Discussion 6

1 Topics

- Utility maximization
- Substitution and Income Effects
- Demand Curve Derivation
- Engel Curve (and its derivation)

2 Concept Review

2.1 Utility Maximization

Household and/or consumer preferences are measured by utility, or satisfaction. We assume everyone makes choices to maximize their utility.

- **Total utility:** The amount of utility gained from total goods or services. For example, if I eat 10 cookies, total utility is how satisfied I feel after eating all 10 cookies.
- **Marginal utility**: The amount of utility gained from each additional unit of goods or services. For example, marginal utility is how satisfied I feel after one additional cookie.
  - **Formula:** Marginal utility can be calculated from $\frac{\Delta TU}{\Delta Q}$, i.e. change in total utility over change in quantity of goods or services.
- **Law of Diminishing Marginal Utility:** The more of one good or service is consumed, the less marginal utility is gained from each additional unit of consumption. For example, the more cookies I eat, the less I feel satisfied with every additional cookie.
- **Marginal Rate of Substitution (MRS):** Given goods X and Y, $\text{MRS} = \frac{MU_X}{MU_Y}$ tells us the rate at which one is willing to substitute good X for good Y.
- **Utility Maximization Rule:** For a utility maximizing consumer, this must hold: $MRS = \frac{MU_X}{MU_Y} = \frac{P_X}{P_Y}$. The equation can be rearranged as $\frac{MU_X}{P_X} = \frac{MU_Y}{P_Y}$.

2.2 Substitution and Income Effects

- **Subsitution Effects:** The change in consumption of a good resulting in a change in its price, when consumer's utility and welfare is kept constant. For example, if

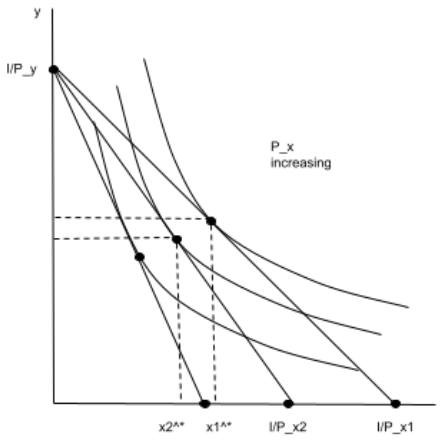
the price of a good falls, it now becomes relatively cheaper. Therefore one might substitute towards it away from other goods.

- **Income Effects:** The increase or decrease in purchases of a good when its price changes that comes from a change in how rich or poor you feel as a result of the price change. For example, if the price of a good decreases, you feel relatively better off ("richer") because you now have income left over that you can spend on more of the good or on other goods.

2.3 Demand Curve Derivation

- Changing the price of good x will allow you to compute quantities. Once you have two price-quantity pairs, you are able to graph the demand curve using the point-slope equation.

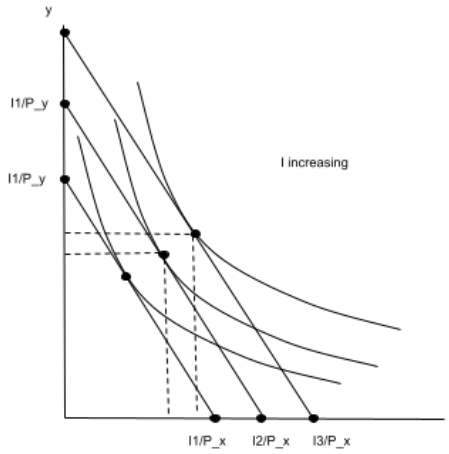
Figure 1: Demand Curve Derivation



2.4 Engel Curve

- Change the income for the consumer to retrieve quantities at each income. The Engel curve is the graph of quantities for good x against income, so once you have two such income-quantity pairs you can graph using the point-slope equation.

Figure 2: Engel Curve Derivation



3 Problems

Exercise 1 (Consumer Theory Without Graphs) Bucky is a utility maximizer. Bucky has \$80 to spend on Badger basketball tickets and economics textbooks. Given that the price of basketball tickets is \$10 and economics textbooks is \$10 in addition to the data in the table:

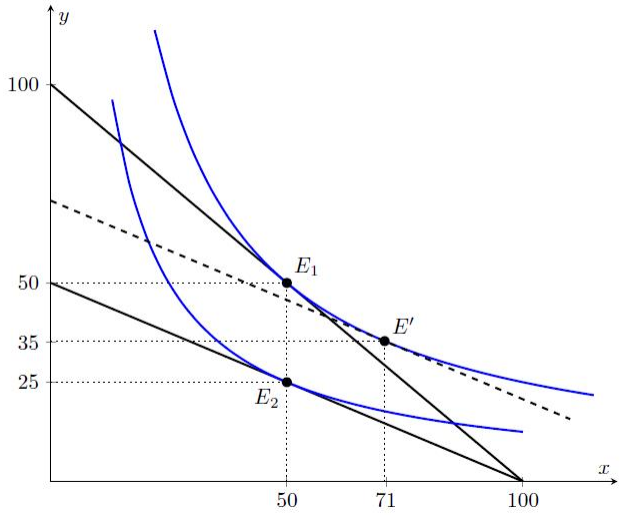
Quantity	TU tickets	MU tickets	MU/\$	TU econ texts	MU econ texts	MU/\$
1	25			40		
2	45			70		
3	60			95		
4	70			115		
5	75			130		
6	77			140		
7	76			145		

1. How many tickets and textbooks should Bucky purchase?

2. What is Bucky's total utility from the purchase?

3. What is Bucky's saturation point for basketball tickets?

Exercise 2 Suppose 2Chainz has preferences between two chains (x) and (y), as represented in the graph below. Point E1 is 2Chainz's initial consumption bundle. Then,



the price of chain 'y' increases, causing 2Chainz to consume at point E2. Point E' is the intermediate point between these two consumption bundles that is used to decompose the price (total) effect into income and substitution effects(it is therefore sometimes called a decomposition basket).

1. Will the substitution effect for chain 'x' be positive or negative? What about the income effect? Which effect is dominant? Explain.

2. Will the substitution effect for chain 'y' be positive or negative? What about the income effect? Which effect is dominant? Explain.

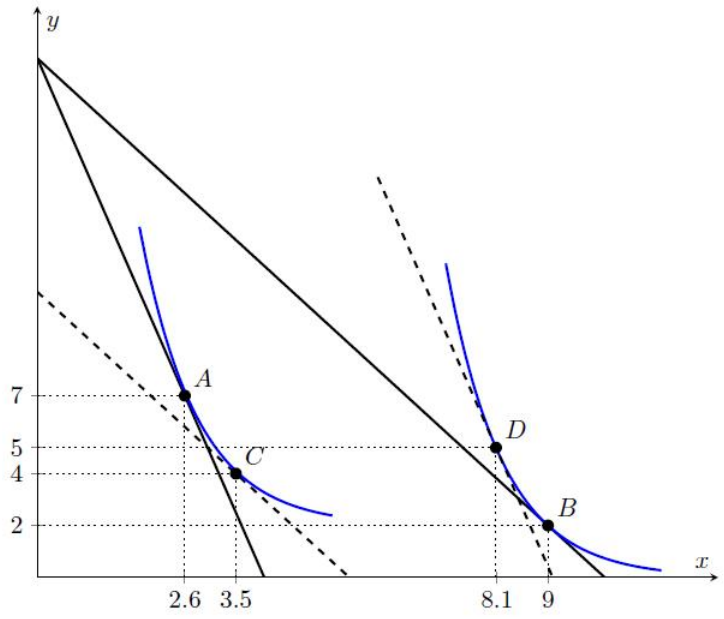
3. Compute the magnitude of these effects by completing the table below.

	Substitution effect	Income effect	Price (total) effect
Pointwise	E_1 to E'	E' to E_2	E_1 to E_2
Chain 'x'			
Chain 'y'			

4. Assuming a linear demand curve for chain 'y', what will this demand curve look like?

5. For 2Chainz is chain 'x' a normal or inferior good? What about chain 'y'? Justify your answer.

Exercise 3 Professor Hansen has recently taken a liking to 1970's R&B/Soul music. She has preferences for Al Green albums (X), and Stevie Wonder albums (Y), which are represented in the graph below. Use it to answer the following questions.



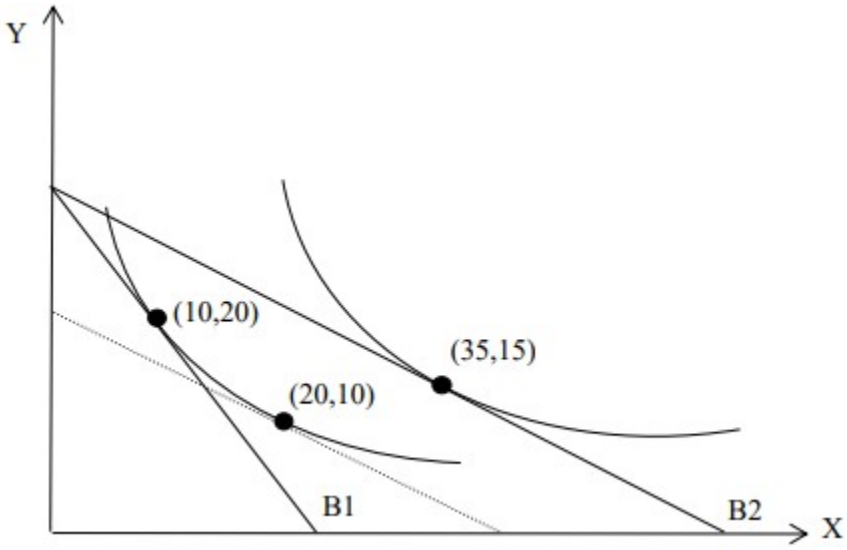
1. Are Al Green albums (X) a normal or inferior good for Prof. Hansen? What about Stevie Wonder albums (Y)? Explain.

2. Suppose Prof. Hansen is initially consuming at point A. Then the price of Al Green albums (X) decreases, causing her to consume at point B. To determine income and substitution effects, which intermediate point should be used to yield the correct result? C or D? Are both okay? (Hint: old utility, new prices.)

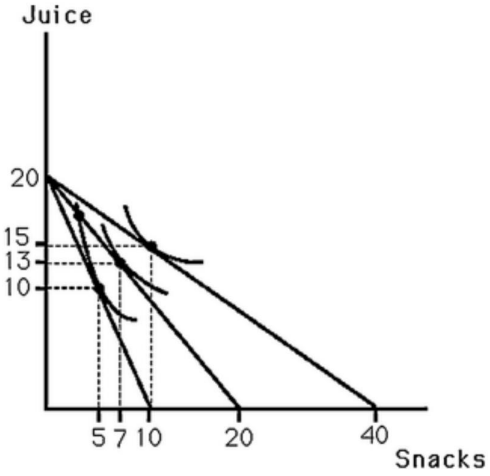
3. Suppose Prof. Hansen is initially consuming at point B. Then the price of Al Green albums (X) increases, causing her to consume at point A. To determine income and substitution effects in this case, which intermediate point should be used to yield the correct result? C or D? Are both okay? (Hint: old utility, new prices.)

4 Multiple Choice Questions

Exercise 4 Use the following information to answer the next two questions. Alice consumes only goods X and Y. The following graph represents Alice's utility maximization problem following an decrease in the price of X, changing her budget line from B1 to B2.



1. Which of the following statements describes Alice's income and substitution effects given the above information and graph?
   (a) Income effect is 5 units of Y; and Substitution effect is 10 units of Y.
   (b) Income effect is -10 units of Y; and Substitution effect is 5 units of Y.
   (c) Income effect is 10 units of Y; and Substitution effect is -5 units of Y.
   (d) Income effect is 5 units of Y; and Substitution effect is -10 units of Y.
2. Now suppose that the initial price of good X is $P_{X1} = \$2$, the new price is $P_{X2} = \$1$, and the price of good Y is $P_Y = \$3$. Suppose that in order to purchase X with the lower price, Alice has to buy a coupon. What is the maximum amount that Alice would be willing to pay for that coupon? (Hint: The greatest amount would be when she retains her old utility level with the new price)
   (a) \$100
   (b) \$80
   (c) \$50
   (d) \$30



Exercise 5 The above figure shows Lily's indifference curves for juice and snacks. Also shown are three budget lines resulting from different prices for snacks. She has \$20 to spend on these goods. Which one of the following point is on Lily's demand curve for snacks?

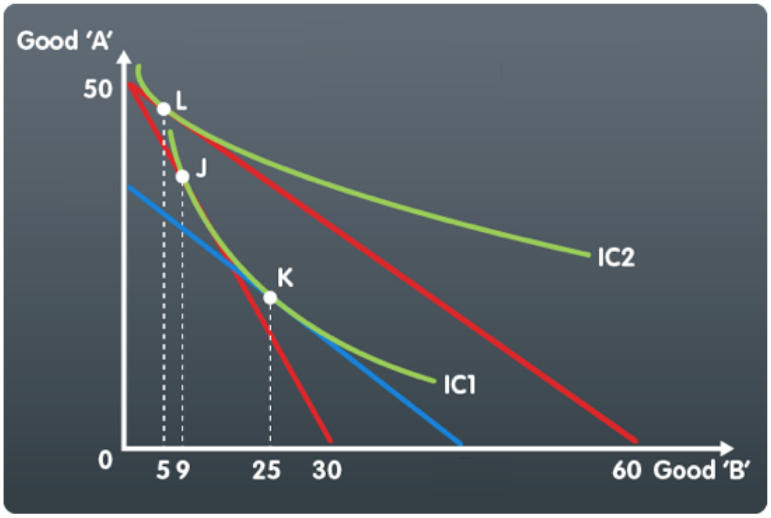
(a) p=\$2, q=7

(b) p=\$2, q=10

(c) p=\$1, q=7

(d) p=\$1, q=10

Exercise 6 Use the following information to answer the next two questions. The following graph[1] describes the situation where the price of good B went down. IC1 indicates the indifference curve before the price change and IC2 indicates the indifference curve after the price change.



1. Which of the following statements describes the income effect?
   (a) The income effect is -20 units of Good B.
   (b) The income effect is -16 units of Good B.
   (c) The income effect is -4 units of Good B.
   (d) The income effect is 16 units of Good B.
2. Which of the following statements is/are true?
   I. The price elasticity of demand is negative.
   II. The price elasticity of demand is positive.
   III. The income elasticity of demand is negative.
   IV. The income elasticity of demand is positive.
   (a) I and III only
   (b) I and IV only
   (c) II and III only
   (d) II and IV only

[1]Graph from Econfix (https://econfix.wordpress.com/2016/09/23/indifference-curves-and-giffen-goods/)