represented by

\[ Q_S = 2P + 20 \]

What is the equilibrium price and quantity?

\[ P = 5, \; Q = 30 \]

Suppose the government imposes a $1 tax on apple suppliers. What is the new price to consumers, price to suppliers, and quantity traded? How large is the deadweight loss imposed by this tax?

\[ P_d = \$5.5, \; P_s = \$4.5, \; Q = 29. \; \text{DWL} = \frac{1}{2} (1)(1) = \frac{1}{2} \]  
[draw the diagram and find the area of the DWL triangle]

**Market failures: monopolies**

10. The XYZ firm is the only producer of TVs in the country of Slovonia. It faces the following demand and cost schedules:

<table>
<thead>
<tr>
<th>Q</th>
<th>P</th>
<th>Total Costs</th>
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<tbody>
<tr>
<td>0</td>
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<td>0</td>
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<tr>
<td>1</td>
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<td>20</td>
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<td>3</td>
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<tr>
<td>4</td>
<td>40</td>
<td>100</td>
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<tr>
<td>5</td>
<td>20</td>
<td>150</td>
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</tbody>
</table>

a. How many TVs should XYZ produce and at what price? Explain.

*You need to set MR = MC. This means calculating total revenue, MR, and MC.*
<table>
<thead>
<tr>
<th>Q</th>
<th>P</th>
<th>TR</th>
<th>MR</th>
<th>Total Costs</th>
<th>MC</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
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<td>2</td>
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<td>160</td>
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<td>3</td>
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<td>100</td>
<td>50</td>
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<td>5</td>
<td>20</td>
<td>100</td>
<td>-60</td>
<td>150</td>
<td>50</td>
</tr>
</tbody>
</table>

At \( Q = 3 \), \( MR = MC = 20 \). The price charged will be 60.

b. The Slovonian government opens the TV market up to competition from other firms in other countries. XYZ is now a **price taker**, and faces a world price of $40. What quantity should XYZ produce now?

A **price taker** sets \( P = MC \). So at a price of $40, the firm will produce UP TO where \( MC = 40 \) and not past that point. Here, that again is where \( Q = 3 \), but now as a price taker, the firm can only charge \( P = 40 \). (The fact that the quantity happened to be the same in part a and b of this problem is a coincidence—the firm will not always necessarily produce the same amount.)

11. Explain the flaws in the following statement: “A monopolist will generally choose to produce the quantity of output where average costs are the lowest. This way the firm gets the highest markup possible: the difference between the price and the average cost is the largest. This will maximize the profits for the firm.”

**Monopolists produce where \( MR = MC \). This might be a point associated with a higher average cost than at the minimum, but the firm cares about not profits, not just profit per unit. They may do better taking a lower profit per unit and selling more units. The best they can do is where \( MR = MC \).**

**Market failures: Externalities**

12. Is the following statement true or false? **Explain.** Monopoly price creates a deadweight loss. If a monopoly produces a good with negative externalities, the combination will be one problem added to another: the generic deadweight loss of monopoly pricing will be added to the generic deadweight loss of negative externalities.

13. What is wrong with this statement? “The government is talking about taxing the consumption of goods that produce negative externalities like pollution and then cutting other taxes. This way the government will not change the total amount of tax
Questions 12 and 13 are both related. Draw a graph where there are negative externalities and find the deadweight loss. Why is there a deadweight loss? Because the private quantity is TOO MUCH—the market will not take into account the external costs and so at the quantity produced, the marginal costs to society exceed the marginal benefits.

Why is there normally a deadweight loss when there is a monopolist or a tax? (Draw those graphs!) Because the quantities produced are usually TOO LITTLE. In this case, having a monopolist produce the good with externalities will help to counterbalance the overproduction. 12 is FALSE—the two forces opposed each other, rather than creating a larger deadweight loss—the monopolist produces less than the competitive market—and that’s good, because the competitive market was producing too much. Ditto on the tax—see the graphs in class with a tax on a negative externality to see how a tax can eliminate the deadweight loss—that is a real gain to the economy. At the same time, in Q13, taxes are reduced in markets where they were leading to deadweight losses. Some people refer to the proposal in Q13 as the double dividend hypothesis—deadweight losses are eliminated in the formerly taxed market and in the externalities market by shifting the tax from one market to the other.

14. In Apria, a widget factory is located upriver from a fish hatchery. Production of widgets results in waste that is dumped in the river. In the absence of any pollution controls, each widget produced would result in $50 in damages to the fish hatchery. The factory currently produces 1000 widgets. In Apria, the factory has the legal right to dump pollutants into the river.

In Babria, there is an identical widget and hatchery. However, in Babria, the hatchery has a legal right to compensation for polluted water.

Pollution scrubbing equipment can eliminate all pollution. The cost of that equipment is $20,000 in either country.

What outcome is the most likely?
   a. The level of pollution will be higher in Babria than in Apria.
   b. The level of pollution will be the same in Babria than in Apria.
   c. The level of pollution will be higher in Apria than in Babria.
   d. More information is needed to compare the pollution levels in the two countries.
C. If the Coase Theorem applies, in Apria the potential damages are $50,000. The pollution equipment only costs $20,000. As a result, the hatchery would be willing to pay for the installation of the scrubbing equipment at the factory, resulting in zero pollution. In Babria, the potential damages of $50,000 are the same. It is cheaper for the factory to install the scrubbing equipment than to compensate the hatchery for the damages. So in both countries, the equipment is installed and there is no pollution. The only difference is who pays for the installation.

A FEW EXTRAS

In an attempt to induce citizens to conserve energy, the government enacted regulations requiring all air conditioners to be more efficient in their use of electricity. After this regulation was implemented, government officials were the surprised to discover that people used even more electricity than before. Using the concept of price elasticity, explain how this could happen.

This is just like the question on Hmk #1 about gas mileage changes. What is the good here? Cold air. Think about demand for cold air. With an efficient air conditioner, the “price” of another degree cooler air has just gone down. As a result, individuals are likely to increase their demand for cold air and lower those thermostats. The question is whether they will lower them a lot or a little. If demand for cold air is elastic, when it is cheaper to cool the air, individuals will lower the thermostat a lot and may end up using even more electricity than before.

The question about low calorie food is the same—and in fact, food scientists were puzzled when the introduction of low calorie food led people to gain weight. The problem is that if this cookie is now 50 calories instead of 100, I amy eat more than before!

Residents of your city are charged a fixed weekly fee of $6 for garbage collection. They are allowed to put out as many cans as they wish. The average household puts out three cans under this plan. Now the city changes to a “tag” system. Each garbage can must have a tag attached. The tags cost $2 and are not reusable. What effect will this system have on the total quantity of garbage collected in the city?

Marginal reasoning is the key here! Here is an example to make this concrete—I do not require an answer this detailed on the exam, but hopefully it will help you get the idea and then you can work on how you would answer it.

Think about 3 cans of garbage—the first is full of trash that is hard to dispose—I’d have to take it personally to the dump. It is worth $10 to me to have the city pick it up. The second is full of kitchen waste that I could compost, but it’s kind of a pain walking out to my compost pile. It is worth $3 to me to have the city pick it up. The third can is full of pine needles. I don’t actually care too much about getting rid of these as I could leave them under the trees. It is worth $1 to me to have the city pick it up. You can make up your own examples with
recyclables, stuff I could take to the thrift store, etc. The point to marginal reasoning is that we have to use it when the benefits or costs of something CHANGE depending on the quantity.

Suppose I’m in the first system. You should be able to see that it’s definitely worth $6 a week for me to have the city pick up my garbage. How many cans will I put out? What if I switch to the $2 a can system? Now how many will I put out?

Now write your answer for the exam question!

On exam question 1, you spent 10 minutes and earned 48 points. In the last few seconds that you devoted to it, you earned 4 of the points. You also spend 10 minutes on question 2, and earned 15 points. In the last few seconds you devoted to questions 2, you earned 10 of the points. Did you allocate your time correctly?

Marginal reasoning yet again! You want the last few second to give you the same number of points on each question. It doesn’t matter what the total number of points, average number of points, etc are. The two numbers that matter are that on question 1, the last few seconds earned you 4 points and on question 2, the last few second earned you 10 points. Your time was better spent on question 2—you should reallocate until the last few seconds on all problems give you the same number of points.

What is the take home lesson here? Given that you get partial credit on your final, don’t spend half an hour on one problem, staring into space for the last 10 minutes, and skip another one!

Good luck!