

ECON 201 – Problem Set 2

Department of Economics

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- Q1.** Consider a consumer who wants to consume only two commodities and has an income of \$100. Assume the price of good 1 is \$10 per unit and the price of good 2 \$20 per unit. Now, inflation causes the price of good 1 to increase to \$20 per unit and the price of good 2 increases to \$25 per unit. On the other hand, the consumer also gets a raise of \$100 (so her new income is \$200). Is she better off or worse off?
- Q2.** Suppose prices are $P_x = 2$, $P_y = 1$ and income is $m = 100$.
- (a) Show the change in the budget set if price of x decreased and price of y increased such that $P'_x = 1$ and $P'_y = 2$.
 - (b) Suppose that the government taxes (at the new set of prices $P'_x = 1$ and $P'_y = 2$) the consumer an extra 0.50 for each unit of x he buys beyond 70 units. Show the new budget set.
 - (c) Suppose that on top of part (b) government subsidizes the consumer with a 0.40 dollar for each unit of y he buys beyond 40 units. That is, there is no subsidy for $y < 40$, and consumer pays 0.40 dollar less for each $y \geq 40$. Show the new budget set.
- Q3.** Suppose the set of bundles is given by $B = \{B_1, B_2, B_3, B_4, B_5\}$. Also suppose that the preferences of a consumer are given by $B_1 \succ B_2 \sim B_3$ and $B_4 \succ B_5$. Can you represent these preferences by a utility function? If yes, provide an example. If no, explain why not. How would your answer change if $B_5 \succ B_1$?
- Q4.** The relation "is preferred to" between commodity bundles is just one example of a binary relation. Another example is the relation "is a full brother of" defined over the set of all human beings. Let xRy mean person x is a full brother of person y . Is the relation R reflexive? Transitive? Complete? Explain your answer in few sentences.
- Q5.** Suppose that there are two commodities and a consumer prefers more to less for each good. If the consumer has transitive preferences, can her indifference curves cross? Why? Illustrate your answer with a graph.
- Q6.** Give an example of preferences by sketching indifference curves which are:
- (a) convex but not monotonic,
 - (b) monotonic but not convex.
- Q7.** Suppose a consumer's preferences can be represented by the utility function $u(x, y) = x + y$.
- (a) Show that $v(x, y) = 10x + 10y$ represents the same preferences.
 - (b) Show that $z(x, y) = x + y^2$ does not.

Q8. Consider the following utility functions:

- (a) $u(x, y) = xy$
- (b) $u(x, y) = x^2y^2$
- (c) $u(x, y) = \ln x + \ln y$

Show that they have the same MRS.

Q9. (a) Define the utility functions and draw the indifference curves for each of the following cases:

- (i) “Every time Nazlı consumes one unit of x_1 , she also wants to consume 2 units of x_2 ”
- (ii) “If the price of x_1 is bigger than the price of x_2 , Betül will only consume x_1 ”
- (iii) “Tekin doesn’t care about the prices of x_1 and x_2 , he only wants to consume x_2 ”

(b) Draw the indifference curves for each of the following utility functions:

- (i) $U(x, y) = x + 2y$
- (ii) $U(x, y) = \min\{2x + y, 2y + x\}$
- (iii) $U(x, y) = \max\{2x + y, 2y + x\}$
- (iv) $U(x, y) = x + \min\{x, y\}$
- (v) $U(x, y) = (x - 1)^2 + (y - 4)^2$

(c) Sketch the shape of the indifference curves for each of the following utility functions and find the marginal rate of substitution:

- (i) $U(x, y) = x^\beta y^{(1-\beta)}$
- (ii) $U(x, y) = ax + by$
- (iii) $U(x, y) = \ln x + y$
- (iv) $U(x, y) = a \ln x + b \ln y$

Q10. Tom always begins his day with a strawberry milkshake. He makes it by mixing milk (x) with five strawberries (y). The secret of a really good milkshake lies in the optimal proportion of milk and fruit: one glass always comes with five strawberries.

- (a) Plot Tom’s representative indifference curves. Depict three indifference curves that pass through the following bundles (5, 1), (10, 10) and (15, 4). What is the MRS at each of these points?
- (b) What utility function represents these preferences? On the graph from (a), indicate the level of utility corresponding to each indifference curve.
- (c) Multiply your utility function by ten and add two to it. How did the indifference curves change? How was the level of utility associated with each indifference curve affected?

Q11. Kate has two favorite kinds of apples: Fuji (x) and Gala (y). Kate loves them both and actually does not distinguish between the two kinds.

- (a) In a graph, show Kate’s indifference that pass through (2, 3) and (3, 3).
- (b) Suggest two different utility functions that represent Kates preferences.
- (c) Find the marginal rate of substitution.

- Q12.** Gin likes chocolate cake and ice cream, but after 10 slices of cake, he gets tired of cake and eating more cakes makes her less happy. Gin always prefers more ice cream to less. Gin's parents require him to eat everything put on his plate:
- Draw a set of indifference curves that depict his preferences between plates with different amounts of cake and ice cream.
 - Suppose that Gin's preferences are as before, but now his parents allow him to leave anything on his plate that he doesn't want. Draw some indifference curves to show his preferences between plates with different amounts of cake and ice cream.
- Q13.** Mark has preferences for guns and banjos represented by $u(x_g, x_b) = x_g + \sqrt{x_b}$.
- Write down the equation for an indifference curve, that is, for some utility level u , write down the number of guns as a function of the number of banjos.
 - Find the MRS between guns and banjos.
 - Determine whether these preferences are convex, that is, determine whether there is diminishing MRS property.
 - Show that, for a budget constraint $p_b x_b + p_g x_g = m$, at any point of tangency between budget line and indifference curves, it must be the case that $x_b = \frac{1}{4} \left(\frac{p_g}{p_b} \right)^2$.
 - What is the optimal consumption bundle, if $p_g = \$2$, $p_b = \$1$ and $m = \$8$?
 - What is the optimal consumption bundle if $p_g = \$5$, $p_b = \$1$ and $m = \$4$?
- Q14.** Suppose a consumer has a utility function $u(x_1, x_2) = x_1^\alpha x_2^{1-\alpha}$.
- Derive the demand functions for x_1 and x_2 .
 - Interpret the results. What share of the budget does she spend on x_1 , and what share on x_2 ?
- Q15.** Al derives utility from three goods: music (m), wine (w) and cheese (c). His utility function is of the simple linear form $u(m; w; c) = m + 2w + 3c$.
- Assuming Al's consumption of music is fixed at 10, determine the equations for the indifference curves for w and c where $u = 40$ and $u = 70$. Sketch these curves.
 - Show that Al's *MRS* of wine for cheese is constant for all values of w and c on the indifference curves calculated in part (a).
 - Suppose Al's consumption of music increases to 20. How would this change your answers in part (a) and (b)? Explain it intuitively.