Recitation 3 Answer Key

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Week 3 (9/11-9/17): Consumer Choice (end)

Recap of this week's most important concepts (Consumer Choice):

- Demand Elasticities
  - Percentage change, midpoint method
  - Price Elasticity of Demand: definition, sign, determinants
  - Extreme cases: perfectly elastic / perfectly inelastic
  - Relationship between price elasticity of demand and slope of demand
  - Elasticity on a linear demand changes throughout the demand line (unit-elastic at the "midpoint" on the demand line, elastic above and inelastic below)
  - Impact of a change in the price on sellers' total revenue (or consumers' expenditure) depends on price elasticity of demand
  - Cross-price elasticity of demand: definition, sign (substitutes vs. complements)
  - Income elasticity of demand: definition, sign (normal vs. inferior goods)
- Consumer Choice – Substitution and Income effects:
  - Identifying both effects on a graph
  - Describing directions of each effect.
  - Terminology: If P_X changes:
    - IE reinforces SE if X is normal
      - If X is a *necessity* (income elasticity < 1): IE is weak so total effect is not large: demand is more price-inelastic
      - If X is a *luxury* (income elasticity > 1): IE is strong so total effect is large: demand is more price-elastic
    - IE opposes SE if X is inferior
      - If $IE < SE$: X is *ordinary* (demand for X is downward sloping)
      - If $IE > SE$: X is a *Giffen* good (demand for X is upward sloping)

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1. Doug spends all his money on books and beer. When Doug quit his job and moved to the United States to attend graduate school, his income fell by 50%. Fortunately, beer (an inferior good) is 50% cheaper in the USA. The price of books (a normal good) is the same as in his home country. Which of the following is true?

   a. Doug consumes less of both goods.
   b. Doug consumes more of both goods.
   c. Doug consumes less beer and more books.
   d. Doug consumes fewer books but more beer.

   Solution: d. His income and the price of beer both fall by 50%, so the ratio (Income/Beer) stays the same. However, the price of books stays the same so the ratio (Income/Books) decreases. Therefore, his budget constraint pivots, keeping the same intercept on the beer axis and decreasing the intercept on the books axis. This is equivalent to an increase in the price of books. The effect of an increase in the price of books can be decomposed between substitution effect (SE) and income effect (IE):

   - SE: fewer books, more beer
   - IE: fewer books (normal good), more beer (inferior good)

   Both effects go in the same direction for both goods, so Doug consumes fewer books and more beer overall.

2. Suppose Kelly consumes only donuts and coffee, and she views them as perfect complements. Which of the following statements must be true?

   I. If the price of donuts decreases, her consumption of coffee decreases due to the substitution effect.
   II. When the price of donuts decreases, it is not clear if her consumption of coffee would increase or decrease.
   III. Both donuts and coffee must be normal goods for Kelly.

   a. I. only
   b. II. only
   c. III. only
   d. I. and II.
   e. I. and III.
   f. II. and III.
   g. I., II. and III.
   h. None

Solution: c.

- I is not correct because there is no substitution effect with perfect complements.
- III is correct because if one of the two goods was inferior, the income effect (and therefore the total effect – as there is no substitution effect) would go in opposite directions for each good, which is inconsistent with the goods being perfect complements (and therefore always being consumed together).
- II is not correct because there is no substitution effect but only the income effect, and both goods must be normal, so a decrease in the price of donuts would increase the consumption of donuts and coffee.

3. After William helped his friend John out of a tight spot, John gave William a gift voucher for $100 to spend at one of John's many hotel restaurants. William believes a beer cost $15 and a steaks cost $25 at the restaurant and plans to purchase 5 beers and 1 steak. However, when William arrives for his dinner, he realizes that steaks are actually $20, and decides to purchase 4 beers and 2 steaks instead. Which of the following is true?

   I. William's demand for steak is price-elastic between $20 and $25

   II. Steak and beer are substitutes for William

   III. Steak must be a normal good for William

   a. I. only
   b. II. only
   c. III. only
   d. I. and II.
   e. I. and III.
   f. II. and III.
   g. I., II. and III.
   h. None

Solution: d.

I. The price elasticity of William's demand for steak when the price of steak decreases from $25 to $20 is equal to -3. The price elasticity is higher than 1 (in absolute value) so William's demand for steak is price-elastic between $20 and $25. Note that another way to gure this out is to look as the amount 3 spent by William on steak, which is the price of steak multiplied by the quantity of steak he purchases, so it is equivalent to the concept of seller's total revenue. Here when the price of steak

decreases from $25 to 20$, William's expenditure on steak increases from $25 to 40$. A decrease in the price increases sellers' revenue (or here, consumer's expenditure) if demand is elastic.

II. A decrease in the price of steak decreases his consumption of beer from 5 to 4, so the two goods must be substitutes. Note that the cross price elasticity of his demand for beer when the price of steak decreases from $25 to 20$ is equal to $+1$. The cross-price elasticity of demand is positive for substitutes.

III. The effect on the consumption of steak can be decomposed between substitution effect (SE) and income effect (IE):

- SE: more steak, less beer: steak becomes relatively cheaper, so the substitution effect makes William buy more of the relatively cheaper good (steak) and less of the relatively more expensive good (beer).
- IE: steak becomes cheaper so his purchasing power increases (his real income increase), so his consumption of normal goods increases and his consumption of inferior goods decreases
  - If steak is normal: more steak
  - If steak is inferior: less steak

If steak is normal, both SE and IE go in the same direction (IE "reinforces" SE) and lead to an increase in steak consumption. If steak is inferior, IE and SE go in opposite directions (IE "weakens" SE), but as long as IE is smaller than SE, SE dominates and the overall consumption of steak increases. Here William's overall steak consumption increases, so steak can be either normal or inferior.

Note that given the budget constraint $P_X Q_X + P_Y Q_Y = Income$; if good X is inferior, good Y must be normal. In other words: the goods cannot be both inferior. If they were both inferior, an increase in income would lead to a decrease in the consumption of both goods, so the left hand side of the budget constraint would decrease while the right hand side increases, which is impossible.

The next questions are for your own practice.

4. In an economy with two goods, apples and oranges, which of the following is always true?

   a. The income elasticity of demand for either apples or oranges is positive
   b. The cross-price elasticity of one good for the other is positive
   c. Apples and oranges are complements
   d. Either apples or oranges is inferior

Solution: a. The two goods can be substitutes or complements. So b. and c. are wrong. It is possible to have 2 normal goods, or one inferior good and one normal good but it is impossible to have 2 inferior goods: in that case an increase in income would decrease the consumption of both goods, which is inconsistent with the budget constraint. Therefore a. is correct and d. is incorrect.

5. Suppose Insomnia Cookies (in Houston Hall) marks down all its cookies to \$1 on Wednesdays. The store manager finds that their revenue from cookies decreases on Wednesdays, but that strategy may still be worthwhile because it encourages customers to buy more ice cream. What can Insomnia Cookies conclude about the market for cookies?

   I. Demand for cookies is price-elastic

   II. Cookies and ice cream are complements

   a. I. only

   b. II. only

   c. I. and II.

   d. Neither I. nor II.

   Solution: b. I. is false: Revenue decreases, so the decrease in price must offset the increase in sales, which implies that demand is inelastic (quantity demanded increases less than price decreases). II. is true: Cookies and ice cream are complements: True. When the price of cookies decreases, people buy more cookies and more ice cream, so they use them together.

6. Which of the following is always correct?

   a. The price elasticity of demand is equal to the inverse of the slope of the demand curve.

   b. If the cross-price elasticity of demand is positive, the two goods are complements

   c. Along a linear demand curve, the price elasticity of demand is constant

   d. None of the above

   Solution: d.

   - a. and c. are not correct: The price elasticity of demand is $\epsilon_D = \frac{\%\Delta Q_D}{\%\Delta P} = \frac{\Delta Q/\bar{Q}}{\Delta P/\bar{P}}$, where ΔQ is the change in quantity and $\bar{Q}$ is the average quantity. It can be rewritten as $\epsilon_D = \frac{\Delta Q}{\Delta P} \times \frac{\bar{P}}{\bar{Q}}$. The first fraction, $\frac{\Delta Q}{\Delta P}$, is the inverse of the slope. But the elasticity is not equal to the inverse of the slope, because it also depends on the second fraction $\frac{\bar{P}}{\bar{Q}}$, which increases as we move up the demand curve.

- b. is not correct: if the cross-price elasticity is positive, it means an increase in the price of good 1 leads to an increase in the quantity demanded for good 2, which means they are substitutes.

7. Philly's bike share service Indego has reported falling revenues in the past. To counteract that downward trend, the service decides to reduce its daily price for bike rental from \$11 to \$9, hoping to see an increase of 30% in Indego bike ridership. They are assuming that demand for Indego bike ride is:

   a. Unit Elastic
   b. Elastic
   c. Inelastic
   d. Can't be determined

   Solution: b. Revenue is price multiplied by quantity sold. A decrease in price leads to a greater quantity sold. Overall, the revenue increases if the increase in sales is great enough to compensate the decrease in price, i.e. if demand is elastic.

8. In a Philadelphia high school, 30% of seniors drive to school and 70% ride their bicycles. The price of gasoline increases from \$1 a gallon to \$3 a gallon. After the price change, 10% of the seniors decide to drive to school. The seniors' demand for gasoline is:

   a. perfectly elastic
   b. elastic
   c. unit-elastic
   d. inelastic
   e. perfectly inelastic

   Solution: c. The price elasticity of demand is equal to the percentage change in quantity demanded over the percentage change in price: $\epsilon_D = \frac{\%\Delta Q_D}{\%\Delta P} = \frac{(10-30)/20}{(3-1)/2} = \frac{-1}{1} = -1$.

9. A survey of fruit consumed by Penn students shows that when peaches cost \$5, 100 peaches are demanded. When peaches cost \$3, 200 peaches are demanded. Which of the following statements is true about the demand for peaches between these two prices?

   a. It is elastic
   b. It is inelastic
   c. It is unit-elastic

d. Not enough information.

Solution: a. The price elasticity of demand is equal to the percentage change in quantity demanded over the percentage change in price: $\epsilon_D = \frac{\%\Delta Q_D}{\%\Delta P} = \frac{(200-100)/150}{(3-5)/4} = \frac{200}{150} > 1$.

10. The demand for hot dogs at the Phillies Stadium is given by a linear downward sloping demand. As the price of hot dogs increases, what happens to the price elasticity of demand for hot dogs in the Phillies Stadium?

    a. It increases.

    b. It decreases.

    c. It stays the same.

    d. We require more information about the demand curve.

    Solution: a. As the price increases, we move up on the demand curve, so demand becomes more elastic.

11. John owns a sporting good store in Missouri. As the price of footballs increases from \$20 to \$25, water bottle sales decrease from 50 to 40 per day. What is the cross-price elasticity of demand for water bottles with respect to the price of footballs?

    a. -2

    b. -1

    c. 0

    d. 1

    e. 2

    Solution: b. The cross-price elasticity of demand is equal to the percentage change in quantity demanded for water bottles over the percentage change in price of footballs: $e_{XY} = \frac{\%\Delta Q_X}{\%\Delta P_Y} = \frac{(40-50)/45}{(25-20)/22.5} = \frac{-45}{45} = -1$

12. Alex usually buys 2 bagels and 4 coffees at the Walnut street cafe. Today, the cafe offers 20% off bagels, so Alex decides to buy 4 bagels and 4 coffees. Which of the following must be true for Alex?

    I. Bagels is a normal good

    II. Coffee is a normal good

    III. Bagels and coffee are complements

    IV. Alex's demand for coffee is perfectly inelastic

a. Only I.
b. Only II.
c. Only III.
d. I. and II.
e. I. and III.
f. II. and III.
g. I., II. and III.
h. I., II. and IV.
i. I., II., III., and IV.

Solution: b. When the price of bagels decreases, they become relatively cheaper compared to coffee, so the substitution effect increases the consumption of bagels and decreases the consumption of coffee. The income effect is an increase in consumption if the good is normal, and a decrease in consumption if the good is inferior. The numbers given above show that the total effect is an increase in the consumption of bagels and no change in the consumption of coffee. So bagels could be normal or inferior (as long as substitution effect dominates income effect if they are inferior), so I. is not necessarily true. Coffee must be a normal good, otherwise overall consumption would decrease, so II. must be true. A change in the price of bagels has no impact on coffee consumption so III. is not true. There is no information on the impact of a change in the price of coffee on coffee consumption, so IV. is not necessarily true.