

Midterm Examination 1

Instructions: *Do all three problems. Think before you write. Do not spend too much time on any one problem. Your goal should be to convince the graders that you understand the material. Use common sense. If you have to leave the room for any reason, please give the instructor your examination on the way out. If you finish before 6:10 pm, you may leave, but be extremely quiet!*

Problem 1. (20 minutes) Answer the following questions about the expenditure function:

- a). Define the expenditure function.
- b). Hold u constant. Prove (formally) that the expenditure function is concave in prices.
- c). Give an economic interpretation of the concavity of the expenditure function in prices.

Problem 2. (40 minutes) Consider the utility function $u(x_1, x_2) = |x_2 - x_1|$.

- a). Sketch the no-better set $B(1, 2)$ for $x_1 = 1$ and $x_2 = 2$. Define $B(1, 2)$ mathematically.
- b). Is the utility function quasiconcave? quasiconvex? Explain.
- c). Are the preferences continuous? monotonic? locally nonsatiated? Explain.
- d). Find the demand correspondence $x(p, w)$. Is $x(p, w)$ a function? Explain.
- e). Find the Hicks compensated demand correspondence, $h(p, u)$.
- f). Write down the own-price ($\partial x_1 / \partial p_1$) and cross-price ($\partial x_1 / \partial p_2$) Slutsky equations with Hicks compensated demand in this case, and demonstrate that they hold true when $p_1 < p_2$.

Problem 3. (20 minutes). Notation: in what follows, $\lfloor x \rfloor$ denotes the greatest integer less than or equal to x , so that, for example, $\lfloor 3.14 \rfloor \equiv 3$ and $\lfloor 3 \rfloor \equiv 3$.

Ma Ching-to consumes only cameras c and rice r . His preferences are defined as follows:

$$\begin{bmatrix} c \\ r \end{bmatrix} \succsim \begin{bmatrix} c' \\ r' \end{bmatrix} \text{ if either of the following is true:}$$

$$\lfloor c \rfloor > \lfloor c' \rfloor$$

or

$$\lfloor c \rfloor = \lfloor c' \rfloor \text{ and } r \geq r'$$

In other words, Professor Ma has lexicographical preferences applied to cameras (a discrete good) and rice (a continuous good). So, for example, we have

$$\begin{bmatrix} 4 \\ 5 \end{bmatrix} \succsim \begin{bmatrix} 4.2 \\ 5 \end{bmatrix} \succsim \begin{bmatrix} 4.3 \\ 3 \end{bmatrix} \succsim \begin{bmatrix} 3.99 \\ 33 \end{bmatrix}.$$

Assume that rice is the numeraire, so that the price of rice is 1. Let p denote the price of cameras and let w denote wealth.

- a). Find the demand correspondence $c(p, w)$ associated with these preferences. Explain. Is $c(p, w)$ a function? Why or why not?
- b). As w increases, what is the upper limit on the amount of rice that Professor Ma will consume? Explain.
- c). [Difficult!] Construct a utility function that corresponds to these preferences.