

**EC 501: Problem Set 3**  
**(Due in class on Tuesday, September 24)**

1. The following table lists three situations for an individual who consumes two goods  $X_1$  and  $X_2$ . The table lists the prices of the goods  $P_1$  and  $P_2$ , the quantities consumed of the goods,  $x_1$  and  $x_2$ , the consumer's nominal income  $I$ , and his utility level,  $U$ .

Situation	$P_1$	$P_2$	$x_1$	$x_2$	$I$	$U$
1	1	1	50	40	90	10
2	1	$\frac{1}{2}$	48	84	90	15
3	1	$\frac{1}{2}$	25	70	60	10

(a) When the price of good 2 drops from \$1 to \$1/2, what is the change in the quantity demanded of  $X_2$  when nominal income is constant at \$90? What part of this change is due to the substitution effect and what part is due to the income effect? Is  $X_2$  a normal good or is it an inferior good?

(b) Fill in the blanks in the table and answer the questions in part (a) for this table:

Situation	$P_1$	$P_2$	$x_1$	$x_2$	$I$	$U$
1	1	1	50	—	70	10
2	1	$\frac{1}{2}$	52	—	70	15
3	1	$\frac{1}{2}$	—	34	58	10

2. Todd buys only two types of food: hamburgers (H) and hot dogs (D). He likes them equally well, except that he feels a hamburger always gives him the same utility as three hot dogs.

- Write down Todd's utility function.
- Find Todd's demand functions for hamburgers and hot dogs.
- If Todd's food budget is \$50 per week and the prices for hamburgers and hot dogs are, respectively, \$5 and \$2, find how many hamburgers and hot dogs Todd would buy each week.
- Suppose the price of hamburgers went up to \$8. What would Todd's consumption pattern be now? How much of the change in consumption of each good would you attribute to the substitution effect and how much to the income effect?

3. The only way Sarah entertains herself is to go to the movies, where she always buys two bags of popcorn.
  - (a) Let  $M$  and  $P$  represent the quantities of movies and popcorn Sarah consumes, let  $p_m$  and  $p_c$  be their prices and let  $I$  be the amount that Sarah has budgeted for entertainment. What is Sarah's utility function for entertainment?
  - (b) Find Sarah's demand functions for movies and popcorn.
  - (c) If Sarah's entertainment budget is \$60 per month and  $p_m = \$10$  and  $p_c = \$2.50$ , how many movies would Sarah go to each month on average and how many bags of popcorn would she buy?
  - (d) Suppose the price of popcorn went up to \$5 per bag. What would Sarah's consumption pattern be now? How much of the change in consumption of each good would you attribute to the substitution effect and how much to the income effect?
  - (e) Find Sarah's compensated demand function for popcorn and draw her ordinary and compensated demand curves on the same graph.
  - (f) Starting with  $I = \$60$  per month and  $p_m = \$10$  and  $p_p = \$2.50$ , find the compensating and equivalent variations of a change in the price of popcorn to \$5.
  
4. John spends  $\$I$  on bottled water which he can buy in two sizes: 0.75 liter and 2 liter. The water is identical in the two sizes and John gets no utility from the containers themselves, only from the water.
  - (a) Write down a utility function for John in terms of the number of small containers ( $x$ ) and the large containers ( $y$ ) that he consumes.
  - (b) Find John's demand function for  $y$ .
  - (c) Find John's compensated demand function for  $y$ .
  - (d) Suppose initially  $I = 20$ ,  $p_x = 1$  and  $p_y = 2$ . Draw John's ordinary and compensated demand curves for  $y$  in the same diagram. Make sure to label all the relevant points.
  
5. Adam's utility function is  $U = A^{1/2} B^{1/2}$  where  $A$ ,  $B$  represent the number of apples and bananas respectively that he consumes.
  - (a) Find Adam's compensated demand functions.
  - (b) Write down Adam's ordinary demand functions (you don't need to derive them). Suppose Adam's income is \$100 and the prices of the goods are  $p_a = \$2$  and  $p_b = \$5$ . How much  $A$  and  $B$  would Adam buy?
  - (c) Suppose  $p_a$  rises to \$5. How much  $A$  would Adam buy now? What if his income were compensated to keep his utility constant? By using your answers to these questions, plot the ordinary and demand curves for  $A$  on the same graph.
  - (d) Find the compensating and equivalent variations of this price change.