Intermediate Microeconomics
ECNS 301
Fall 2015

Homework #: 5

Due by the beginning of class on: Thursday October 22, 2015

Name: _____________________________________________

Instructions:
There are 5 questions worth a total of 100 points. Answer each question clearly and concisely. You must show your work to receive credit. You are allowed to work with others, but all work must be your own.

Clearly print your name above and in the space provided on the next page. You must turn in both sides of this cover sheet along with your responses. You do not need to turn in the questions, only your responses with the cover sheet. All pages must be stapled to be graded.
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**Consumer Demand**

1. Since 1900, real income has increased tremendously, yet the average number of children has fallen. Illustrate the following possible explanations in separate diagrams with budget sets and indifference curves between number of children and “all other goods”.

   (a) Children are an inferior good; because we are richer now we want fewer of them.

   (b) Children are a normal good, but it has become more expensive to bear and raise them.

   (c) Children are a normal good and they do not cost any more to raise than they did. However, preferences have changed, and couples today want smaller families than couples did in 1900.

2. A consumer’s utility function is given by

   \[ U(x, y) = 4x^{\frac{1}{2}} + y^{\frac{1}{2}} \]

   The consumer’s income is \( I \), the price of good \( y \) is \( P_y \) and the price of good \( x \) is \( P_x \).

   (Warning: the algebra in this problem is messy but it is good practice.)

   (a) What is the marginal rate of substitution?

   (b) What is the equation for the budget constraint?

   (c) What is the demand function for \( x \) (as a function of prices and income)?
Applications of Consumer Demand

3. Consider Joe Blow’s utility function: \( U = xy \), where \( x \) is packs of cigarettes and \( y \) is dollars spent on all other goods. Joe has income \( m = 32 \); the price of cigarettes \( (x) \) is \( P_x = 1 \) and the price of all other goods \( (y) \) is \( P_y = 2 \).

(a) What is the optimal consumption bundle and what level of utility is achieved?

(b) Assume that the supply of cigarettes is perfectly elastic. The government imposes a tax of $1 per pack on cigarettes. What will be the after-tax price paid by Joe to consume a pack of cigarettes?

(c) What will the new optimal consumption bundle be with the tax and what is Joe’s level of utility?

(d) How much revenue will the government raise with the tax?

(e) Consider two proposed tax reforms:

   Reform 1: Eliminate the tax on cigarettes and impose a lump sum tax (effectively an income tax) that raises the amount of revenue equal to that of the $1 per unit tax.

   Reform 2: Eliminate the tax on cigarettes and impose a lump sum tax that leaves the consumer at the level of utility reached under the $1 per unit tax.

   i. By how much utility would Reform 1 make Joe better or worse off? Illustrate. (It will be helpful to draw your indifference curves and budget constraints to scale and make sure they pass through the correct points.)

   ii. By how much would Reform 2 change the amount of revenue for the government? Illustrate. (Hints: To solve for the amount of the lump sum tax imposed in Reform 2, remember that the utility function given results in an even division of income between spending on \( x \) and spending on \( y \). Use a calculator for the messy calculations this question.)
4. The government subsidizes daycare for low income families (especially important now that welfare ends after 2 years). For simplicity, consider a single mother who wants to enroll in school. If possible, she would enroll in school full time and buy 40 hours of daycare. Assume all commodities are normal, indifference curves are smooth and convex, ignore any effects on the price of daycare, and ignore changes in her future income, etc. It is your job to evaluate the following three proposed government programs.

Plan A: Day care subsidies where the subsidized price is set so that exactly 40 hours of daycare are purchased.

Plan B: Direct cash payments which can be used for any purchase (welfare payments are continued while the family is in school). The family receives an exact quantity of additional income which leads to 40 hours of daycare purchased.

Plan C: The government provides 40 hours of day care free of charge to low income families. (Cost to government is current market price.)

(a) Show the income and substitution effects of Plan A graphically.
(b) Show the income effect of Plan B graphically. Is there a substitution effect?
(c) In your graphs above, label the cost to the government of each plan. Which costs the government more: Plan A or Plan B?
(d) Which provides the low income consumer with the highest level of utility: Plan A or Plan B?
(e) Which costs the government more: Plan A or Plan C?
(f) Compare Plan B to Plan C on the basis of cost to the government. (Pay attention to the income elasticity of day care consumption.)
5. Now that you’ve done this graphically, let’s connect question 4 with some numbers. There are two families: the Smith family and the Jones family. Let’s see how the policies from question 4 (Plans A-C) would affect them. Daycare costs $10 per hour ($P_x = 10$). Both have an initial income of $100 (m = 100)$. With Plan C, the government provides free child care for 40 hours, and since day care is $10 an hour, Plan C will cost the government $400.

(a) The Smith family has a demand function for daycare given by

$$x = 10mp_x^{-2}$$

where $x$ is the number of hours of daycare and $P_x$ is the price of $x$.

i. What is their income elasticity of demand?

ii. Is day care a normal good or an inferior good?

iii. What is their own price elasticity of demand?

iv. Is demand elastic or inelastic?

v. How many hours of daycare do they buy before the government intervention?

(b) Under Plan A the government subsidizes child care. What would the subsidy have to be to induce the Smith family to buy 40 hours of daycare?

(c) How much would that cost the government? (Take the subsidy and multiply it by 40)

(d) Under Plan B, the government gives the Smith family enough income to induce them to purchase 40 hours of childcare. How much income would they need to voluntarily buy 40 hours of child care?

(e) The Jones family has a demand function given by

$$x = 10m^{\frac{3}{2}}p_x^{-1}$$

i. What is their income elasticity of demand?

ii. What is their own price elasticity of demand?

iii. Which family’s demand is more responsive to changes in the price? To changes in income?

iv. How many hours of daycare do the Jones’ buy before the government intervention?

(f) Under Plan A what would the subsidy have to be to induce the Jones family to buy 40 hours of child care?

(g) How much would that cost the government?

(h) Under Plan B, how much income would they need to voluntarily buy 40 hours of child care?

Can you see why you got the answers that you did? (Now go back and look at your answers to the last question.)