Midterm exam

answers

Instructions: You have 75 minutes to complete this exam. Write your answers on the white sheets of paper provided to you. Credit, including partial credit, will depend principally on your explanations, so be sure to write thorough answers. Unsupported answers will receive 0 credit. Good luck!

Problem 1 (10 points) You have already sold 100 doses of a new medicine you've developed. Here is your average cost schedule:

Q	AC
99	\$201
100	\$200
101	\$199

Your roommate offers to buy another dose from you for \$150. Should you accept her deal? Does your answer depend on anything? Explain briefly.

The marginal cost of the 101^{st} unit is \$99, and so the firm can profit by selling the 101^{st} unit for \$150, so long as it doesn't have any better offers.

Problem 2 (10 points) Hugo has normal convex indifference curves over pizza and soda. As it turns out, she is indifferent over 6 slices of pizza and 1 soda, and 1 slice of pizza and 6 sodas.

a. Is she likely to prefer the bundle with 5 sodas and 3 slices to the bundle with 6 sodas and 1 slice, or is there not enough information? Explain. (Hint: you are much more likely to get points for 2a and 2b if you draw a relevant picture.)

If her indifference curves have the usual convex shape, any bundle on the line connecting $(6, 1)$ and $(1, 6)$ should be at least as good as the bundle $(6, 1)$ (draw a picture). $(4, 3)$ is such a bundle. Since the bundle $(5, 3)$ has one more slice and just as many sodas as $(4, 3)$, it must be better than $(4, 3)$ and therefore better than $(6, 1)$.

b. Is she likely to prefer the bundle with 3 sodas and 3 slices to the bundle with 6 sodas and 1 slice, or is there not enough information? Explain.

It depends. If she regards the two goods as very substitutable (very straight indifference curves), $(3, 3)$ will be worse for her. If she regards them as very complimentary (extremely "bent" indifference curves), $(3, 3)$ will be superior to $(6, 1)$. A good answer will draw a picture covering both cases.

Problem 3 (20 points) Answer the following two subquestions about utility maximization:

a. Jay allocates a budget of \$15/day over coffees and sodas. His marginal utility over coffees is $14CS$, while his marginal utility over sodas is $7C^2$. A coffee costs \$5, while a soda costs \$2.50. How many coffees and how many sodas should he purchase to maximize his utility?

$C^* = 2$, $S^* = 2$.

b. Hector has \$20/day to spend on coffees and sodas. For Hector, the marginal utility of coffee is 7, while the marginal utility of soda is 3 (that is, he has constant marginal utility). The price of a coffee is \$5, while the price of a soda is \$2.50. How many coffees and how many sodas should Hector purchase to maximize his utility?

For Hector, coffee and soda are perfect substitutes, so he will spend all his money on whichever good gives him more utility. Per dollar, coffee gives him utility at rate $\frac{MU_C}{p_C} = \frac{7}{5}$, compared to $\frac{3}{2.5}$ for soda. Since the former is larger than the latter, Hector will consume only coffee, meaning $C^* = 4$, $S^* = 0$.

Problem 4 (15 points) A music publisher pays \$10 to prepare a plate for printing music. After the plate is prepared, the publisher can make as many copies of the music as he wants for \$1 per copy.

a. Give equations for average cost, average variable cost, and marginal cost.

$AC = \frac{10}{q} + 1$. $MC = 1$. $AVC = 1$.

b. Graph average cost, average variable cost, and marginal cost.

Problem 5 (20 points) Greg is a day trader, while his neighbor Jennifer is a professor. Greg's income is risky; if he has good luck (probability .5), he makes \$160,000/year. If he has bad luck (probability .5), he makes only \$40,000. Jennifer's job is more stable. She makes \$100,000/year with certainty. Both receive utility $\sqrt{w}$ from wealth w.

a. Would Greg trade jobs with Jennifer if he were given the option? If so, give the maximum amount by which Jennifer's income could be lowered for which this is still true. If not, give the minimum amount by which it would have to be raised before he would choose to switch.

Greg would get utility $\sqrt{100,000} = 316.23$ from Jennifer's job. From his job, he gets utility $.5\sqrt{40000} + .5\sqrt{160000} = 300$. Clearly, then, he would prefer to switch jobs, at least thinking about income alone. This would still be true so long as the professor job pays at least $\$X$, where X is given by $\sqrt{X} = 300$, or $X = 90,000$. Thus, Jennifer's income could be lowered by up to \$10,000 before Greg would prefer to keep his own job.

b. Suppose that Greg offers the following deal to Jennifer: If I have good luck, I will give you $\$x$, while if I have bad luck, you will give me $\$y$. Show that it is possible for Greg to choose x and y such that 1. Jennifer accepts the deal (she is made better off) and 2. It is worthwhile for Greg (he is made better off).

If $x = 70,000$ and $y = 50,000$, then Greg gets \$90,000 with certainty. As this is his certainty equivalent, he would be willing to do this (to make him strictly prefer the arrangement, you could make $x = 69,999$.) Jennifer would then get utility of $.5\sqrt{170,000} + .5\sqrt{50000} = 317.96$, which is greater than her utility of 316.23 of having a certain \$100,000 income.

Problem 6 (10 points) Suppose that the elasticity of demand for cigarettes is $-\frac{1}{4}$, while the supply elasticity is 1. Currently the price of a pack of cigarettes is \$4, while there are 32 million packs sold.

a. Estimate linear demand and supply functions. (hint: you may use either packs sold or millions of packs sold as the unit for quantity. It does not matter which.)

Assume the demand equation has the form $Q^D = a - bp$. From the equation for elasticity, $-\frac{1}{4} = b\frac{4}{32}$, so $b = 2$. Then, it must be that $32 = a - 2 * 4$, so $a = 40$. Therefore, $Q^D = 40 - 2p$. A similar calculation gives $Q^S = 8p$.

b. Suppose new government regulations make producing cigarettes more costly, so that at any price, 25% fewer cigarettes are supplied. What is the new equilibrium price and quantity?

The new supply curve is then $Q^S = 6p$. Equating to demand gives $p = \$5$, $Q = 30$.

Problem 7 (15 points) Consider a city that has a number of hot dog stands operating throughout the downtown area. Suppose that each vendor has marginal cost function $\$.1q$ for it's q^{th} hot dog sold, meaning that its variable costs of selling q hot dogs is $\$.05q^2$. In addition, each stand must pay a licensing fee to the city of \$F/day. A stand must pay one year's worth of licensing fees in advance, so it is a fixed cost.

a. Suppose that $F = \$125$. Suppose that the current price of a hot dog is \$4. What is the maximum profit each firm can earn?

At this price, each firm maximizes profits by selling 40 hot dogs, for a profit of $4*40-125-.05*40^2 = -\$45$.

b. Will the long-run price be higher, lower, or the same as in part a.? Explain the economic intuition behind your answer.

Since firms are losing money, some will exit gradually, driving the price upward as the market supply curve shifts to the left.

c. Suppose that the city wants to increase revenue gained from hot dog licensing fees. Should they increase or decrease F? If it depends, say on what it depends.

It depends. As they increase F, more firms will exit, meaning there are fewer firms left to pay the fees. Revenue gained from the fee will be increasing for low F, and decreasing for high F, though where revenue is maximized will depend on characteristics of the market.