

# Econ 11 Midterm

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Name: \_\_\_\_\_

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TA: \_\_\_\_\_

## Exam Rules

1. The exam starts at 3:30 and ends at 4:45.
2. There are 5 short answer questions worth 10 points each and 2 long questions worth 50 points each (total 150 points)
3. Calculators are allowed, but not required.
4. You may use one double-sided 8.5x11 sheet of paper with notes as a cheat sheet.
5. Please put all materials other than your calculator, cheat sheet, and a pen or pencil in your bag. If you have a phone or other item out for any reason you will be given a 0 on the exam.
6. You must SHOW ALL WORK. No credit will be given for an answer with no work. You may leave an answer unsimplified, but be clear about the steps you took to get there so the graders can easily see if it's correct

## Short Questions (10 Points Each)

1. A consumer's preferences can be represented by the utility function  $U(x, y) = x^6 y^2$ . Which of the following utility functions represent the same preference? For each that does, explain how you know. For each that does not, provide an example showing that the utility function represents a different preference.

(a)  $U(x, y) = 3 \ln(x) + \ln(y)$

(b)  $U(x, y) = x^6 + y^2$

(c)  $U(x, y) = 5x^{3/4}y^{1/4}$

2. A consumer has a utility function over cups of Tea (T) and cups of Coffee (C) given by  $U(T, C) = 4T + 3C$ . Would the consumer be willing to give up 3 cups of tea in order to receive 5 cups of coffee? Explain why by referring to their marginal rate of substitution and a graph of an indifference curve.

3. A consumer has a utility function given by  $U(x, y) = 3x^2 + 5y^2$ . The price of  $x$  is 2 and the price of  $y$  is 4. If the consumer has an income of 68, how much  $x$  and  $y$  will they choose to consume to maximize their utility?

4. A consumer gets utility from bicycles, but they can only buy frames (F) and wheels (W) separately. They need 1 frame and 2 wheels to make a completed bicycle and get no utility from extra frames or wheels. Write down a utility function that can represent their preference (5 points) and solve for their Hicksian demand (5 points)

5. A consumer has a utility function given by  $U(x, y) = 6x + 2y$ . The price of  $x$  is 3 and the price of  $y$  is 2. The consumer has an income of 12. You are interested in determining the substitution effect of an increase in the price of  $x$ . Explain why for these preferences the substitution effect will depend on the size of the price increase.

## Long Questions (50 points each)

1. A consumer has utility function

$$U(x, y) = xy$$

- (a) (10 points) The consumer wants to minimize their expenditure to reach a level of utility  $\bar{U}$ . Write down and solve a Lagrangian to find their Hicksian demands for  $x$  and  $y$

- (b) (10 points) What is this consumer's expenditure function?

(c) (10 points) Using the expenditure function, find the consumer's indirect utility function.

(d) (10 points) Using the indirect utility function and the Hicksian demands, find this consumer's Marshallian demands for  $x$  and  $y$  (do not solve the utility maximization problem directly)

- (e) (10 points) Assume the price of  $x$  and  $y$  are originally both equal to 1 and the consumer has an income of 8. If the price of  $y$  increases to 2 (hint: this is a discrete change), find the total, income and substitution effects of this price change on the consumption of  $y$ .

2. A consumer receives utility from healthy food (H) and junk food (J). Their utility function over these two goods is given by

$$U(H, J) = 10 \ln(H) + J$$

A serving of healthy food costs \$5 and a serving of junk food costs \$4. The consumer has a daily income of \$80 and spends it all on healthy food and junk food.

- (a) (10 points) How much healthy food and junk food will the consumer buy each day to maximize their utility?

- (b) (10 points) The government wants to reduce the consumer's consumption of junk food, so it imposes a tax on junk food of \$2 per serving. What happens to the consumer's optimal consumption? How much revenue does the government raise from the tax?



(c) (10 points) The government is wondering how harmful the tax is to the consumer's current happiness. How much income would a consumer at the original prices (before tax) have needed to reach the same utility as the consumer actually achieves after the tax? (round to the nearest hundredth)

(d) (10 points) The government realizes they have made the consumer worse off and decides to compensate the consumer so that their utility after the tax remains the same as their utility was before the tax. How much would they need to pay the consumer to accomplish this goal? What would be the consumer's optimal choice after the tax and the compensation? (round to the nearest hundredth)

- (e) (10 points) The government realizes that the policy in part d was expensive and wants to increase revenue. It decides to increase the size of the tax to \$6 per unit. What will be the consumer's new optimal consumption? Did the government accomplish its goal of increasing revenue? Why or why not? (you can return to the original income for this calculation and ignore the compensation from part d)

Extra Space