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Economics 111: Intermediate Microeconomics

Spring 2005

Final

You have 3 hours. Only clarifying questions are allowed. Do not cheat. Do not panic. Enjoy the exam.

Questions 1 to 10 are multiple choice or true/false. Circle the correct answer. (5 points each correct answer).

1. Regardless of her income or prices, Marge always spends 25% of her income on housing, 10% on clothing, 30% on food, 15% on transportation, and 20% on recreation. This behavior is consistent with which of the following?:

a. All goods are perfect substitutes.

b. Marge's demands for commodities do not change when price change.

c. Marge consumes all goods in fixed proportions.

d. Marge has a Cobb-Douglas utility function.

e. None of the above.

2. If there are two goods and if the price of good 2 decreases, a consumer's demand for good:

a. 1 will increase only if it is a Giffen good for her.

b. 2 will increase only if it is a Giffen good for her.

c. 2 will increase only if it is an inferior good for her.

d. 2 will decrease only if it is a Giffen good for her.

e. None of the above.

3. Supply and demand theory shows us that the burden of a sales tax is independent from whether the tax is collected from the sellers or the buyers.

True False

4. The First Welfare Theorem is true even when there are negative externalities.

True False

5. From the Armchair Economist's discussion on "Trains and Sparks" as an example of externalities we learnt the following:

a. when circumstances prevent negotiations, the costs of damage should be borne by the party that can prevent them more cheaply.

b. when circumstances prevent negotiations, who pays the cost of the externality does not affect the ultimate allocation of resources.

c. governments should not regulates markets.

d. all of the above.

e. none of the above.

6. The term "moral hazard" refers to situations where:

a. there are no externalities.

b. some agents will want to invest in signals that will differentiate them from other agents.

c. investment in signals may be privately beneficial but publically wasteful.

d. one side of the market cannot observe the "type" or quality fo the goods on the other side.

e. one side of the market cannot observe the action of the other side.

7. Alberto and Benito consume two goods. They trade only with each other and there is no production. Alberto's utility function is $U_A = 2x_{A1} + x_{A2}$ and Benito's is $U_B = x_{B1}x_{B2}$. The following prices constitute an equilibrium:

a. $p_1 = p_2 = 1$.

b. $p_1 = 2$, $p_2 = 1$.

c. $p_1 = \frac{1}{2}$, $p_2 = 1$.

d. $p_1 = 1$, $p_2 = 2$.

e. none of the above.

8. Moe has 16 dollars to spend in a bar. His utility function is $U = \sqrt{b}$, where b denotes the consumption of bottles of beer in the bar. The price of a bottle of beer is \$1. Unfortunately the bar is in a risky part of town and there is a 50% chance that they will get mugged on his way to the bar, in which case he ends with no money. What is the maximum amount he is willing to pay the street tough guy for protection? (with protection the probability of mugging is zero):

a. 0.

b. 4.

c. 8.

d. 12.

e. 16.

$EU = \frac{1}{2}\sqrt{0} + \frac{1}{2}\sqrt{16} = 2$

$\sqrt{16-P} = 2 \Rightarrow 16 - P = 4$

$\boxed{P = 12}$

9. Perfect price discrimination denotes the situation in which a monopolist charges:

a. each consumer the maximum price he/she is willing to pay for each unit.

b. different prices for different units but every individual that buys the same amount pays the same price.

c. different prices to different people, but every unit sold to an individual sell for the same price.

d. a price above marginal cost.

e. a price equal to the average income elasticity.

10. Suppose some kidnapers abduct a hostage and then discover that they can't get paid. Should the kidnapper kill the hostage? If released, should the hostage identify the kidnapper? The kidnapper would feel bad about killing the hostage, receiving a payoff of -3. In that case the hostage feels even worse, receiving a payoff of -10. If the hostage is released and does not identify the kidnapper, the kidnapper gets a payoff of 5 and the hostage a payoff of 3. But if the hostage identifies the kidnapper, the latter gets a payoff of -5 and the former a payoff of 5. The backwards induction solution is:

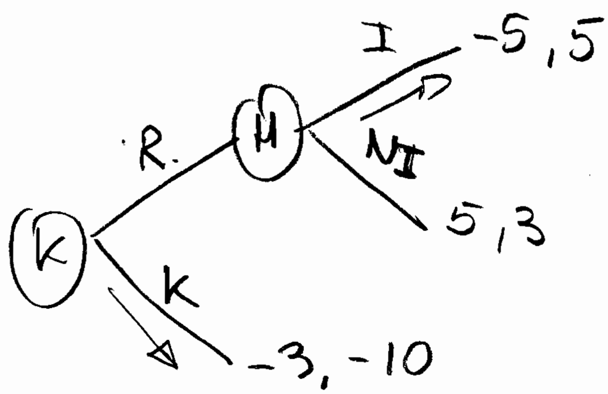
a. Kidnapper kills, if released hostage identifies.

b. Kidnapper kills, if released hostage does not identify.

c. Kidnapper releases, hostage identifies.

d. Kidnapper releases, hostage does not identify.

e. I should have read Varian's textbook more carefully.



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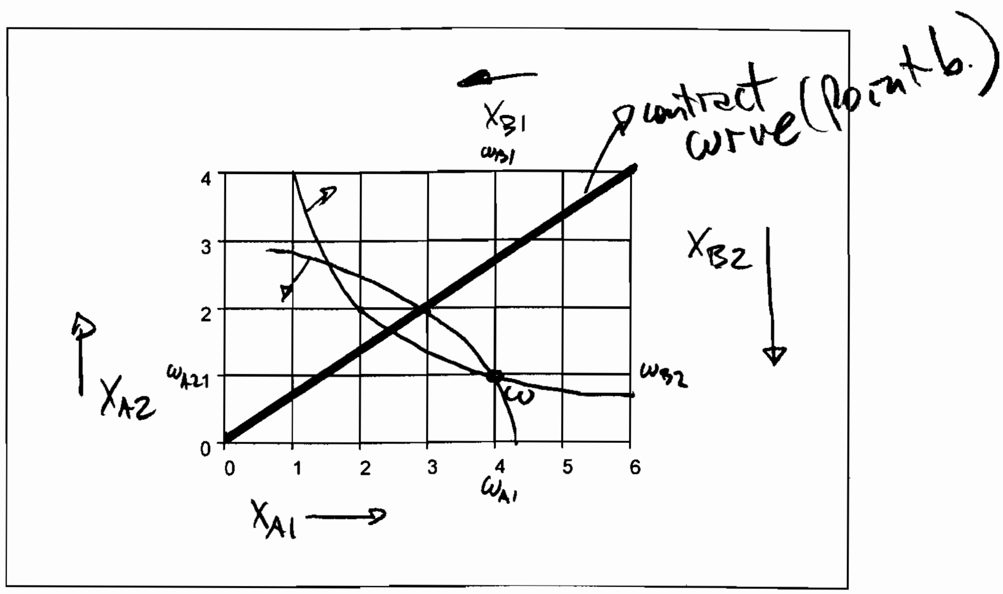
11. (25 points) Consider a world with two agents: A and B. The utility of A is $U_A = x_{A1}x_{A2}$ and the utility of B is $U_B = x_{B1}x_{B2}$. The initial endowments are $\omega_A = (4, 1)$ and $\omega_B = (2, 3)$.

a. In the following figure draw the Edgeworth Box labeling all axis and draw the initial endowment and the indifference curves that go through it.



b. Find the Contract Curve. Draw the Contract Curve in the Edgeworth Box of point a.

$$MRS_A = \frac{X_{A2}}{X_{A1}} \qquad MRS_B = \frac{X_{B2}}{X_{B1}} \qquad \begin{aligned} X_{A2} + X_{B2} &= 4 \\ X_{A1} + X_{B1} &= 6 \end{aligned}$$

$$\Rightarrow MRS_A = MRS_B \text{ implies } \frac{X_{A2}}{X_{A1}} = \frac{4 - X_{A2}}{6 - X_{A1}}$$

$$6X_{A2} - \cancel{X_{A1}X_{A2}} = 4X_{A1} - \cancel{X_{A2}X_{A1}} \Rightarrow \boxed{X_{A2} = \frac{2}{3}X_{A1}}$$

c. Find the demand functions of A for general p_1, p_2 and m_A.

$$X_{A1}^* = \frac{m_A}{2p_1} \qquad X_{A2}^* = \frac{m_A}{2p_2}$$

d. Find the demand functions of B for general p_1, p_2 and m_B.

$$X_{B1}^* = \frac{m_B}{2p_1} \qquad X_{B2}^* = \frac{m_B}{2p_2}$$

e. Find the competitive equilibrium price p_1^* (assume that $p_2 = 1$). Find the equilibrium allocation ($x_{A1}^*, x_{A2}^*, x_{B1}^*$ and x_{B2}^*).

$$X_{A1}^* + X_{B1}^* = 6 \Rightarrow \frac{4p_1+1}{2p_1} + \frac{2p_1+3}{2p_1} = 6$$

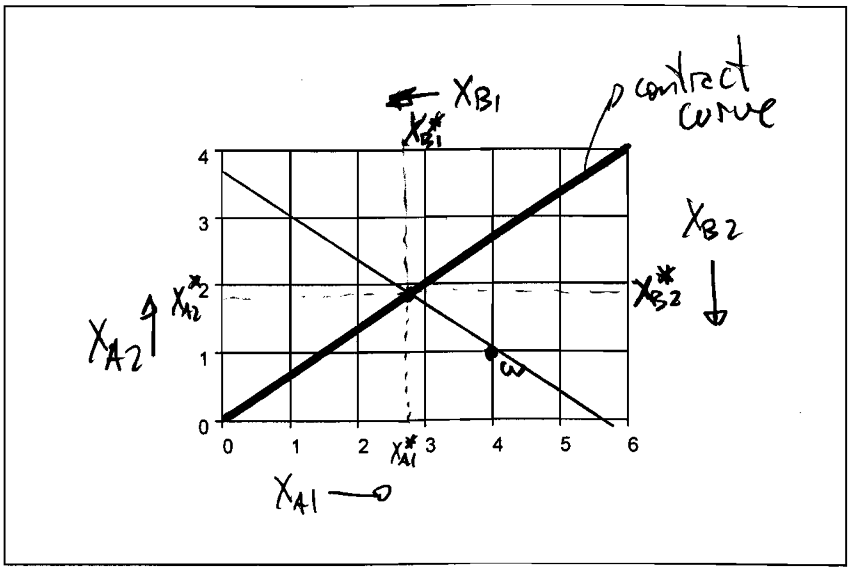
$$\Rightarrow 6p_1 + 4 = 12p_1$$

$$4 = 6p_1 \Rightarrow \boxed{p_1^* = \frac{2}{3}}$$

(Note that MRS_A at contract curve is 2/3 then by the First welfare theorem it must be that $p_1^* = \frac{2}{3}$)

f. In the following figure draw the draw the initial endowment, the contract curve, the equilibrium budget lines and the equilibrium consumption bundles. (Label each of them in the graph).

$$X_{A1}^* = \frac{4 \times \frac{2}{3} + 1}{2\,\frac{2}{3}} = \frac{\frac{8}{3}+1}{\frac{4}{3}} = \frac{11}{4} \qquad \text{etc.}$$



g. Why is good one cheaper than good 2?

there is more of good 1 than good 2.

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12. (20 points) An airport is located next to a housing development. Denote as x the number of planes that land in per day and y the number of houses in the housing develpment. The profits of the airport are $\Pi_A = 26x - x^2$, and the profits of the development are $\Pi_B = 22y - y^2 - xy$.

a. Find the optimal number of landings and houses if a single profit-maximizing company owns both the airport and the housing development.

$$\Pi = \Pi_A + \Pi_B = 26x - x^2 + 22y - y^2 - xy$$

$$\frac{d\Pi}{dx} = 26 - 2x - y = 0 \quad \Rightarrow \quad \boxed{\begin{array}{l} x^* = 10 \\ y^* = 6 \end{array}}$$

$$\frac{d\Pi}{dy} = 22 - 2y - x = 0$$

b. If different firms own the airport and the housing development, find the equilibrium number of landings and houses. Are these levels efficient? Why? Why not?

A's problem: $\max_x \Pi_A = 26 - x^2 \Rightarrow \frac{d\Pi_A}{dx} = 26 - 2x = 0$

$\boxed{x^{NE} = 13} > x^*$

$\Rightarrow$ inefficient

B's problem $\max_y \Pi_B = 22y - y^2 - xy$

$\Rightarrow \frac{d\Pi_B}{dy} = 22 - 2y - x = 0$

$\Rightarrow y = \frac{22 - x}{2} \Rightarrow y^{NE} = \frac{22 - x^{NE}}{2}$

$\Rightarrow \boxed{y^{NE} = 4.5} < y^* \Rightarrow$ inefficient

There is a negative externality

c. If the government decides to levy a tax t on the number or landings, how large must t be for the equilibrium level of landings to be efficient? (hint: write Π_A when there is a tax and then find how x depends on t, finally choose the t that gives you the x you want.) What would y be then?

$\Pi_A = 26x - x^2 - tx \Rightarrow x = 13 - \frac{t}{2}$

To have $x = 10 \Rightarrow \boxed{t = 6}$

d. After loobying by airport officials, the government has decided that instead of levying a tax on the airport, the housing developer will have to pay a tax t for each plane below 13 that does not land (the total payment to the airport would then be $t(13 - x)$). How large must t be for the equilibrium level of landings to be efficient? What would y be then?

$\Pi_A = 26x - x^2 + t(13 - x)$

$\Rightarrow 26 - 2x - t = 0 \Rightarrow$ for $x = 10$ we have that $\boxed{t = 6}$

$\Rightarrow \boxed{y = 6} = y^*$

e. What is the name of the theorem that explains the relationship between the equilibrium allocations in points c and d?

Coase theorem

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13. (20 points) Consider the following simultaneous-moves game:

		2 A	2 B
1	A	0, 0	1, 3
1	B	3, 1	0, 0

a. Find the pure strategy Nash equilibria.

(B, A) , (A, B)

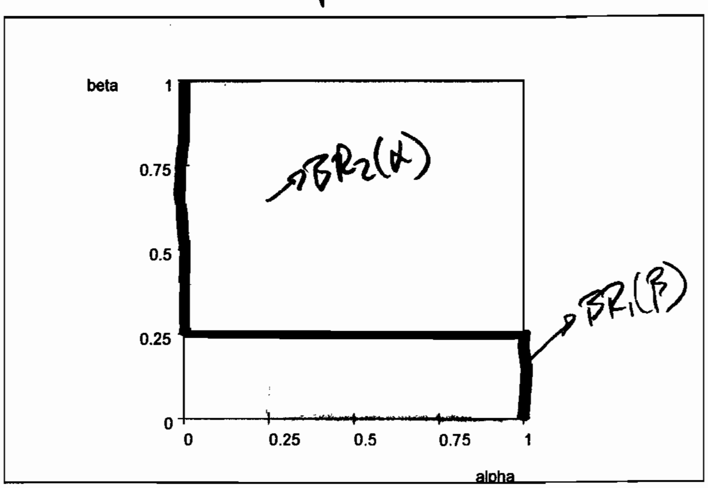
b. In the following graph draw the best response curves for both players. α denotes the probability that player 1 plays A and β denotes the probability that player 2 plays A.

$U_1(A) = (1-\beta)$ $\Rightarrow$ play A ($\alpha=1$) if $1-\beta > 3\beta$ $\Leftrightarrow \beta < 1/4$

$U_1(B) = 3\beta$

$\Rightarrow$ indifferent if $\beta = 1/4$

play B if $\beta > 1/4$



$U_2(A) = 1-\alpha$

$U_2(B) = 3\alpha$

$\Rightarrow$ choose A if $\alpha < 1/4$

c. Find the mixed strategy Nash equilibria.

$$\left(\frac{1}{4}A+\frac{3}{4}B,\ \frac{1}{4}A+\frac{3}{4}B\right)$$

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14. (15 points) Consider a monopolist who sales a product in two different markets (A and B). The inverse demand functions are $P_A = 100 - q_A$ and $P_B = 60 - q_B$. The production cost is $C(Q) = Q^2$ where $Q = q_A + q_B$. Ugly #s.

a. Write the profit function for the monopolist as a function of q_A and q_B.

$$\pi = (100 - q_A)q_A + (60 - q_B)q_B - (q_A + q_B)^2$$

$$= 100q_A - q_A^2 + 60q_B - q_B^2 - (q_A^2 + 2q_Aq_B + q_B^2)$$

b. Find the optimal quantities sold in both markets and prices.

$$\frac{d\pi}{dq_A} = 100 - 2q_A - 2q_A - 2q_B = 0 \Rightarrow 4q_A = 100 - 2q_B$$

$$2q_A = 50 - q_B$$

$$\frac{d\pi}{dq_B} = 60 - 2q_B - 2q_A - 2q_B = 0$$

$$\Rightarrow 60 - 4q_B - 50 + q_B = 0$$

$$10 = 3q_B \Rightarrow \boxed{q_B^* = \frac{10}{3}}$$

$$\boxed{q_A^* = 25 - \frac{5}{3} = \frac{70}{3}}$$

$$\boxed{P_B^* = 60 - \frac{10}{3} = \frac{170}{3}}$$

$$\boxed{P_A^* = \frac{300 - 70}{3} = \frac{230}{3}}$$

c. Find the value of the marginal revenue and marginal cost by market at the optimal solution.

$MR_A = 100 - 2 f_A^* = 100 - \frac{140}{3} = \frac{160}{3}$ $\quad MC_A = 2(f_A + f_B) = \frac{160}{3}$

$\qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \overset{?}{\parallel}$

$MR_B = 60 - 2 f_B^* = 60 - \frac{20}{3} = \frac{160}{3}$ $\quad MC_B = MC_A$

d. Find the consumer surplus by market and total producer surplus at the optimal solution.

$$CS_A = \frac{\left(100 - \frac{230}{3}\right)}{2} * \frac{70}{3} = 272.22$$

$$CS_B = \frac{\left(60 - \frac{170}{3}\right)}{2} * \frac{10}{3} = 5.56$$

$\Pi^* = 1266.7$

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15. (20 points) Sam has \$100. This money is divided as follows: \$36 is safely in the bank and \$64 in a box in his house. His utility function in terms of money is $U(M) = \sqrt{M}$.

from the Bank

a. Sam can choose whether to buy a lock for the box in his house for \$20. If he buys the lock the probability that the \$64 will be stolen is 0.3. If he doesn't buy the lock the probability the \$64 are stolen is 0.7. Will he buy the lock?

$$EU_{Lock} = .7\sqrt{100-20} + .3\sqrt{36-20} = 7.461$$

$$EU_{no\ lock} = .3\sqrt{100} + .7\sqrt{36} = .3 * 10 + .7 * 6 = 7.2$$

$$\Rightarrow \text{Buy lock}$$

b. Suppose Sam got the lock as a present from a friend and he locks the box. Suppose also that he can insure the money at the box against theft for an actuarially fair premium (the actuarially fair price to insure one dollar will be equal to the probability of losing the dollar). He can choose to insure an amount x against theft. How many dollars will Sam insure?

$$P = .3X$$

$$EU(x) = .7\sqrt{100-.3X} + .3\sqrt{36-.3X+X}$$

$$\frac{dEU}{dx} = \cancel{.7}\,\cancel{\frac{1}{2}}\,\frac{1}{\sqrt{100-.3X}}(-\cancel{0.3}) + \cancel{.3}\,\cancel{\frac{1}{2}}\,\frac{1}{\sqrt{36+.7X}}(\cancel{.7}) = 0$$

c. Suppose there are many people like Sam in society and the insurance company cannot observe whether each individual has a lock or not. Assume that the insurance company know that half the population has a lock and the other half does not. The insurance company charges an actuarially fair premium under the assumption that all

$$100 - 0.3X = 36 + .7X$$

5

$$\boxed{64 = X}$$ Full insurance

agents buy the same amount of insurance. How many dollars will Sam insure?

Fair insurance = .5

$$EU = .7\sqrt{100 - .5X} + .3\sqrt{36 + .5X}$$

$$\frac{dEU}{dX} = .7 \frac{1}{2}\frac{\cancel{(-.5)}}{\sqrt{100 - .5X}} + .3\frac{1}{2}\frac{\cancel{(.5)}}{\sqrt{36 + .5X}} = 0$$

d. Given your answer to point c, are the profits of the insurance company going to be positive or negative. (You do not have to provide calculations, an intuition is good enough).

$$\frac{.3}{\sqrt{36 + .5X}} = \frac{.7}{\sqrt{100 - .5X}} \Rightarrow X = -29 \text{ which is impossible}$$

$$\Rightarrow X = 0 ??$$

Negative since only people without locks will buy the insurance.