Practice Questions—Chapters 1 to 6.
Introduction and Consumer Theory
ECON 203
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These questions are to help you prepare for the exams only. Do not turn them in. Note that not all questions can be completely answered using the material in the chapter in which they are asked. These are all old exam questions and often the answers will require material from more than one chapter. Questions with lower numbers were asked in more recent years.

1 Chapter 1 and 2—Economic Models and The Mathematics of Optimization

1. Why is every model wrong by construction?

2. What are the three insights from Nezarettin Hoca and the Ants? Which of these is most important? Show that the other two can be derived from this one.

3. List three of the four great insights of rationality. For each one explain what the insight is and for two of them give an example of how you can use this insight.

4. On rationality:

   (a) What is the motivation for economists to assume rationality, or what is the motivational definition of rationality?
   (b) Give the Positive definition of Rationality.
   (c) Give the Normative definition of Rationality.
   (d) Write down the three preference axioms we need for the Normative definition of Rationality, defining each and giving an intuitive (not graphical) counter-example to one of them.

2 Chapter 3—Preferences and Utility

1. We usually assume that people have *monotonic* preferences. A person has *monotonic* preferences if when you give them more of every good they are always happier.

   (a) Give an example that makes it clear that no one's preferences are monotonic.

(b) Prove that someone with monotonic preferences will spend all of their income. You may either use a graph or algebra, and you should start your proof by assuming that the person does not spend all of her income.

2. We generally assume that people have convex preferences. Define this assumption either using words or mathematics, show an indifference curve that is ruled out by this assumption and why it is ruled out, and give a example using only words of preferences that are not convex. Why do we make this assumption? (*HINTS:* your answer to the last question will be related to utility maximization, and writing down a precise definitions using only words is very difficult.)

3. On the preference axiom of *monotonicity.*

   (a) Define this axiom. Your answer does not have to have mathematical terms in it.
   (b) What does this axiom tell us about indifference curves and marginal utilities?
   (c) Why is this axiom completely unreasonable as an assumption about human behavior? Your answer should include an example.
   (d) Prove either using a graph or math that this means that at your optimal consumption ($\{F^*, C^*\}$) you will spend all your income ($p_f F^* + p_c C^* = I$).

4. About *rationality.*

   (a) Write down the three axioms that give us the normative definition of rationality. The best answers will use both words and mathematical symbols, but you may use only one for partial credit.
   (b) For each one write down a counter example using words.
   (c) For two of them draw indifference curves that do not satisfy these axioms.
   (d) Write down the positive definition of rationality, and explain why it does not need to satisfy the three axioms you wrote down in part 4a.

5. On the normative definition of rationality:

   (a) What three axioms of choice make up this definition? Define each one using words or symbols.
   (b) For two of these axioms give a real life example of how these preferences might fail. (You can not use indifference curves in this answer.)
   (c) Show what two of these axioms rule out in indifference curves.

6. Show that a consumer with the utility function $u(x, y) = xy^2$ has the same demand curves as the consumer with the utility function $u(x, y) = \frac{1}{1000} \ln x + \frac{1}{500} \ln y$. Why is this?

2

3 Chapter 4—Utility Maximization and Choice

1. Consider the utility function $U(F,C) = C - \frac{1}{F}$, let p_f be the price of F, p_c be the price of C, and I be the income of this consumer. Assume that the demand for F and C is strictly positive throughout this question unless the question specifically says this is not true.

    (a) Find both of the marginal utilities and verify that they are strictly positive for $C > 0$ and $F > 0$. What does this tell us about this utility function? What does it tell us about the relationship between expenditure $(p_f F + p_c C)$ and income (I)?

    (b) Write down the Lagrangian function he will maximize.

    (c) Find the first order conditions of his maximization problem.

    (d) Solve for the bang for the buck of F and C. Using these find the demand for F.

    (e) Find the demand for C.

    (f) What is a *corner solution*? What mathematical condition tells us that a consumer will be in a corner solution? With this utility function is the consumer ever in a corner solution? If so, when?

    (g) In a table find four values for F and C so that $U(F,C) = 4$ and then graph this indifference curve.

    (h) In the same graph draw the budget set if $p_c = 3$, $p_f = 3$ and $I = 18$. Show the utility maximizing bundle in your graph. HINT: There should be a tangency between your indifference curve and the budget constraint, but the optimal values of F and C will not necessarily be in integers.

2. Roderick is a most unlucky lad. He was born with 5 legs, so he has 1 left feet and 4 right feet. Since he has special needs, his parents let him buy his own shoes, and give him an allowance of I to buy shoes with. His utility function is $U(L,R) = \min\left\{L, \frac{R}{4}\right\}$ where L is the quantity of left shoes he buys and R is the quantity of right shoes he buys.

    (a) In a graph, draw the indifference curve for Roderick where $U(L,R) = 2$. Warning: this graph must be precise.

    (b) Define what we mean when we say that preferences are *convex*. Are these preferences convex? Explain why or why not using the graph above.

    (c) Define what we mean when we say that preferences are monotonic. Are these preferences monotonic? *Warning: Your definition and your answer must agree, be careful that they do.*

    (d) By analyzing the graph find the ratio of L to R that Roderick will always buy, regardless of prices. Explain your reasoning.

(e) Find the demand for L.

(f) Find the demand for R.

(g) Assume that the price of right shoes, p_r, increases. What will be the substitution effect from this price change? Explain.

3. Tolga Han is a simple fellow, since his parents pay for his food and clothes all he spends money on is footballs (F) and candy (C). His utility function is $U(F, C) = FC^4$.

   (a) Is this utility function monotonic? (You should only consider $F > 0$ and $C > 0$).

   (b) Write down the Lagrangian function he will maximize.

   (c) Find the first order conditions of his maximization problem.

   (d) Solve for the bang for the buck of Footballs and Candy. Equalize the bangs for the bucks and find a formula for C in terms of F and prices.

   (e) Find the demand for Footballs.

   (f) Find the demand for Candy.

4. For the utility function $U(F, C) = F^{\frac{3}{5}} C^{\frac{1}{3}}$.

   (a) Is this utility function monotonic? (You should only consider $F > 0$ and $C > 0$).

   (b) Find another utility function that is ordinally equivalent to this one. You may use this utility function throughout the rest of the question. Be sure to show that the two utility functions are equivalent.

   (c) Write down the Lagrangian function he will maximize.

   (d) Find the first order conditions of his maximization problem.

   (e) Solve for the bang for the buck of F and C. Equalize the bangs for the bucks and find a formula for C in terms of F and prices.

   (f) Find the demand for F.

   (g) Find the demand for C.

5. Mark Aydin is a simple lad, all he really wants in life is Popcorn (C) and Olives (O). His parents (who do ensure that he eats a healthy diet) have decided to give Mark Aydin an allowance of A to spend on his two favorite goods. The price of olives is p_o, the price of popcorn is p_c and Mark Aydin's utility function is $U(O, C) = 2C + 12O^{\frac{1}{2}}$.

   (a) Write down the Lagrangian function he will maximize.

   (b) Find the first order conditions of his maximization problem.

   (c) Solve for the bang for the buck of Olives and Popcorn.

(d) By equalizing the bang for the bucks find his demand for olives. *Note: You may assume that he consumes a strictly positive amount of both goods.*

(e) Find the demand for popcorn.

(f) Find conditions on p_o, p_c, and A such that Mark Aydin will choose not to consume any popcorn.

(g) What kind of solution to his maximization problem is it when he consumes none of one (or more) goods? Is this type of solution common or weird for real consumers? Explain.

(h) If $p_o = 3$ and $p_c = 3$ and $A = 96$, graph and clearly label his budget set, his optimal consumption, and an indifference curve through that consumption bundle below. *Your graph does not need to be too precise, but I expect it to look approximately correct.*
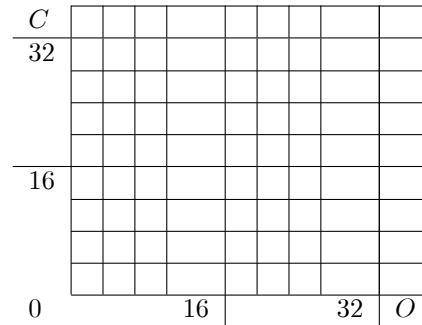
6. If you have Constant Elasticity of Substitution utility function with 3 goods (X, Y, and Z) the demand curves will have the form $X = \theta_x \left(p_x, p_y, p_z\right) I$, $Y = \theta_y \left(p_x, p_y, p_z\right) I$, and $Z = \theta_z \left(p_x, p_y, p_z\right) I$.

(a) Find a general formula for the share of your income that you spend on the good X. Find a constraint on $\theta_x \left(p_x, p_y, p_z\right)$ using this formula.

(b) Find the income elasticity of X, is this good normal, inferior, or a luxury good? Explain your answer, if it can be more than one list all of the categories it fits into.

(c) Using the budget constraint find a constraint on $\theta_x \left(p_x, p_y, p_z\right)$, $\theta_y \left(p_x, p_y, p_z\right)$ and $\theta_z \left(p_x, p_y, p_z\right)$.

(d) What is the most unrealistic aspect of Constant Elasticity of Substitution demand curves (compared to real demand curves)?

(e) Write down three common utility functions that are Constant Elasticity of Substitution Utility functions. You may answer either using verbal descriptions or by writing down sample Utility functions.

7. Assume that your utility function is $U\left(F, C\right) = -\frac{1}{4F} - \frac{1}{C}$ where F is food, C is clothing, p_f and p_c are the prices of food and clothing respectively, and I is your income.

(a) Is this utility function monotonic? If it is what can you assume about the budget set? (The Budget Set is the $\{F, C\}$ such that $p_f F + p_c C \leq I$.)

(b) Write down the Lagrangian function you will maximize.

(c) Find the first order conditions of her maximization problem.

(d) Solve for the bang for the buck for Clothing and Food.

(e) Solve for the quantity of Food demanded in terms of Clothing and prices.

(f) Solve for the demand curve for Candy bars.

(g) Solve for the demand curve for Food.

(h) What is the income elasticity of these goods? Are they normal, inferior, or luxury goods? (Hint: Guesses will get no credit but the answer should be a constant like 2 or $\frac{1}{3}$.)

8. Assume that the utility function is: $U(F, C) = 2\sqrt{F} + 2C$ where F is food, C is clothing. Let p_f and p_c be the prices of food and clothing respectively, and I be the income.

(a) Is this utility function monotonic? If it is what can you assume about the budget set? (The Budget Set is the $\{F, C\}$ such that $p_f F + p_c C \leq I$.)

(b) Find the bang for the buck of food and clothing. Under what conditions will this person consume only food? What type of solution is this to her utility maximization problem?

For the rest of the question you can assume that this consumer consumes a positive amount of both food and clothing.

(c) Write down the Lagrangian function she will maximize.

(d) Find the first order conditions of her maximization problem.

(e) Solve for the bang for the buck of Clothing and Food.

(f) By equalizing the bang for the bucks solve for the demand for Food.

(g) Using the budget constraint demand for Clothing.

(h) What is the derivative of these goods with respect to income? Are they normal or inferior?

9. Lale is a simple child, all she wants is Candy Bars (C) and French Fries (F). Her mom (who *does* make sure she eats a healthy diet) gives her I lira a week to buy whatever she wants. Assume her utility function is:

$$U(C, F) = -C^{-1} - F^{-1}$$

(a) Is Lale's utility function monotonic? Prove your answer.

(b) Write down the Lagrangian function she will maximize.

(c) Find the first order conditions of his maximization problem.

(d) Solve for the bang for the buck for candy bars and french fries, and equalize.

(e) Solve for the quantity of French fries demanded in terms of Candy bars and prices.

(f) Solve for the demand curve for Candy bars by substituting the above term into the budget constraint.

(g) Solve for the demand curve for French fries.

10. Assume that Ata Demirer (from Avrupa Yakasi) has decided to start an Extreme Aiken diet, where he eats nothing but kofte (K) and sis kebap (S). He doesn't really care about which he eats, just the total quantity so we can write his utility function as: $U(K, S) = \frac{3}{4}K + S$ where we multiply K by $\frac{3}{4}$ because each serving of kofte (K) is smaller than a serving of sis kebap (S).

(a) Find the bang for the buck of K and S.

(b) When will he consume no S? When will he consume no K? What kind of solution to his utility maximization problem is it when he consumes no K or no S?

(c) Find his demand functions for K and S. (Notice that little algebra is called for, given your answer to b you should be able to write them down and explain why they have the form the do.)

11. Lale is a simple child, all she wants is Candy Bars (C) and French Fries (F). Her mom (who *does* make sure she eats a healthy diet) gives her I lira a week to buy whatever she wants. Assume her utility function is:

$$U(F, C) = F^2 C^4$$

(a) What is another utility function that is ordinally equivalent to this utility function?

(b) Write down the Lagrangian function she will maximize.

(c) Find the first order conditions of her maximization problem.

(d) Solve for the bang for the buck for candy bars and french fries.

(e) Solve for the quantity of French fries demanded in terms of Candy bars and prices.

(f) Solve for the demand curve for Candy bars.

(g) Solve for the demand curve for French fries.

12. Sam Longshanks' utility function for food and clothing is $U(F, C) = CF^2 + 2F^2$. He's a simple fellow so all he spends his income (I) on is food (F—which has a price of p_f) and clothing (C—which has a price of p_c). In this question always assume that Sam spends some money on both food and clothing.

(a) If you substitute in $X = C+2$ what standard type of utility function is the new function $V(F, X)$? You can use this to simplify your further analysis.

(b) Set up Lagrangian

(c) Find the first order conditions for an optimum.

(d) Using the first order conditions find a function of X (or C) in terms of F and prices.

(e) Find the demand curve for F from the budget constraint.

(f) Find the demand curve for C.

13. Consider a student who only consumes CDs (C) and Fast Food (F). Let the price of CDs be p_c and the price of Fast Food be p_f. Assume that their utility function is:

$$U(F, C) = 8 \ln F + C$$

(a) Set up the Lagrangian and find the first order conditions, where the income of the student is I.

(b) Assuming that she consumes both Fast Food and CDs solve for her demand curves.

   i. By equalizing the bang for the buck's solve for F in terms of prices.

   ii. Using the budget constraint solve for the demand curve for C. Notice that you've already solved for the demand curve for F.

(c) Solve for the "Bang for the buck" for Fast Food and CDs. If $F = 1$, $C = 3$, $p_f = 1$, $p_c = 16$ what should she increase her consumption of? Why?

(d) Assume that $p_f = 1$.

   i. How high does the price of CD's have to be before she will spend all of her money on Fast Food (the answer will be in terms of income, I and the price of CD's, p_c)?

   ii. Consuming all Fast food is what type of solution to her maximization problem?

14. Professor Samaritan always gives two midterm exams in his Finance course. He only uses the higher of the two scores that a student gets on the midterms when he calculates the course grade.

(a) Kim Noodler wants to maximize her grade in this course. Let m_1 be her score on the first midterm and m_2 be her score on the second midterm. In a graph with m_2 on the vertical axis and m_1 on the horizontal axis plot an indifference curve that passes through $m_1 = 10$ and $m_2 = 80$, and another that passes through $m_1 = 70$ and $m_2 = 60$. Which of these combination of scores would Kim prefer?

(b) Are Kim's preferences convex? What would be the best way to allocate her time between the two midterms?

It turns out that Kim is also taking an Economics of Law course from Professor Rasputin who also gives two midterms but—unlike Prof. Samaritan—she throws out the higher of the two grades when calculating the final score. Again, let m_1 be Kim's score on the first midterm and m_2 be her score on the second midterm.

(c) In a graph plot an indifference curve for Kim that passes through m_1=20 and m_2=70 and another one that passes through m_1=60 and m_2=50. Which of these combinations of Economics scores would Kim prefer?

(d) Are Kim's preferences convex?

(e) I'm considering which of these two methods to use. Since all of the material in this class is important, I want to be sure that you guys understand everything to at least some degree. Which of these two methods would you recommend to me? Why?

15. For this problem the consumers utility function is $U(F, C) = FC^2$, where income equals 6, and the price of food and clothing are both two.

   (a) Find what the consumers will consume and graph her indifference curve through that consumption bundle.

   (b) Now assume that the price of x falls to one, find her new consumption bundles and graph her new indifference curve.

   (c) Find the point on the old indifference curve where the consumer would consume at the new prices.

   (d) Indicate the Income and Substitution effects on a graph.

4 Chapter 5—Income and Substitution Effects

1. Define *Consumer Surplus*, you may use a graph or words. Why is it not a good measure of Consumer Welfare? What characteristics of a good make Consumer Surplus an acceptable measure of Consumer Welfare.

2. Define a *normal* and a *luxury* good and give examples of both kinds of goods. Be sure that your definition makes it clear how to tell the two apart.

3. About the impact of income and prices.

   (a) Write down the Slutsky equation in elasticity form. Define all terms used.

   (b) When a price changes what two effects does it have on demand? Define each effect and relate it to a term in the Slutsky equation.

(c) If we have a normal good, which will cause a bigger increase in the demand for that good?

    i. A 1% increase in the income.

    ii. A 1% decrease in the price.

Explain your answer. Note: Clearly a precise answer will depend on the elasticities, I am looking for a general guideline. A wrong answer carefully argued can get almost full credit.

(d) If we have an inferior good, which will cause a bigger increase in the demand for that good?

    i. A 1% decrease in the income.

    ii. A 1% decrease in the price.

Explain your answer. Note: Clearly a precise answer will depend on the elasticities, I am looking for a general guideline. A wrong answer carefully argued can get almost full credit.

4. A scientist in Moldavia has just invented *thneed*. A thneed's a fine something that everyone needs. It's a shirt. It's a sock. It's a glove. It's a hat. But it has other uses. Yes far beyond that. It can be used to build buildings. Made into a car. You can even eat it, with it you will go far.

Unfortunately, for practically every use it's been put to (and it can do almost everything) it has always been worse than the original. As food it is rather nasty tasting, even though it's very good for you—you literally don't need to eat anything else. Houses built with thneed invariably leak, and the cars tend to need repair a lot. For clothing not only is it scratchy but it has a very ugly yellow-green color. Basically you have to be desperate to use thneed, on the other hand it is cheap—it sells for 10 kurus a kilo.

(a) Based on the paragraph above, is thneed a normal good, a luxury good, or an inferior good? Explain your answer.

(b) Write down the slutsky equation in elasticity form.

(c) I argue that of any good ever described, thneed is the most likely to have an upward sloping demand curve. Using the slutsky equation explain my reasoning.

(d) Define Consumer surplus, would consumer surplus be a good measure of consumer welfare for thneed? Why or why not.

(e) The Turkish government wants to increase the consumption of thneed because of its health benefits. They are considering three different programs, for each program indicate which program will increase the consumption of thneed (if there is a choice) and using a graph show why you think this. You may assume that demand is downward sloping in this section.

    i. A price subsidy or tax.

    ii. An income subsidy or tax.

    iii. Giving X units of thneed to each consumer. In this part indicate what size X should be to increase consumption of the average consumer.

(f) If the demand for thneed is upward sloping how would it change your answers to the last part of the question, if at all.

(g) Which author in what book first invented thneed?

5. About the Slutsky equation.

(a) Write down the Slutsky equation in elasticity or derivative form.

(b) Define $I(p_x, p_y, U_0) = \min_{X,Y} p_x X + p_y Y - \lambda(U(X,Y) - U_0)$, $h_x(p_x, p_y, U_0)$ as the Hicksian or Income Compensated demand for X, and $X(p_x, p_y, I)$ as the normal or Marshallian demand for X. Given the identity $X(p_x, p_y, I(p_x, p_y, U_0)) = h_x(p_x, p_y, U_0)$ derive the Slutsky equation in elasticity form.

(c) When a price changes what two effects does it have on demand? Define each effect and relate it to a term in the Slutsky equation.

(d) Illustrate the two effects with three graphs, one of the total effect and one of each effect in isolation. Which graph corresponds to which term in the Slutsky equation?

6. The price of gasoline has increased from $p_g^o = 1$ to $p_g^n = 2$. In order to lessen the impact on the citizens, the government is planning on giving out an income subsidy of $S_g = 8$. Assume that the income of all consumers is $I = 32$ and that the price of all other goods (Y) is one. There are 3 consumers in this society, their consumption of gasoline (G) before and after the changes are listed below:

	G_0	G_n
Ahmet (A)	6	4
Baris (B)	14	12
Cansu (C)	16	6

assume that all of these consumers have monotonic preferences.

(a) In the graph below draw the old and new budget sets and the old and new consumption points of all consumers. Label all critical points. Label the consumption bundles by the first letter of the person's name and an o (old consumption) or n (new consumption) subscript. To be clear, for Cansu you should label the points C_o (her old consumption) and her new consumption C_n, Ahmet A_o and A_n and Baris B_o and B_n for his new consumption.

Your graph does not need to be too precise, but I expect it to look approximately correct.

Y

40

20

0   15   30   G
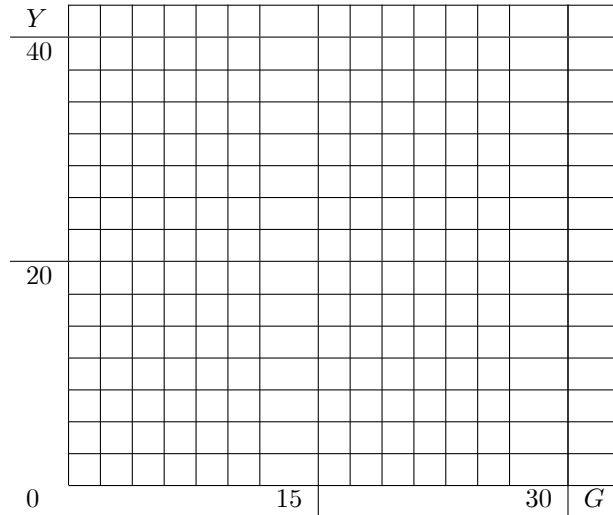
(b) How was the fact that preferences were monotonic critical to answering the last question correctly?

(c) Which of these consumers can you be sure will be better off after the change? Which will be worse off? Which can you not tell? In each case explain your reasoning, points will not be awarded for correct guesses.

(d) The government notices that more than half their citizens are worse off after the price increase and the subsidy.

    i. Given the information above, they ask you to find the lowest subsidy that will guarantee at least half the citizens will be better off.

    ii. What more information could you use to decrease the amount of the subsidy? How would you use it?

7. About defining and using the Slutsky equation.

(a) Write down the Slutsky equation in elasticity or derivative form.

(b) Explain how this equation indicates the two effects of a change in price on the demand for a good. Describe each effect and explain what terms in the equation captures each effect.

(c) Explain how this equation captures the difference between net and gross substitutes. Be sure to clearly explain the difference between the net and gross concepts.

(d) Using this equation explain how X can be a gross substitute of Y while Y is a gross compliment of X.

8. In this question I want you to illustrate graphically the two effects of an increase in price on the quantity demanded. Throughout this question assume $U(X,Y) = XY$. With this utility function the demand curves are $X = \frac{1}{2}\frac{I}{p_x}$ and $Y = \frac{1}{2}\frac{I}{p_y}$ and the bang for the buck of X is $\frac{U}{p_x X}$, and for Y is $\frac{U}{p_y Y}$.

   (a) What are these two effects? Define each effect. What do we know about the sign of these effects? If we can't be sure about the sign of one of the effects when will it be positive and when will it be negative?

   (b) In a graph draw a budget set when income (I) is 48, the price of X (p_x) is 2 and the price of Y (p_y) is 12. Also graph the budget set when p_x increases to 8 (I and p_y are the same as before). Indicate the old and new consumptions of X in the graph, label the old consumption X_o and the new consumption X_n.

   (c) What will utility be at the old consumption? Draw this indifference curve in a graph

   (d) How much X and Y would this person consume if they were on the old indifference curve but faced the new prices (when $p_y = 12$, $p_x = 8$)? Indicate the level of X consumed on a graph, denote it X_i.

   You can answer this question either mathematically or using the graph, but for full credit your answer must be exactly correct. The answer will be an integer.

   (e) Is this good normal or inferior? You can answer this question either using math or the graph. If you answer it using math you must show how the graph is consistent with your answer.

   (f) Using the three points $\{X_o, X_n, X_i\}$ identify the two effects of an increase in p_x on the demand for X. Explain why these differences represent the two effects.

   (g) Write down the Slutsky equation in either derivative or elasticity form—defining each term. Discuss how this captures the two effects of an increase in p_x on the demand for X, relating your answers to your answer in part f.

9. In this question I want you to graphically represent the income and the substitution effect. In this problem the price of X will increase from p_x^o to p_x^n, the price of Y will be unchanged at p_y and the income will be I. In the graph on page 14 the indifference curve is the level of utility this person gets at (p_x^o, p_y, I).

   (a) In the graph on page 14 draw the old budget constraint. Be sure to label the points where it touches the axes using (p_x^o, p_y, I). Also try to make it tangent to the indifference curve at $X = 4$ $Y = 8$. The old consumption of X, X_o, will be 4.

(b) In the graph on page 14 draw the new budget constraint. Be sure to label the points where it touches the axes using (p_x^n, p_y, I).

(c) Now in the graph on page 14 draw an intermediate budget constraint where the prices are (p_x^n, p_y) but the income is high enough that the budget constraint just touches the indifference curve. Label the intermediate level of consumption of X you find X_i.

(d) What is the relationship between X_o and X_i? Is $X_i \geq X_o$ or $X_i \leq X_o$? Is this just a coincidence or is this always true? Why? Is $X_i - X_o$ the income or the substitution effect?

(e) If X is an inferior good what is the relationship between the final consumption (X_n) and X_i? Is $X_i \geq X_n$ or $X_i \leq X_n$? Is $X_n - X_i$ the income or the substitution effect?

(f) If X is a normal or luxury good what is the relationship between the final consumption (X_n) and X_i? Is $X_i \geq X_n$ or $X_i \leq X_n$?
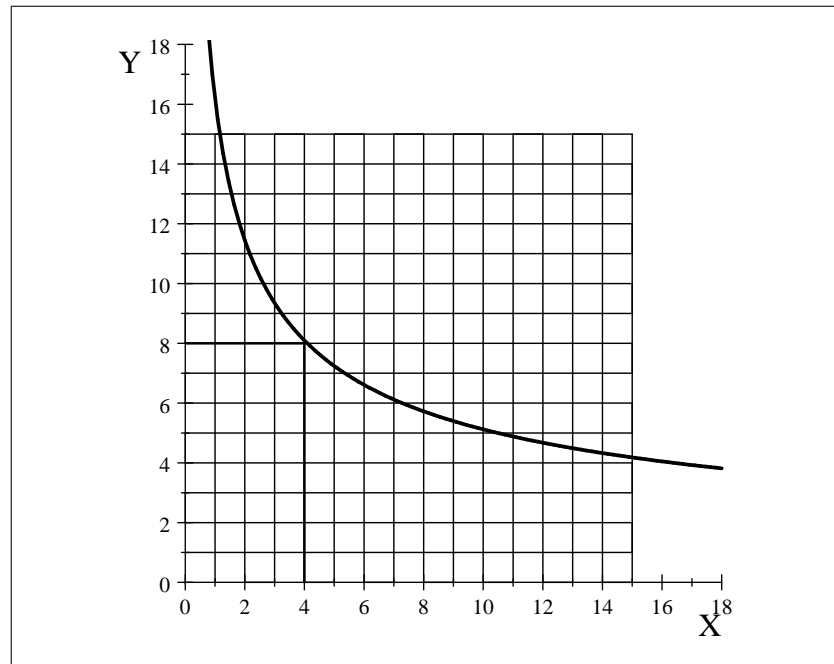
10. In this question I want you to compare Consumer Surplus and Compensating Variation. Compensating Variation is the area between the Hicksian (or *compensated*) demand curve and the vertical axis between the old and new price.

(a) Define Compensating Variation in more intuitive terms. In other words explain the concept Compensating Variation captures that makes it a welfare concept.

(b) At the old price what relationship will there be between Marshallian (or standard) demand for X and the Hicksian demand for X. Why is this true?

(c) Write down the Slutsky equation in elasticity or derivative form, and explain how this captures the substitution and income effect.

(d) Give an example of a good where the difference between Consumer Surplus and Compensating variation will be small and explain why the difference will be small using the Slutsky equation.

(e) Explain how the Slutsky equation can be used to find the difference in the slope (or elasticity) of the Hicksian and Marshallian demand curves.

(f) Using your answers to parts 10b and 10e in a graph draw a Marshallian demand curve and a Hicksian demand curve, and the change in Consumer Surplus and Compensating variation when the price of X changes from p_x^o to p_x^n. Be sure that the Marshallian demand is X_0 at the price p_x^o.

11. The Turkish government has decided they want to increase the consumption of bread and are considering three options.

(a) An Income Subsidy (Increasing Income) so that people can afford more bread.

(b) Giving out "Bread Tickets"—in this program the government gives each person a number of tickets that can only be used to purchase bread.

(c) A price subsidy or price ceiling that will reduce the price of bread.

Please answer the following questions about these three programs.

(a) What type of good is bread in Turkey? Is it normal, inferior, or a luxury good?

(b) In a graph show the impact of an Income Subsidy. Who would increase their consumption of bread? Would anyone decrease their consumption of bread?

(c) In a graph show the impact of Bread Tickets. Who would increase their consumption of bread? Would anyone decrease their consumption of bread?

(d) In a graph show the impact of a price subsidy. Who would increase their consumption of bread? Would anyone decrease their consumption of bread?

(e) Given that the Turkish government chose a price subsidy over bread tickets or an income subsidy what does this tell you about their goal? Do they want everyone to consume more bread or only some people? How can you tell?

12. Why can demand curves sometimes slope upwards? Why do we usually assume that demand curves are downwards sloping?

13. The government is considering giving food tickets to people, these tickets entitle the holder to one unit of food per ticket. Assume that they are not planning on giving that many tickets to each person.

    (a) What type of good is food? What does this mean about the elasticity of food with respect to income?

    (b) Draw a representative consumer's budget set before and after the government institutes this policy.

    (c) You think there are three possible reasons they might want to give food tickets to everyone.

        i. To increase the amount they spend on food.
        ii. To decrease the amount they spend on food.
        iii. To make sure that everyone spends at least a certain amount on food.

    Evaluate whether the program achieves each of the three above objectives. Argue your case each time.

14. When there is a change in one price:

    (a) Write down the Slutsky Equation in derivative form and then derive the equation in elasticity form using this equation.

    (b) Using words and symbols define the two effect captured by the Slutsky equation, and explain why each one is there.

    (c) For each of the following equations, state whether they can be demand functions, and if they can what share of income must be spent on X?

        i. $X(p_x, p_y, I) = 10 p_x^{\frac{3}{4}} p_y^{-2} I^{-3}$
        ii. $X(p_x, p_y, I) = 12 p_x^2 p_y^{-\frac{2}{3}} I^{-1}$

15. The Turkish government is considering new methods to subsidize the consumption of bread, which is an inferior good. Their current method is a price ceiling, refusing to allow bread makers to charge more than a certain price.

    (a) They are considering replacing this with a direct subsidy of bread, giving everyone a certain number of "bread tickets" that can only be used of purchasing bread. Explain why this policy will not increase the amount of bread consumed and might decrease it.

    (b) One evil politician suggests that instead of bread tickets the government should just raise the income tax. Explain how this policy is better than bread tickets.

(c) One politician listens carefully to your answer above and suggests that it might be best to tax bread. Is he completely crazy? Is it possible that this could increase the consumption of bread? Why? Is this as good as the evil politicians idea? Use the concept of income and substitution effects in your answer.

16. The state of Kansas in the United States is concerned because the consumption of Margarine (made with corn oil–one of their chief products) is too low. Margarine is an inferior good, in this case discuss the effect of:

   (a) Giving each Kansan ten pounds of Margarine per month.

   (b) Changing the Kansans' income through an income tax/subsidy. (Hint, why didn't I say "increasing" the Kansans' income?)

   (c) Changing the price of Margarine through a direct subsidy tax.

   Compare the effect of each of these policies on the demand for margarine, and rank them where possible.

17. When the price of gasoline was $1.00 per gallon, Joe consumed 1000 gallons of gasoline. The price increased to $1.50, and the government told Joe that it would give him $500 to offset the price increase. Will Joe be happier, the same, or less happy after the price increase and transfer? How much gasoline will he consume? Use the concepts of substitution and income effect in your answer. THERE IS A CLEAR ANSWER TO THIS, THINK IT THROUGH!

5   Chapter 6—Demand Relationships Among Goods.

1. Assume that a consumer has a Cobb-Douglass utility function for X and Y, and the demand functions $X = \frac{\alpha I}{p_x}$, $Y = \frac{\beta I}{p_y}$ for $\alpha > 0$ and $\beta > 0$.

   (a) Find the elasticity of X and Y with regards to p_x, p_y, and I. To be clear you need to find six elasticities.

   (b) Find the share of your income that you spend on X and on Y. To be clear you need to find two income shares. What constraints can you place on α and β based on these shares?

   (c) Are X and Y gross compliments or gross substitutes? Are X and Y net compliments or net substitutes? Warning: You must support your answer with clear mathematics.

2. Assume that this person's demand for X is given by:

$$X = \frac{1}{2p_x p_y^2} I^3$$

(a) Find the elasticities of X with respect to p_x, p_y, and I. Is Y a gross substitute or complement of X? Is X a normal, inferior, or luxury good? (Hint: Guesses will get no credit, but the answer should be a constant, like 3 or $\frac{1}{2}$.)

(b) Write down the Slutsky Equation in elasticity form.

(c) What is the share of income this person spends on X? The answer will be a function of prices and income. Do not assume that you know the values of prices or income.

For the rest of the question assume that $I = 1$ and $p_y = 1$.

(d) Assume that $p_x = 1$, are X and Y net substitutes or net compliments? (Notice that the share of income spent on Y is $s_y = 1 - s_x$.)

For the rest of the problem assume that p_x has risen, the old price is $p_x^o = 1$ while the new price is $p_x^n = 2$.

(e) Using the demand curve find the old and new quantities of X, label your answers as X_0 and X_n.

(f) In a graph draw the two budget sets and the old and new consumption points. Indicate X_0 and X_n.

(g) In the same graph now find a possible indifference curve and the imaginary budget line that indicates the quantity this person would buy at the new prices if they had enough income to stay on the same indifference curve as before the price change. Label the quantity of X they would consume in this case as X_i.

(h) Indicate the income and the substitution effect of the price change using these three quantities ($\{X_o, X_i, X_n\}$). Does the income effect have the same sign as the substitution effect? Why or why not?

3. Why can X be a gross substitute of Y while Y is a gross compliment of X? Why can X NOT be a net substitute of Y if Y is a net compliment of X?

4. Assume that the demand curve for food is $F = I^3 p_c^{-2} p_f^{-2}$ and the demand for clothing is $C = I^{-4} p_f^1 p_c^{-3}$.

(a) Find out if each good is normal, inferior, or a luxury good.

(b) Is food a gross compliment or gross substitute of clothing? Is clothing a gross substitute or a gross complement of Food?

(c) Write down the slutsky equation.

(d) If the share of income spent on clothing ($\frac{p_c C}{I}$) is $\frac{1}{8}$ and the share spent on food ($\frac{p_f F}{I}$) is $\frac{1}{2}$ are these goods net substitutes or complements?

5. Assume that the demand for F and C are given by:

$$
\begin{aligned}
F &= 10 - 2p_f + p_c + I \\
C &= 15 - 2p_c - p_f + I
\end{aligned}
$$

where p_f is the price of food, p_c is the price of clothing, and I is income.

(a) What is the difference between net and gross substitutes? Use the slutsky equation in your answer.

(b) Are F and C gross substitutes or complements?

(c) Are F and C net substitutes or complements? Assume that $I = 5$ and $p_c = p_f = 1$.