Engineering Economic Analysis
Spring 2019

Problem set 2

Due: 2019.04.30

1. An individual consumes only good 1 and 2, and his preferences over these two goods can be represented by Cobb-Douglas utility function $u(x_1, x_2) = x_1^{\alpha} x_2^{\beta}$ where $\alpha, \beta > 0$. This individual currently works for a firm in Suwon where initial prices are $p^0 = (p_1, p_2)$, and his income (or wealth) is m . The firm that this individual works for is considering moving its office to Seoul, where good 1 has the same price, but good 2 is twice as expensive, i.e., the new price vector is $p' = (p_1, 2p_2)$.
   A. How is this individual consumer surplus affected by the price change?
   B. Now this worker proposes to his boss "I would really prefer to stay in Suwon. In fact, I would accept a salary reduction if I could keep working for the firm in Suwon." Then, how much would this individual be willing to accept a reduction in his income?

2. Maude spends all of her income on delphiniums and hollyhocks. She thinks that delphiniums and hollyhocks are perfect substitutes; one delphinium is just as good as one hollyhock. Delphiniums cost \$4 a unit and hollyhocks cost \$5 a unit.

   (a) If the price of delphiniums decreases to \$3 a unit, will Maude buy more of them? What part of the change in consumption is due to the income effect and what part is due to the substitution effect?

   (b) If the prices of delphiniums and hollyhocks are respectively p_d = \$4 and p_h = \$5 and if Maude has \$120 to spend, draw her budget line in blue ink. Draw the highest indifference curve that she can attain in red ink, and label the point that she chooses as A.

   (c) Now let the price of hollyhocks fall to \$3 a unit, while the price of delphiniums does not change. Draw her new budget line in black ink. Draw the highest indifference curve that she can now reach with red ink. Label the point she chooses now as B.

   (d) How much would Maude's income have to be after the price of hollyhocks fell, so that she could just exactly afford her old commodity bundle A?

   (e) When the price of hollyhocks fell to \$3, what part of the change in Maude's demand was due to the income effect and what part was due to the substitution effect?

3. Ellsworth's utility function is U(x, y) = min{x, y}. Ellsworth has \$150 and the price of x and the price of y are both 1. Ellsworth's boss is thinking of sending him to another town where the price of x is 1 and the price of y is 2. The boss offers no raise in pay. Ellsworth, who understands

compensating and equivalent variation perfectly, complains bitterly. He says that although he doesn't mind moving for its own sake and the new town is just as pleasant as the old, having to move is as bad as a cut in pay of \$A. He also says he wouldn't mind moving if when he moved he got a raise of \$B. What are A and B equal to?

4. (2018 Mid-term) The demand for kitty litter, in pounds, is $D(p) = A - p + \ln m$, where p is the price of kitty litter, m is income, and $A + \ln m > p$. Find the condition on the price level under which the supplier of kitty litter can raise the revenue by increasing its price.

5. (2018 Mid-term) Given prices $p_1,\ p_2$, a consumer with the utility function $u(x_1, x_2) = x_1^{\,2} x_2$ wants to minimize her expenditure while enjoying the minimum utility level of $\bar{u}$. Note that the consumer's utility function satisfies the non-satiation preference.

(a) Find the consumer's ordinary (Marshallian) demand functions for both goods.

(b) Prove or disprove the following statement using the Hessian matrix and Cramer's rule (*any other approach will be given no scores!*); at the optimal demand level, the consumer would decrease the demand of good 2 in order to increase the minimum utility level of $\bar{u}$.

6. (2018 Mid-term) There are two goods, food and clothing, whose quantities are to be denoted by x and y with the prices of p_x and p_y respectively. There is a consumer whose income is to be denoted by $m > 0$ and utility by u. His expenditure function is known to be $e(p_x, p_y, u) = \sqrt{p_x p_y u}$.

(a) Find the consumer's Hicksian and Marshallian demand functions.

(b) Suppose that the market environment has been $p_x = \$1, p_y = \$1, m = \$100$. Now the price of food rises to $p_x = \$1.1$, while income and the price of clothing are same as before. If the government wants to compensate the consumer by giving him some extra income, how much extra income would be needed to restore him to the old utility level?

(c) If the government decided to compensate the consumer by giving him enough extra income to enable him to purchase the same quantities as he did at the original income and prices. Given this income and the new prices, what quantities will the consumer actually buy?