

### Homework 3

due: Monday, Feb 23, in class

**Problem 1:** Introspection reveals that your preferences for food (F) and housing (H) can be represented by the utility function  $U(F, H) = \ln(F - C_F) + \ln(H - C_H)$ , where  $C_F$  and  $C_H$  are some positive constants. Furthermore, you have income  $I$  and face prices  $P_F$  and  $P_H$  for food and housing respectively.

- Derive the optimality condition  $MRS = P_F/P_H$ .
- Combine your result from a) with the budget constraint to find the demand functions for food and housing.
- Provide an interpretation of the constants  $C_F$  and  $C_H$ .

**Problem 2:** To answer the following questions, use sufficiently large diagrams with good  $X$  on the horizontal and good  $Y$  on the vertical axis. Make sure that the indifference curves you depict satisfy the usual assumptions.

- Consider an increase in income. Using a separate diagram for each case, show how demands for  $X$  and  $Y$  are affected if  $X$  is an inferior good, if  $X$  is a normal but not a luxury good, and if  $X$  is a luxury good. Explain why  $X$  and  $Y$  cannot both be inferior (or luxury) goods.
- Consider an increase in the price of  $X$  and suppose  $X$  is a normal good. Show how the price change affects the demand for  $X$  and  $Y$  and decompose the total effect into income and substitution effect.
- Repeat b) when  $X$  is a Giffen good, that is, when the demand for  $X$  is increasing in the price of  $X$ . Determine whether  $X$  must be a normal or inferior good in this case.

**Problem 3:** Consider a simplified version of the U.S. income tax: tax payers owe no income tax for the first \$10,000 they earn, but 15% on any income above 10,000. Now the Congress is considering two alternative ways to reduce the tax burden: a reduction in the tax rate or an increase in the amount that is tax free.

- What effect would a reduction in the tax rate have on the individual's labor supply if she earned \$30,000 to start with? Explain using income and substitution effect.

- b) What effect would an increase in the amount of tax free income have on the individual's labor supply? As before, explain using income and substitution effect.

**Problem 4:** Suppose your demand for hot chocolate at the Moonstruck Cafe takes the form  $Q_{hc}^D = \frac{I}{10P_{hc}}$ , you receive a monthly income of 600 USD and the price of a Mayan hot chocolate is (initially) 3 USD.

- a) How many hot chocolates do you consume? How many would you consume if you had an income of 6,000 USD? What is the income elasticity of your demand?
- b) Suppose the Moonstruck Cafe raises its price, instead of 3 you now have to pay 5 USD. Calculate the change in your consumer surplus. Why would it be wrong to argue that your welfare loss is the initial quantity consumed times the change in price?
- c) You know which utility function gave rise to this demand function of yours, don't you? How much additional income would you need to be as happy as before the price change?