

ECON 4010/6010–001

INTERMEDIATE MICROECONOMICS/MICROECONOMICS

Marcio Santetti | Fall 2021

Problem Set 1

Instructions: This Problem Set covers topics from our *Utility & choice* lectures. Recall that there is no need to turn in this assignment.

Problem 1

- (a) Present a *concrete* example of transitive preferences.
- (b) Present a *concrete* example of complete preferences which are *not* transitive.
- (c) Present a *concrete* example of perfect complements.
- (d) Present a *concrete* example of perfect substitutes.
- (e) Present a *concrete* example of a bundle where one component is an economic “bad.” Make sure to provide some context in your answer.

Problem 2

Suppose apples (A) and bananas (B) cost \$.40 and \$.10 each, respectively. A consumer has \$8.00 to spend on these two.

- (a) Write this consumer’s budget constraint.
- (b) Sketch this budget constraint, with bananas on the y -axis and apples on the x -axis. Do not forget to label the axes and highlight its slope.
- (c) Now, assume that this consumer’s preferences are illustrated by the following utility function:

$$U(A, B) = \sqrt{A \cdot B}$$

If $A = 5$ and $B = 50$, what will utility be?

- (d) If $A = 10$, what value for B will provide the same level of utility as in part (c)?
- (e) If $A = 20$, what value for B will provide the same level of utility as in parts (c) and (d)?

Problem 3

From Problem 2, answer the following additional questions:

- (a) Calculate the Marginal Rate of Substitution (MRS).
- (b) What are the utility-maximizing quantities of A and B ?
- (c) Finally, draw this consumer's indifference curve, highlighting the utility-maximizing point.

Problem 4

Suppose individual A consumes only books and newspapers. For the following parts, books should be on the horizontal axis, while newspapers on the vertical axis. Do not forget to label the axes!

- (a) Assume that A has \$100 to spend. Each book costs \$10 and each newspaper costs \$2. Draw A 's budget constraint and calculate its slope.
- (b) Now assume that the bookstore where A gets his books and newspapers runs a special deal: three books for the price of two. Everything else stays the same. Draw A 's budget constraint and calculate its slope.

Problem 5

Consumer B 's marginal utility from apples (A) and oranges (O) are, respectively, given by:

$$MU_A = \frac{4}{A^{1/2}} \quad MU_O = \frac{1}{O^{1/2}}$$

Derive B 's demand function for oranges as a function of her income (I) and the prices of apples (p_A) and oranges (p_O).

Problem 6

Athlete C can either play soccer (S , x -axis) or run (R , y -axis) to exercise. The utility she gets from each activity is equal to the number of calories she burns. Every hour of soccer playing burns 800 calories, while every hour of running burns 600 calories. C has five hours to exercise each week.

- (a) Write down a utility function $U(S, R)$ representing Athlete C 's preferences in terms of her exercising options.
- (b) Write down C 's "budget" constraint as a function of S and R . **Hint:** here, "prices" will be equivalent to one hour dedicated to each exercise.
- (c) Draw Athlete C 's indifference curve and "budget" constraint. Make sure to label the axes and highlight the slope of each curve.

Problem 7

A common utility function used to illustrate economic examples is the *Cobb-Douglas* function where $U(X, Y) = X^\alpha Y^\beta$, where α and β are decimal exponents that sum to 1 (e.g., 0.4 and 0.6).

- (a) For this utility function, find the Marginal Rate of Substitution (MRS). **Hint:** use marginal utilities.
- (b) From your part (a) results, show that the income fraction a consumer spends on good X is equal to $P_X X / I = \alpha$. **Hint:** recall that $\alpha + \beta = 1$.
- (c) From your part (a) results, show that the income fraction a consumer spends on good Y is equal to $P_Y Y / I = \beta$.
- (d) Use your results from the previous parts to show that total spending on good X does not change if the price of X changes.
- (e) Use your results from the previous parts to show that the quantity of good X purchased does not change if the price of Y changes.

Problem 8

Suppose you go to the store and want to buy a pair of shoes.

- (a) Assuming your utility function is composed only of these items, write down this function.
- (b) What is the utility-maximizing condition for this specific example?
- (c) Illustrate your answer to part (b) as a function of your income and prices. **Hint:** use your budget constraint.