Economics 101
Spring 2018
Homework #4
Due Thursday, April 5

**Directions:**

- The home will be collected in a box **before** the lecture.
- Please place **your name, TA name, and section number** on top of the homework (legibly). Make sure you write your name as it appears on your ID so that you can receive the correct grade.
- Please **staple** your homework: we expect you to take care of this prior to coming to the large lecture. You do not need to turn in the homework questions, but your homework should be neat, orderly, and easy for the TAs to see the answers to each question.
- Late homework will **not** be accepted so make plans ahead of time.
- **Show your work**. Good luck!

**Please realize that you are essentially creating "your brand" when you submit this homework. Do you want your homework to convey that you are competent, careful, and professional? Or, do you want to convey the image that you are careless, sloppy, and less than professional? For the rest of your life you will be creating your brand: please think about what you are saying about yourself when you submit any work for someone else.**

Part I – Elasticity

1. Consider the following market demand and market supply curves for Kimchi in Madison, where P is the price per unit of kimchi and Q is the quantity of kimchi.

Demand: $Q = 150 - 3P$
Supply: $Q = 2P$

a) Given the above information find the equilibrium price and quantity in this market.

b) Calculate the point elasticity of demand at this equilibrium. Is demand elastic or inelastic at this point? Explain your answer. Given this answer, is the total revenue of producers being maximized at this equilibrium? If not, will producers enhance their total revenue by increasing or by decreasing the price they charge for kimchi? Explain the reasoning behind your answer.

c) Calculate the point elasticity of supply at this equilibrium. We know on kimchi's demand curve, the price elasticity of demand will decrease as the price of kimchi decreases (or quantity increases). Will this property hold for the price elasticity of supply for kimchi? (*Hint:* use the point elasticity formula to verify your answer.)

d) Suppose the government decides to impose an excise tax of $10 per unit on kimchi. Calculate the Consumer Tax Incidence (CTI) and Producer Tax Incidence (PTI) of this excise tax. Compare the ratio of the tax incidence (CTI/ PTI) with the ratio of elasticity (price elasticity of

demand/ price elasticity of supply) at the initial equilibrium. Does our conclusion about the relationship between elasticity and tax incidence (in homework #3, problem 1, part (d)) still hold here?

Part II – Consumer Theory

2) Ally's income is $100. She consumes cheese curds and apples. Suppose the price of cheese curds is $1 and price of one apple is $2.

a. Draw Ally's budget line on the graph. Put cheese curds on y-axis and apples on x-axis. What is the equation of the budget line in slope-intercept form? Let A stand for apples and C for cheese curds.

b. Ally decides she wants to have 25 servings of cheese curds and 40 apples every month. Is this bundle affordable for her? Does it exhaust her income? What if her choice is 15 servings of cheese curds and 40 apples?

c. Ally works as an Economics 101 TA. The department decides to decrease TAs' wages. Ally's new income decreased to $50, while the prices for the two goods stay at their initial level. What is the equation of this new budget line (BL1)? How does it compare to the budget line from part (a), (BL2)?

d. Think of a different scenario. Let the income level be at $100, but due to the financial crisis the prices for both goods doubled from their initial levels. What happened to Ally's budget line? How does it compare to the budget lines, BL1 and BL2, from parts (a) and (c)?

e. Suppose now it is known that the prices of apples and cheese curds have changed so that Ally now consumes 60 servings of cheese curds and 30 apples with her income. The new price of one unit of cheese curds is $1 and the price of one apple is $3. What is Ally's new budget line? Draw a graph where you represent this new budget line, BL3, along with budget lines BL1 and BL2. Label your graph carefully and completely!

f. Let Ally's utility function be $U = AC$, and thus her marginal utilities are given by $MU_C = A$ and $MU_A = C$. Assume that the price of one serving of cheese curds at $1, price of one apple $2 and income at $100. Given this information and holding everything else constant, what is the consumption bundle, (A, C) that maximizes her utility?

3) Assume a graduate student consumes only two food items: coffee(X) and chocolates(Y). He spends his monthly stipend of $300 on these two food items. One bar of chocolate costs him $2 and one cup of coffee costs him $2. The utility function for this graduate student is given by the equation:

$$U = XY^2$$

This graduate student's marginal utility from consuming coffee (X) and his marginal utility from consuming chocolates (Y) are given by the following equations:

$$MU_X = Y^2$$

$$MU_Y = 2XY$$

(a) Given the above information and holding everything else constant, graph the budget line (BL1) with chocolates measured on the y-axis and coffee measured on the x-axis. Under the current price levels, how many bars of chocolates and how many cups of coffee does the graduate student consume when this student maximizes their utility? What is the total utility at this optimal bundle?

(b) Due to an environmental tax imposed on the usage of paper cups, the price of coffee has increased to $8 per cup. How does the budget line, BL2, change? Given this change and holding everything else constant, what is the optimal consumption bundle now? Show all your work for how you found this answer! **Assume in this problem that it is possible to consume partial cups of coffee.**

(c) Find the income and substitution effects on the amount of coffee consumed due to this environmental tax. Show your work and provide your reasoning in finding this answer. (You will need a calculator for some of the computations.)

(d) The economics department agrees that the reduction in the level of coffee consumption due to this environmental tax reduces the productivity of graduate students. The department approves a cash grant for this graduate student such that his utility is restored to the pre-environmental tax level of utility. What is the amount of the cash grant this student receives? What is the optimal consumption bundle for this student after receiving the cash grant? Show your work and your reasoning for this set of answers.

(e) Some of the faculty disagree with this plan described in (d). They instead propose a cash grant for this graduate student so that he can consume the exact bundle that he used to consume before the environmental tax. What is the amount of this cash grant? Would he stick to the original consumption bundle after receiving this cash grant? What is the new optimal consumption bundle given this new cash grant? Show how your found your answers and provide a cogent explanation behind your work.

Part III – Producer Theory

4) You have just graduated, and your first job is as a manager at Widget Co., a company that makes widgets. Your engineer gives you the following table of costs, but, for some reason, he has forgotten to fill in most of it. The per unit cost of labor (the wage) is $10, and the per unit cost of capital is $50.

| **Q** | **K** | **L** | **MPL** | **APL** | **FC** | **VC** | **TC** | **AFC** | **AVC** | **ATC** | **MC** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 10 | 0 | - | - | | | | - | - | - | - |
| | 10 | 1 | | | | | | | | | $1 |
| | 10 | | | 12.5 | | | | $20 | | | |
| 35 | 10 | 3 | | | | | | | | | |
| | 10 | | | | | $40 | | | | $13.50 | |
| | 10 | | | | | | $550 | | | | $10 |

a) Using your knowledge of producer theory, fill in the missing information from the table. (You may need a calculator for some of the entries.) Remember that:

MPL is the [(change in total product)/(change in total labor)]
APL is the [(total product)/(total labor)]
AFC = FC/Q
AVC = VC/Q
ATC = TC/Q
MC = [(change in total cost)/(change in output)]

5) Suppose the market for cheese curds is perfectly competitive. The demand curve for cheese curds is given by

$$Q = 600 - 50P$$

Suppliers of cheese curds are all identical and have the following cost structure:

Marginal cost for the representative firm: $MC = 2q$
Total cost for the representative firm: $TC = q^2 + 9$

a) Find the equations for the fixed costs, variable costs, average variable costs, and average total costs for a representative firm. Plot marginal costs, average variable costs, and average total costs for a representative firm on the same graph.