

14.01 Fall 2010
Problem Set 3

1. (12 points) Assume the government has two policy options, a cash grant of \$200 and providing food stamps worth \$200.
 - (a) (3 points) Draw the budget constraint faced by the consumer in each of these two situations.
 - (b) (3 points) Now, draw a set of indifference curves that corresponds to an individual who would be indifferent between these two policies.
 - (c) (3 points) Next, draw a set of indifference curves corresponding to an individual who would prefer to have a cash grant rather than food stamps.
 - (d) (3 points) Is there a consumer who strictly prefers food stamps to cash grants (i.e., is better off with food stamps rather than a cash grant?) Why does the government use food stamps?

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2. (22 points) Suppose there are exactly two consumers (Albie and Bubbie) who demand strawberries. Suppose that Albie's demand for strawberries is given by

$$q_a(p) = p^\alpha f_a(I_a)$$

and Bubbie's demand is given by

$$q_b(p) = p^\beta f_b(I_b)$$

where I_a and I_b are Albie and Bubbie's incomes, and $f_a(\cdot)$ and $f_b(\cdot)$ are two unknown functions.

- (a) (5 points) Find Albie and Bubbie's (own-price) elasticities of demand, $\epsilon_{q_a,p}$ and $\epsilon_{q_b,p}$. Use the sign convention that $\epsilon_{y,x} = \frac{\partial y}{\partial x} \frac{x}{y}$.
 - (b) (5 points) Suppose that $\alpha > 0 > \beta$. Are strawberries a Giffen good for Albie? Are strawberries a Giffen good for Bubbie?
 - (c) (12 points) Are strawberries an inferior good for Albie? Are strawberries an inferior good for Bubbie? Assume that these demands arise from utility maximization, given linear budget constraints. Hint: This question should not require much/any algebra beyond (b).
3. (24 points) Joe considers beer and soda to be perfect substitutes at a rate of 1:2, that is, he always receives the same utility if he has one beer or two sodas to drink. He spends \$12 a day on drinks, and beers cost \$3 while sodas cost \$1 each. However, one day the price of beers decreases to \$2; there is no change in his budget.
 - (a) (6 points) How does consumption change when the price of beers changes? What is Joe's new level of utility?
 - (b) (6 points) Show with the aid of a graph what happens to the optimal allocation and the level of utility when the price of beer changes.
 - (c) (6 points) How much must Joe's budget decrease to return him to the original utility level?
 - (d) (6 points) Now assume the price of beers returns to the original price of \$3. Describe the demand curve for soda holding the price of beer and income constant; a graphic representation is optional.

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4. (42 points) Xiaoyu spends all her income on statistical software (S) and clothes (C). Her preferences can be represented by the utility function: $U(S, C) = 4 \ln(S) + 6 \ln(C)$.
 - (a) (6 points) Compute the marginal rate of substitution of software for clothes. Is the MRS increasing or decreasing in S? How do we interpret this?
 - (b) (6 points) Find Xiaoyu's demand functions for software and clothes, $Q_S(p_S, p_C, I)$ and $Q_C(p_S, p_C, I)$, in terms of the price of software (p_S), the price of clothes (p_C), and Xiaoyu's income (I).

- (c) (6 points) Draw the Engel curve for software.
- (d) (6 points) Suppose that the price of software is $p_S = 2$, the price of clothes is $p_C = 3$, and Xiaoyu's income is $I = 10$. What bundle of software and clothes (S, C) maximizes Xiaoyu's utility?
- (e) (6 points) Suppose the price of software increases to $p_S = 4$. What bundle of software and clothes does Xiaoyu demand now?
- (f) (6 points) Given the price increase, how much income does Xiaoyu need to remain as happy (have the same utility) as she was before the price change? What bundle of software and clothes would Xiaoyu consume if she had that additional income, given the new prices?
- (g) (6 points) Going back to the situation in part (e) ($p_S = 4$ and $I = 10$), decompose the total change of software and clothes demanded into substitution and income effects. In a clearly-labeled diagram with software on the horizontal axis, show the income and substitution effects of the increase in the price of software.

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14.01SC Principles of Microeconomics
Fall 2011

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