

ECON 301

Due: Oct. 8 (ECON 301/001) and Oct. 9 (ECON 301/003)

Due at the beginning of class.

The problem set can be submitted in groups of up to 4 students.

Answers must be typed or clearly hand-written.

No late problem sets will be accepted.

Attention: justify your answers by showing the steps of your argument/reasoning. Show your work. Numerical answers not accompanied by related work will not be considered.

PROBLEM SET 2

1. Linus has the utility function $U(x, y) = x + 3y$.
 - a. Use blue ink to draw the indifference curve passing through the point $(x, y) = (3, 3)$. Use black ink to sketch the indifference curve connecting bundles that give Linus a utility of 6.
 - b. On the same graph, use red ink to draw Linus's budget line if the price of x is 1 and the price of y is 2 and his income is 8. What bundle does Linus choose in this situation?
 - c. What bundle would Linus choose if the price of x is 1, the price of y is 4, and his income is 8?

2. Clara's utility function is $U(X, Y) = (X + 2)(Y + 1)$, where X is her consumption of good X and Y is her consumption of good Y .
 - a. Write an equation for Clara's indifference curve that goes through the point $(X, Y) = (2, 8)$. On the axes, sketch Clara's indifference curve for $U = 36$.
 - b. Suppose that the price of each good is 1 and that Clara has an income of 11. Draw in her budget line. Can Clara achieve a utility of 36 with this budget?
 - c. At the commodity bundle, (X, Y) , what is Clara's marginal rate of substitution (MRS)?
 - d. What is Clara's utility maximizing consumption of goods X and Y ?

3. Ambrose, the nut and berry consumer, has a utility function $U(x_1, x_2) = 4\sqrt{x_1} + x_2$ where x_1 is his consumption of nuts and x_2 is his consumption of berries.
 - a. The commodity bundle $(25, 0)$ gives Ambrose a utility of how much? Other points that give him the same utility are $(16, 4)$, $(9, \underline{\quad})$, $(4, \underline{\quad})$, $(1, \underline{\quad})$, and $(0, \underline{\quad})$. Plot these points and draw a red indifference curve through them.
 - b. Suppose that the price of a unit of nuts is 1, the price of a unit of berries is 2, and Ambrose's income is 24. Draw Ambrose's budget line with blue ink. How many units of nuts does he choose to buy? How many units of berries?
 - c. Find some points on the indifference curve that gives him a utility of 25 and sketch this indifference curve (in red).
 - d. Now suppose that the prices are as before, but Ambrose's income is 34. Draw his new budget line (with pencil). How many units of nuts will he choose? How many units of berries?
 - e. Suppose that the price of nuts is still 1 and the price of berries is 2, but Ambrose's income is only 9. Draw his budget line (in blue). Sketch the indifference curve that passes through the point $(9, 0)$. What is the slope of his indifference curve at the point $(9, 0)$?
 - f. What is the slope of his budget line at this point?
 - g. Which is steeper at this point, the budget line or the indifference curve?
 - h. Can Ambrose afford any bundles that he likes better than the point $(9, 0)$?

4. In her communications course, Nancy takes two examinations. Her overall grade for the course will be the maximum of her scores on the two examinations. Nancy decides to spend a total of 400 minutes studying for these two examinations. If she spends m_1 minutes studying for the first

examination, her score on this exam will be $x_1 = m_1/5$. If she spends m_2 minutes studying for the second examination, her score on this exam will be $x_2 = m_2/10$.

- a. Draw a “budget line” showing the various combinations of scores on the two exams that she can achieve with a total of 400 minutes of studying. On the same graph, draw two or three “indifference curves” for Nancy. On your graph, find the point on Nancy’s budget line that gives her the best overall score in the course.
 - b. Given that she spends a total of 400 minutes studying, find Nancy’s optimal scores for the first and second examination. What is her overall score?
5. Mary’s utility function is $U(b, c) = b + 100c - c^2$, where b is the number of silver bells in her garden and c is the number of cockle shells. She has 500 square feet in her garden to allocate between silver bells and cockle shells. Silver bells each take up 1 square foot and cockle shells each take up 4 square feet. She gets both kinds of seeds for free.
- a. To maximize her utility, given the size of her garden, how many silver bells and cockle shells, should Mary plant?
 - b. If she suddenly acquires an extra 100 square feet for her garden, how much should she increase her planting of silver bells and cockle shells?
 - c. If Mary had only 144 square feet in her garden, how many cockle shells would she grow?
 - d. If Mary grows both silver bells and cockle shells, how large her garden must be in square feet?
6. Donald Fribble is a stamp collector. The only things other than stamps that Fribble consumes are Hostess Twinkies. It turns out that Fribble’s preferences are represented by the utility function $u(s, t) = s + \ln t$, where s is the number of stamps he collects and t is the number of Twinkies he consumes. The price of stamps is p_s and the price of Twinkies is p_t . Donald’s income is m .
- a. Show that if he buys both goods, Donald’s demand function for Twinkies depends only on the price ratio and not on his income.
 - b. Since there are only two goods, any money that is not spent on Twinkies must be spent on stamps. Use the budget equation and Donald’s demand function for Twinkies to find an expression for the number of stamps he will buy if his income is m , the price of stamps is p_s and the price of Twinkies is p_t .
 - c. What happens if $m < p_s$?
 - d. Donald’s wife complains that whenever Donald gets an extra dollar, he always spends it all on stamps. Is she right? (Assume that $m > p_s$.) Why?
 - e. Suppose that the price of Twinkies is \$2 and the price of stamps is \$1. Draw Fribble’s Engel curve for Twinkies in red ink and his Engel curve for stamps in blue ink. (Hint: First draw the Engel curves for incomes greater than \$1, then draw them for incomes less than \$1.)
7. The government’s Bureau of Labor Statistics periodically makes studies of family budgets and uses the results to compile the consumer price index. The tables below report total current consumption expenditures and expenditures on certain major categories of goods for 5 different income groups. People within each of these groups all had similar incomes. Group A is the lowest income group and Group E is the highest.

TABLE 1 - Expenditures by Category for Various Income Groups

Income Group	A	B	C	D	E
Food Prepared at Home	465	783	1078	1382	1848
Food Away from Home	68	171	213	384	872
Housing	626	1090	1508	2043	4205
Clothing	119	328	508	830	1745
Transportation	139	519	826	1222	2048
Other	364	745	1039	1554	3490
Total Expenditures	1781	3636	5172	7415	14208

TABLE 2 – Percentage Allocation of Family Budget

Income Group	A	B	C	D	E
Food Prepared at Home	26	22	21	19	13
Food Away from Home	3.8	4.7	4.1	5.2	6.1
Housing	35	30			
Clothing	6.7	9.0			
Transportation	7.8	14			

- a. Complete Table 2.
 - b. Which of these goods are normal goods? Which of these goods satisfy your textbook's definition of luxury goods at most income levels?
 - c. Which of these goods satisfy your textbook's definition of necessity goods at most income levels?
 - d. Use the information from Table 1 to draw "Engel curves." (Use total expenditure on current consumption as income for purposes of drawing this curve.) Use red ink to draw the Engel curve for food prepared at home. Use blue ink to draw an Engel curve for food away from home. Use pencil to draw an Engel curve for clothing. How does the shape of an Engel curve for a luxury differ from the shape of an Engel curve for a necessity?
8. Answer parts a. and b. using the appropriate economic model.
- a. Orange juice and apple juice are known to be perfect substitutes. Draw the appropriate price-offer curve (for a variable price of orange juice) and income-offer curve.
 - b. Left-shoes and right-shoes are perfect complements. Draw the appropriate price-offer and income-offer curve.
9. Paula consumes two products: A and B. Initially, the prices of the two products and quantities consumed are $P_A = \$10$, $Q_A = 3$, $P_B = \$10$, $Q_B = 7$. Paula has \$100 to spend per time period. After a reduction in price of B, the prices and quantities consumed are: $P_A = \$10$, $Q_A = 2.5$, $P_B = \$5$, $Q_B = 15$. Assume that Paula maximizes utility under both price conditions. Also, note that if after the price reduction enough income were taken away from Paula to put her back on the original indifference curve, she would consume $Q_A = 1.5$ and $Q_B = 9$.
- c. Determine the change in consumption of good B due to the income and substitution effect.
 - d. Is product B a normal, inferior or Giffen good?
10. Joe consumes apples and bananas. His utility function is $U(x_A, x_B) = x_A x_B$. The price of apples is \$1, the price of bananas is \$2, and Joe's income is \$40 a day. The price of bananas suddenly falls to \$1.
- a. What was his consumption of bananas and apples before the price change? Use black ink to draw the original budget line and put the label A on his chosen consumption bundle.
 - b. If, after the price change, Joe's income had changed so that he could exactly afford his old consumption bundle, how much would have been this income? With this income and the new prices, how many apples and bananas would he consume? Use red ink to draw the budget line corresponding to this income and these prices. Label the bundle that Joe would choose at this income and the new prices with the letter B.
 - c. Does the substitution effect of the fall in the price of bananas make him buy more bananas or fewer bananas? How many more or fewer?
 - d. After the price change, what is his optimal consumption? Use blue ink to draw Joe's actual budget line after the price change. Put the label C on the bundle that he actually chooses after the price change. Label the income effect, the substitution effect, and the total effect on the demand for bananas.