Principles of Economics I
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Problem Set 1 (Due Sep 23, 2022)

1. This exercise is designed to let you see what the feasible set can look like in concrete choice situations. The context is that of allocating a monetary budget of $w$ euros between gigabytes of data per month of data transfer on a smartphone (x-axis) and all other consumption (on $y$-axis).
(a) The simplest pricing scheme allows you to buy any number $x$ of GB per month at a fixed price of $p$ euros per GB (prices and GB are in monthly terms). How many GB can you buy if you use your entire budget on GB? Of course, you may choose not to buy any GB at all and in this case, you can use w on other consumption. Draw the set of feasible choices of $(x, y)$, i.e. combinations of $x$ GB of data transfer and $y$ euros of other consumption such that you do not exceed your total budget for the case where $w=15$ and $p=2$.
(b) To see the effect of a price change, draw the feasible set when $w=15$ and $p=3$. To see the effect of a wealth change, draw the feasible set for $w=5$ and $p=2$.
(c) Consider another plan that allows you to buy up to $\bar{x}$ GB of data at a lower price $p^{\prime}<p$ if you pay a fixed (monthly) payment of $f$ euros. Any amount data above $\bar{x}$ is still sold at $p=2$. Draw the feasible set for this plan for $w=15, f=3, \bar{x}=5$ and $p^{\prime}=1$.
(d) Often you are given the choice between alternative plans. What is the feasible set if you can choose between the plans in part a) and c)? (Hint: for each level $x$ of data transfer, which plan delivers $x$ at the least cost?)
(e) In Finland, it is common to offer schemes with only a fixed payment: you can choose any $x$ that you want without any extra charge if you pay a higher fixed fee $f^{*}>f$. Draw the feasible
set of this plan for $f^{*}=8$ and draw the feasible set when you can choose between all three alternatives.
2. In order to move towards choice from such feasible sets, we start by forming the indifference curves of a consumer in this market.
(a) In the ( $\mathrm{x}, \mathrm{y}$ ) -coordinate system of the previous question, think about the shape that indifference curves should take. In particular, do you think that MRS between GB and other consumption becomes lower as you increase the number of GB's? If so, draw indifference curves reflecting this.
(b) Suppose that because of time constraints, you will never use more than 30 GB per month. What is your MRS at any point $(x, y)$ with $x>30$ ?
(c) For the feasible set of Problem 1.a), determine graphically the optimal choice for the consumer with the indifference curves from part a) of this question. How can you express the MRT in this problem?
(d) Consider plans from parts a) and c) of the previous question. Is it possible that a consumer is indifferent between the two plans?
(e) We say that Ann likes data more than Bob if the MRS of Ann (denoted by $\left.M R S_{A}\right)$ is higher than the MRS of $\operatorname{Bob}\left(M R S_{B}\right)$ at all $(x, y)$. Show by drawing the picture for the plan in 2.a) that at optimum, Ann chooses a higher $x$ than Bob. (Hint: draw the picture for Ann's optimal choice and consider Bob's indifference curve through Ann's optimal consumption).
3. In most economic situation, you have more than two goods to choose between. Let's start with a concrete example, where the vector $(x, y, z)$ denotes your consumption of apples, bananas and oranges. Denote the marginal rate of substitution between apples and bananas by $M R S_{a, b}$ and similarly for apples and oranges, $M R S_{a, o}$ and bananas and oranges $M R S_{b, o}$. In words, $M R S_{a, o}$ measures the smallest number of (small units of) oranges that you would need to get in order to agree to give up an apple (small unit of apple). Similarly, we can define $M R S_{o, a}$ as the number of apples that you need to get to agree to give up one orange.
(a) If $M R S_{a, o}=2$ when measured at consumption $(10,6,4)$, how large is $M R S_{o, a}$ at $(10,6,4)$ ?
(b) If $M R S_{a, o}=2$ when measured at consumption $(10,6,4)$, and $M R S_{o, b}=4$ at $(10,6,4)$, how large is $M R S_{a, b}$ at $(10,6,4)$ ?
(c) How would you think that the MRS's at $(x, y, z)$ compare to MRS's at $\left(x, y, z^{\prime}\right)$ when $z^{\prime}>z$ ? In words, what do you think happens typically to the different MRS's as consumption of oranges increases?
4. The last problem in this problem set concerns feasible lifetime consumptions. The choice is how to allocate a lifetime budget between consumption as student (on the x -axis) and consumption when working (y- axis). When studying, Cecilia receives a student benefit to $b$ and when working, she receives a wage income $w$. This means that the point $(b, w)$ in the coordinate system is a feasible consumption pair.
(a) If Cecilia cannot borrow or save, she can only consume up to $b$ when student and up to $w$ when old. If she can save at an interest rate $r$, she can transform $\Delta x$ units of foregone consumption when student into $(1+r) \Delta$ units of consumption when working. Draw the set of feasible consumptions when Cecilia can save but not borrow for numerical values $b=5, w=20, r=.1$. What is the MRT for Cecilia in this problem?
(b) Draw the feasible set for the case where Cecilia can also borrow at the same interest rate $r$.
(c) Suppose next that has symmetric preferences over consumptions when young and when old. This means that her MRS $=1$ at any point where $x=y$, i.e. when her consumption when student and when working are the same. Is it optimal for Cecilia to consume the same amounts when student and when working?
(d) When should Cecilia consume more? Can you decide from the information thus far if Cecilia should borrow or save?
(e) Draw the feasible set in the case where Cecilia can borrow at interest $r_{b}$ or save at interest $r_{s}$ with $r_{b}>r_{s}$.
