Economics 101
Fall 2018
Homework #4[1]
Due Tuesday, November 20, 2018

Directions:

- The homework will be collected in a box labeled with your TA's name **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.
- **Please show your work.** Good luck!

Part I: Consumer Theory (Budget lines, Indifference Curves, Demand Curve, Income and Substitution Effects)

1. Jim is a Cubs fan with a fixed income of $100. Jim only purchases two goods: bags of peanuts (P) and Cubs baseball hats (H). Initially each bag of peanuts costs $5 and each baseball hat costs $20.

a) Find the equation for Jim's budget line and then graph this budget line (BL1) in a well-labeled graph. Measure hats on the vertical axis and bags of peanuts on the horizontal axis.

b) Can Jim afford the bundle (P, H) = (10,2)? Can Jim afford the bundle (P, H) = (6,4)? Provide a proof and complete explanation for your answer to these two questions.

c) Suppose you are told that given the above information, Jim maximizes his utility when he consumes 4 bags of peanuts and 4 baseball hats. Given this information draw a graph that illustrates Jim's budget line, his indifference curve (IC1), and his consumer utility maximizing point (Point A). Make sure your graph is completely and clearly labeled.

d) Now suppose that the price of peanuts increases from $5 per bag to $10 per bag. Furthermore you are told that with this price change Jim maximizes his utility when he consumes bundle B consisting of 2 bags of peanuts and 4 baseball hats. Graph Jim's new budget constraint (BL2) and new indifference curve (IC2). Label his new utility maximizing point B in your graph. Once you have drawn all this in your graph construct BL3, the imaginary budget line. BL3 should be parallel to BL2 and just tangent to IC1. Once you have BL3 drawn in your graph, label point C where BL3 is just tangent to IC1. Then complete the graph by indicating the income effect and substitution effect with regard to bags of peanuts on the graph.

[1] This homework is partially adapted from Econ 101, 2018 Spring semester.

e) Given the information you have been given thus far in this question, derive Jim's demand curve for peanuts, assuming that his demand curve is a straight line. For the demand equation use P as the symbol for the price per bag of peanuts and Q as the quantity of peanuts.

f) Let's return to the original situation where Jim has $100 to spend on peanuts and hats and where the price of a bag of peanuts is $5 and the price of a hat is $20. Now suppose peanuts and baseball hats are perfect substitutes for Jim: Jim's utility function is such that buying 2 bags of peanuts gives him the same satisfaction as buying one baseball hat. Given this information what bundle of (peanuts, hats) will Jim consume to maximize his satisfaction given his income? Explain your answer.

g) Let's return to the original situation where Jim has $100 to spend on peanuts and hats and where the price of a bag of peanuts is $5 and the price of a hat is $20. Now suppose that peanuts and baseball hats are perfect complements for Jim. That is, he always buys exactly 1 baseball hat with each bag of peanuts. Given this information and holding everything else constant, what bundle will he consume? Would Jim consume 10 bags of peanuts and 12 baseball hats at any income level in this scenario? (use initial prices)

2. Pam, a cat, only consumes two goods: fish (F) and candy (C). Through careful negotiations with Michael (her owner), Michael agrees to spend $72 per week to buy Pam these two goods and Pam can choose whatever bundle she prefers provided Michael can afford that bundle given the money he has to spend on the two goods. One can of fish cost $9 and one pack of candy costs $6. The table below shows some of Pam's marginal utilities relating to her consumption of these two goods:

$\mathbf{Q_F}$	1	2	3	4	5	6	7	8	9
$\mathbf{MU_F}$	72	36	24	18	14.4	12	10.28	9	8
$\mathbf{Q_C}$	1	2	3	4	5	6	7	8	9
$\mathbf{MU_C}$	72	36	24	18	14.4	12	10.28	9	8

a) Given the above information and holding everything else constant, find the equation for Pam's budget line and then graph this budget line as BL1 in a graph where candy (C) is measured on the vertical axis and fish (F) is measured on the horizontal axis.

b) What is Pam's utility maximizing bundle at this budget constraint? What is her total utility from consuming this bundle? In your graph illustrate this optimal bundle and label it point A. Draw an indifference curve that goes through bundle A and is tangent to BL1: label this indifference curve IC1.

c) Suppose the price of a can of fish decreases to $4 per can. Given this information and holding everything else constant, find the equation of Pam's new budget line (BL2) and graph it in the same diagram as in part (a). Label this new budget line BL2.

d) What is her utility maximizing bundle with the new budget line? Remember you have that initial table to consult to help you figure this out! What is the change in her consumption of good F when Pam moves from point A to point B?

e) Observe the table carefully. What other consumption bundle from this table gives Pam the same utility level as she got at point A (the amount you calculated in (b))? Once you have found this point label it point C on your graph and draw an indifference curve that contains both point A as well as point C. Label this indifference curve IC1 in your graph.

f) How much additional money would Pam need from Michael to afford this bundle C? Why will Pam need less money to afford this bundle than she needed to afford bundle A?

g) Verify that the consumption bundle you found in (e) is the utility maximizing bundle for the level of income you determined in (f). This new level of income is based upon the new price of fish.

h) What is the equation for Pam's imaginary budget line, BL3? Graph it in the same diagram and label it BL3.

i) Identify graphically and numerically how much of the change in Pam's consumption of fish is due to the income effect and how much of the change is due to the substitution effect. Explain your answer fully and make sure your graph identifies clearly both the substitution and the income effect.

3. A poor graduate student survives on two types of food items, pizza (P) and mushroom soup (S). He spends all of his monthly income of $80 on food. One slice of pizza and one cup of soup both cost $1. You are also provided the following information about the graduate student's utility function:

$$U = P*S$$
$$MU_P = S$$
$$MU_S = P$$

a. Graph the budget line (BL1), with pizza on the x-axis and soup on the y-axis. Under current price levels, how many slices of pizza and how many cups of soup does the student consume? Show how you found this optimal bundle and then label this optimal bundle as Bundle A in your graph. What is his total utility at this optimal bundle?

b. To encourage healthy living, the mayor imposes an excise tax of $3 on each slice of pizza. How does this tax affect the graduate student's budget line? Provide an equation for this new budget line, BL2. What is his optimal consumption bundle, Bundle B, now? Show how you found this optimal consumption bundle. When this student maximizes his utility now, how much utility will he have? Show how you found this answer. How much tax revenue is collected from this student? Illustrate in your graph BL2 and Bundle B. Make sure your graph identifies all intercepts as well as the coordinates of any known points. Also in your graphs include the indifference curves that represent the level of utility this student has at Bundle A and at Bundle B. Label these indifference curves IC1 and IC2, respectively.

c. Find the income and substitution effects on pizza consumed due to the pizza tax. This will take some work: remember that you need to find that consumption bundle, Bundle C, that has the same level of utility as Bundle A but which is based upon the new price of a slice of pizza. Show the work you did to find this optimal consumption Bundle C and then draw the imaginary budget line, BL3, and Bundle C in a graph that includes BL1, BL2, IC1, IC2, Bundle A and Bundle B. In this new graph indicate the change in consumption of pizza due to the substitution effect and the change in consumption of pizza due to the income effect.

d. Suppose the excise tax described in this question has been implemented, but at the same time the University provides the graduate student with a cash grant so that the student can attained his original (pre-tax utility level) level of utility. The University does this because they recognize that the excise tax on pizza causes the real income or purchasing power of the graduate student's nominal income to fall. Given this information and holding everything else constant, what is the amount of this cash grant?

Part II: Producer Theory (Production and costs)

4. J.J.'s Diner makes Leslie Knope's favorite waffles using capital (K) and labor (L). The table summarizes the production and cost functions for J.J.'s Diner, where Q, K and L respectively represent the quantity of waffles, capital and labor. Costs are measured in dollars. This firm also happens to be a producer in a perfectly competitive waffle market.

K	L	Q	FC	VC	TC	AFC	AVC	ATC	MC	MPL
2		0			10					
2		1			18					0.25 units of output/unit of labor
2	5	2								
2	6	3								
2		4							4	
2		5			32					
2		6			38					
2	20	7								

a. Given the above information and holding everything else constant, how much does one unit of capital cost to J.J.'s Diner? Explain how you found your answer to this question.

b. If J.J.'s produces 10 waffles, what are the average fixed costs for the firm? Show how you calculated this average fixed cost.

c. What is the price of a unit of labor? Explain how you found your answer to this question.

d. Fill in the blank cells in the above table. Round each answer as required to two places past the decimal.

e. What is the minimum price for a waffle at which J.J.'s is willing to stay in the market in the short run? Explain your answer.

f. What is the minimum price for a waffle at which J.J.'s is willing to stay in the market in the long run? How many waffles will J.J.'s produce at this price? Explain your answer.

g. At what quantity is the average total cost minimized?

Part III: Perfect competition

5. Ann runs a shoe factory in a perfectly competitive industry. You are told the following information about her shoe factory and the market where q is the level of output produced by Ann's factory, Q is the total amount produced in the industry, and P is the price per unit:
   Total cost function for Ann's factory: $TC = 2q + (1/50)q^2 + 50$
   Marginal Cost for Ann's factory: $MC = 2 + (1/25)q$
   Market Demand Curve in the industry: $Q = 5020 – 5P$

a. Given the above information, find the equations for FC, VC, ATC, and AVC.

b. How many pairs of shoes will Ann's factory produce when the market price is equal to $5? How many will it produce when price is equal to $10? Show how you found your answers to these questions.

c. What is the factory's breakeven point in the long run? What is the price at that quantity?

d. Calculate the value of profits for Ann's factory in the long run.

e. Given the above information and holding everything else constant, how many shoe factories will there be in this market in the long run? When answering this question assume all factories are identical with the same cost functions as Ann's.

f. Derive the market supply curve.

Suppose Ann adopts a new technology to produce shoes, which causes her marginal cost to decrease by $1 per pair of shoes, and her fixed cost to increase by $5.

g. Given this information and holding everything else constant, what is the TC equation for Ann now? What is her MC equation now?

PartIV: Elasticity

6. The market demand curve and the market supply curve for Masks-Я-Us, a company that makes masquerade ball masks in Verona, can be described by the following equations where P is the price per unit and Q is the quantity of masks:

   Market Demand Curve: $P = 10 - (1/5)Q$
   Market Supply Curve: $P = 2 + (1/5)Q$

a. Using the mid-point method, calculate the price elasticity of demand when price changes from $8 to $6.

b. Using the point method, calculate the price elasticity of demand when the price is equal to $8. Then, using the point method, calculate the price elasticity of demand when the price is equal to $6.

c. Should Masks-Я-Us lower or raise its price to gain more revenue if its current price is $6 per unit? Explain your answer.

d. Find the market equilibrium in this market. Calculate the point elasticity of demand and the point elasticity of supply at this market equilibrium.