Massachusetts Institute of Technology

Department of Economics

14.01 Principles of Microeconomics

Exam 1

Last Name (Please print): _ _ _ _ _ _ _ _ _ _ _ _ _ _

First Name: _ _ _ _ _ _ _ _ _ _ _ _ _ _

Instructions. Please read carefully.

The exam has a total of 100 points. Answers should be as concise as possible. This is a closed book exam. You are not allowed to use notes, equation sheets, books or any other aids. You are not allowed to use calculators. You must write your answers in the space provided between questions. DO NOT attach additional sheets of paper. This exam has 18 pages (13 pages + 5 blank pages for scratch work)

DO NOT WRITE IN THE AREA BELOW:

Question 1 _ _/16   Question 2 _ _/10

Question 3 _ _/23   Question 4 _ _/25

Question 5 _ _/26

Total _ _/100

1. **True/False/Uncertain Questions** (16 points)

   In this section, write whether each statement is True, False or Uncertain. You should fully explain your answer, including diagrams where appropriate. Points will be given based on your explanation.

   (a) (4 points) A consumer finds two goods to be perfectly substitutable. Claim: The optimal bundle for this consumer will always be a corner solution.

   (b) (4 points) Innovations in the production of batteries lead to a rightward shift in the market supply for hybrid cars, while demand stays the same. Since this leads to a decrease in the equilibrium price and an increase in the equilibrium quantity, demand is more inelastic at the new equilibrium.

(c) (4 points) A consumer has selected an optimal bundle of two goods that includes some of each good. The price of one good increases. Claim: her utility is lower after the price increase compared to before it.

(d) (4 points) When market demand and supply shift in opposite directions, we can un-ambiguously say how the equilibrium price and quantity change.

2. Market demand for frozen yogurt (10 points)

Market surveys show that there are two types of consumers for frozen yogurt. The first type like frozen yogurt and have an inverse demand curve of $P = 5 - \frac{1}{2}Q$. The second type are crazy about frozen yogurt and have an inverse demand curve of $P = 20 - Q$. In the town of Smallville there are only 2 consumers: one of them likes frozen yogurt and the other is crazy about frozen yogurt.

(a) (5 points) Using the individual demand curves above, derive the market demand for frozen yogurt in Smallville. Plot the market demand curves.

(b) (5 points) Suppose that the market supply for frozen yogurt in Smallville is given by $Q^S = 2 + P$. Find the equilibrium price and quantity. How much does each consumer buy at the equilibrium price? (Hint: Check the equilibrium price and quantity you get on a graph.)

4

3. **Consumer preferences and optimal allocations** (23 points)

Mary is starting a jewelry collection. She wants to own matched sets of three bracelets and one necklace that can be worn together, and she doesn't want to own any bracelets or necklaces that are not in a matched set of this size.

(a) Draw Mary's indifference curves and write her utility function. Put bracelets on the y axis and necklaces on the x axis. Assume she receives utility of 3 utils from each matched jewelry set she owns.

(b) (5 points) Currently, Mary has 32 dollars to spend. The price of necklaces is $p_n = 2$ and the price of bracelets is $p_b = 2$. What is the optimal allocation of necklaces and bracelets for Mary? How much utility does she achieve from this allocation?

(c) (4 points) Due to a shortage of gold, the price of necklaces increases to $p_n = 10$. What is the new allocation of necklaces and bracelets at this price level, and what utility does Mary obtain?

(d) (4 points) Luckily, Mary's parents value their daughter's utility, and are willing to give her enough income to ensure that she has the same utility she did prior to the price change. How much extra money do they have to give her?

(e) (5 points) Mary has a sister Lily who doesn't like wearing matched sets of jewelry and has different preferences. Her utility function is nb^2. If she started with the same jewelry budget as Mary of 32 dollars and then faced the same price shock, what would be the decrease in her utility when the price of necklaces increases from $2 to $4?

(f) (3 points) Mary and Lily's parents are going to give a gift of equal monetary value to both sisters. They are trying to decide whether to give cash or give jewelry. Which sister is more likely to prefer cash? Please explain intuitively and/or graphically; there is no need for algebra in this section.

4. **Labor markets and labor supply shocks** (25 points)

Consider the labor market in the country of Widgetland. The demand for labor is given by:

$$L^D = 34 - 4w$$

where w is the wage rate.

Labor supply is:

$$L^S = \overline{L} + 2w$$

where $\overline{L}$ is the number of people in the country willing to work at a wage of zero.

(a) (5 points) Suppose that $\overline{L} = 10$. Find the equilibrium wage and equilibrium demand for labor. Is demand for labor elastic or inelastic at the equilibrium wage?

Suppose that there is a sudden influx of migrant labor, which increases the number of people willing to work at a wage of zero to $\overline{L} = 16$. For the remainder of the problem, set $\overline{L} = 16$.

(b) (5 points) Compute the new market equilibrium. What happens to the equilibrium wage rate?

(c) (5 points) In reality an increase in population should affect the demand for labor as well as the supply. Explain how the equilibrium wage and labor demanded will change compared to the market equilibrium in part (a) if demand for labor were to increase as well.

(d) (5 points) The government in Widgetland becomes worried about the upcoming election and decides to appease voters by imposing a minimum wage of $\underline{w} = 4$. What happens in the labor market as a result? What is the demand and supply for labor now? Include a graph in your explanation.

(e) (5 points) The government is unhappy with the results of the minimum wage law and repeals it. Instead it introduces a subsidy of $\tau = 1$ dollar on labor that is paid to workers. What happens to the equilibrium wage and labor used as a result of this subsidy? How much do workers get in equilibrium?

5. **Income and substitution effects** (26 points)

Glenn's utility function for goods X and Y is represented as $U(X,Y) = X^{0.2}Y^{0.8}$. Assume his income is \$100 and the prices of X and Y are \$10 and \$20, respectively.

(a) (4 points) Express his marginal rate of substitution (MRS) of good Y for good X. As the amount of X increases relative to the amount of Y along the same indifference curve, does the absolute value of the MRS increase or decrease? Explain.

(b) (4 points) Express his marginal rate of substitution (MRS) of good Y for good X. As the amount of X increases relative to the amount of Y along the same indifference curve, does the absolute value of the MRS increase or decrease? Explain.

(c) (5 points) What is his optimal consumption bundle (X^*, Y^*), given income and prices of the two goods?

(d) (5 points) How will this bundle change when all prices double and income is held constant? When all prices double AND income doubles?

(e) (4 points) Derive the demand curve for good X and the demand curve for good Y as a function of prices assuming income is $100.

Now a government subsidy program lowers the price of Y from $20 per unit to $10 per unit.

(f) (4 points) Calculate the change in good Y consumption resulting from the program. In a clearly labeled diagram with Y on the y-axis and X on the x-axis, graphically show the change in consumption of good Y resulting from the program.

(g) (4 points) In a clearly labeled diagram with Y on the y-axis and X on the x-axis, graphically show the change in consumption attributable to the separate income and substitution effects for good Y only. Explain the intuition of the income and substitution effects. No calculations are required for this part.

(h) How much does the program cost the government?

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14.01SC Principles of Microeconomics
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