

## Problem Set 1

(Due Date: Oct. 13)

1. For lunch, Ada prefers to eat soup and bread in fixed proportions. When she eats  $X$  pints of soup, she prefers to eat  $\sqrt{X}$  ounces of bread. If she has  $X$  pints of soup and more than  $\sqrt{X}$  ounces of bread, she eats all the soup along with  $\sqrt{X}$  ounces of bread, and throws the extra bread away. If she has  $X$  pints of soup and fewer than  $\sqrt{X}$  ounces of bread (say  $Y$  ounces), she eats all the bread along with  $Y^2$  ounces of soup and throws the extra soup away.
  - a) Draw Ada's indifference curves between soup and bread.
  - b) Assume she spends all her income on soup and bread. Plot her income-consumption curve, her Engel curve for soup, and her Engel curve for bread.
  - c) Derive her demand function for the two goods. [Note that demand function is a function of prices and income].
2. Gary has two children, Kevin and Dora. Each one consumes "yummies" and nothing else. Gary loves both children equally. For example, he is equally happy when Kevin has two yummys and Dora has three, or when Kevin has three yummys and Dora has two. But he is happier when their consumption is more equal.
  - a) Draw Gary's indifference curves.
  - b) What would they look like if he loved one child more than the other?
  - c) Suppose that Kevin starts out with two yummys and Dora with eight yummys, and that Gary can redistribute their yummys. Draw a "budget line" that shows his available choices and indicate his best choice by adding indifference curves.
  - d) How would your answer differ if Kevin started out with six yummys and Dora with four?
3. Connie has a monthly income of \$200 that she allocates among two goods: meat and potatoes.
  - a. Suppose meat costs \$4 per pound and potatoes \$2 per pound. Draw her budget constraint.
  - b. Suppose also that her utility function is given by the equation  $U(M,P)=2M+P$ . What combination of meat and potatoes should she buy to maximize her utility? (Hint: Meat and potatoes are perfect substitutes)
  - c. Connie's supermarket has a special promotion. If she buys 20 pounds of potatoes (at \$2 per pound), she gets the next 10 pounds for free. This offer applies only to the first 20 pounds she buys. All potatoes in excess of the first 20 pounds she buys. All potatoes in excess of the first 20 pounds (excluding bonus potatoes) are still \$2 per pound. Draw her budget constraint. What combination of meat and potatoes maximizes her utility?
  - d. An outbreak of potato rot raises the price of potatoes to \$4 per pound. The

supermarket ends its promotion. What does her budget constraint look like now? What combination of meat and potatoes maximizes her utility?

4. Most countries have civilians' medical insurance system. The insurance system in some countries, like Singapore, is operated through obligatory deposits. It means that every civilian will have a medical insurance account and the civilian should deposit some income into this account obligatorily. Consider a consumer in Singapore with income  $Y$ . He will spend  $C$  on consumption,  $S_1$  on medical account, and  $S_2$  on ordinary deposit. Suppose his utility function is  $U(C, S_1, S_2) = C^\gamma S_1^\alpha S_2^\beta$ . And he has the budget constrain:  $C + S_1 + S_2 = Y$ . Assume  $L$  is the lower limit value of  $S_1$ .

- a. Derive the demand function of  $S_1$  and  $S_2$  when  $L$  is unrestrained.
- b. Derive the demand function of  $S_1$  and  $S_2$  when  $L$  is restrained.

5. 某消费者的效用函数为  $U(x, y) = \log x + 9 \log y$ ，其中  $x$  代表该消费者每月消费的汽油量， $y$  代表他每月消费的其他商品数量（为简化起见，我们令  $y$  的价格为1）。该消费者的每月的收入为1000元。由于政府的管制，消费者购买的汽油量最高不能超过40单位。

- 1) 令汽油的价格为  $P_x$ ，求出消费者对于  $x$  和  $y$  的需求函数；
- 2) 如果  $P_x=2$ ，消费者愿意购买多少数量的汽油？在这一点上，他的边际替代率是多少？是大于还是小于  $P_x$ ？关于这个结果，请给出经济学的直观解释。
- 3) 如果  $P_x=3$ ，消费者愿意购买多少数量的汽油？在这一点上，他的边际替代率是多少？是大于还是小于  $P_x$ ？关于这个结果，请给出经济学的直观解释。
- 4) 我们假定  $P_x=2$ ，但是存在一个汽油的黑市，允许消费者在40单位配额之外以每单位3元的价格购买汽油，请问消费者在黑市上愿意购买多少汽油？