

**14.01, 2007 Fall**  
**Problem Set 3**  
**Due: September 28th**

1. Please write your name, the name of your TA, and your section/recitation time (e.g. MWF 10am, or F 1 pm) on top of your solutions.
2. Problem sets are due IN SECTION/RECITATION. Late Problem sets will not be accepted under any circumstances.

**Questions:**

1. Are the following statements true, false? Please give an explanation.
  - (a) (8 points) If pork chops and mashed potatoes are the only goods consumed and they are perfect complements, then neither can be an inferior good.
  - (b) (8 points) Ursula and Jessica are dining at Stanley's Surf and Turf, which sells only lobsters and steaks. An economics student working part-time in the restaurant asks the two customers about their marginal rates of substitution (MRS) and discovers that Ursula's MRS of lobster for steak is  $-2$ . Ursula and Jessica face the same prices for the two foods. Therefore, we know Jessica's MRS of lobster for steak must also equal  $-2$ .
2. (8 points) In the first week of July, Bob's favorite store charges \$2.50 for an ice cream and \$1.50 for a soda. Bob spends all his income on ice-cream and soda and chooses to consume 6 ice-creams and 10 sodas. By the first week of August, prices have risen to \$3 per ice-cream and \$2 per soda. Bob's income has also changed. He still only consumes ice-cream and soda, but he now buys 4 ice-creams and 20 sodas. Is Bob's behavior in the two weeks consistent with valid indifference curves? Can you determine in which week Bob is better off? Explain.
3. Anna spends all of her income on shirts ( $S$ ) and jeans ( $J$ ). Anna's preferences can be represented by the utility function  $U(S, J) = 3\sqrt{SJ}$ .
  - (a) (10 points) Derive the demand functions for shirts and jeans in terms of the price of shirts ( $P_S$ ), the price of jeans ( $P_J$ ), and income ( $I$ ).

- (b) (4 points) Draw the Engel curve for shirts.
  - (c) (3 points) Suppose the price of a shirt is \$4, the price of a pair of jeans is \$16, and Anna has \$128 income. What bundle of shirts and jeans  $(S, J)$  maximizes Anna's utility?
  - (d) (2 points) Suppose the price of a shirt increases to \$16. What bundle of shirts and jeans will Anna demand now?
  - (e) (8 points) Devastated by the sudden price increase, Anna decides to ask her brother for money to help finance her clothing purchases. How much total income does Anna need to remain as happy as she was before the price change?
  - (f) (3 points) If Anna has exactly enough income to keep her as happy as she was before the price change, what bundle of shirts and jeans will Anna demand?
  - (g) (10 points) Unfortunately, Anna's brother refuses to give Anna any money. She is now back to the situation in part c: the price of shirts has increased from \$4 to \$16, and her income remains unchanged at \$128. Decompose the total change in consumption of shirts and jeans purchased into a substitution effect and an income effect. In a clearly-labeled diagram with shirts on the horizontal axis, draw the income and substitution effects of the increase in the price of a shirt.
4. There are 100 consumers in the economy. Half of them belong to tribe A and demand oranges according to the individual inverse demand curve  $P = 10 - 2Q$ . The other half belong to tribe B and demand oranges according to the individual inverse demand curve  $P = 16 - 4Q$ . Suppose that the market-clearing price for oranges is \$4.
- (a) (4 points) At the market-clearing price, how many oranges does each member of tribe A buy? What is the price elasticity of demand by a member of tribe A at this point?

- (b) (4 points) At the market-clearing price, how many oranges does each member of tribe B buy? What is the price elasticity of demand by a member of tribe B at this point?
- (c) (12 points) What is the market demand for oranges in this economy? Is the market demand function linear? If not, where is the kink?
- (d) (6 points) Using the market demand function derived in part c., what is the total quantity of oranges demanded in this economy at the market-clearing price? (Hint: check that this is consistent with your answers to parts a. and b.) What is the price elasticity of market demand at this point? Is the absolute value of the price elasticity of market demand larger than the absolute value of the price elasticity of individual demand?
- (e) (10 points) If the price increases from \$4 to \$10, how does the consumer surplus change? Graph the demand curve with quantity on the horizontal axis and price on the vertical axis, and show the change in consumer surplus.