

Problem Set 2 - Consumer Theory

1. Suppose a consumer's utility derived from consuming cookies is described by the function $U = 15X + 1.5X^2 - 1/3X^3$
 - i) Make a table showing total and marginal utility for X from 0 to 7 units.
 - ii) Would this individual ever choose to consume more than 5 units? Explain.

2. Draw the graphs with indifference curves of the following descriptions of preferences:
 - a. George dislikes broccoli and would be willing to pay something to not have to eat it.
 - b. Ann does not care whether she has more diet soft drinks or fewer diet soft drinks.
 - c. Natalya likes rap and rock music. Natalya's preferences exhibit a diminishing marginal rate of substitution between the two types of music.
 - d. Amy likes M&M's, plain and peanut. For Amy, the marginal rate of substitution between plain and peanut M&M's does not vary with the quantities of plain and peanut M&M's she consumes.
 - e. Matthew knows his limit. He likes beer up to a point, but if he drinks too much he gets sick.
 - f. Peter is very picky about his buttered popcorn. He tops every quart of popped corn with exactly one-quarter cup of melted butter.

3. In each of the following examples, a consumer purchases just two goods: X and Y. Based on the information in each of the following parts, sketch a plausible set of indifference curves (that is, draw at least two curves on a set of labelled axes, and indicate the direction of higher utility). Also, write down a utility function $U(X, Y)$ consistent with your graph. Note that although all these preferences should be assumed to be complete and transitive (as required for utility representation), not all will be monotone.
 - i) Erkal enjoys cheeseburger x and milkshake y, and consuming more of one makes consuming the other more enjoyable.
 - ii) Sergei loves cucumber x, but he hates carrots y.
 - iii) Irina likes banana muffin x, and neither likes nor dislikes strawberry tart y.
 - iv) Gerdis always buys three blue shirts x for every pair of jeans y.

- v) Nick likes both chocolate x and jelly y , and always gets the same additional satisfaction from bar of chocolate as he does from two ounces of jelly.
4. Sally consumes two goods, X and Y . Her utility function is given by the expression $U = 3 * XY^2$. The current market price for X is \$10, while the market price for Y is \$5. Sally's current income is \$500.
- Sketch a set of two indifference curves for Sally in her consumption of X and Y .
 - Write the expression for Sally's budget constraint. Graph the budget constraint and determine its slope.
 - Determine the X, Y combination which maximizes Sally's utility, given her budget constraint. Show her optimum point on a graph. (Partial units for the quantities are possible.)
 - Calculate the impact on Sally's optimum market basket of an increase in the price of X to \$15. What would happen to her utility as a result of the price increase?
5. Calculate the optimal consumption combination for each of the following utility functions:
- $U = 30 X_1 X_2$
 - $U = 30 X_1^\alpha X_2^{1-\alpha}$
 - $U = X_1 + 2X_2$
 - $U = \min \{ X_1, X_2 \}$
6. Janice Doe consumes two goods, X and Y . Janice has a utility function given by the expression:
- $$U = 4x^{0.5}y^{0.5}$$
- So, $MU_x = \frac{2y^{0.5}}{x^{0.5}}$ and $MU_y = \frac{2x^{0.5}}{y^{0.5}}$. The current prices of X and Y are 25 and 50 respectively. Janice currently has an income of 750 per time period.
- Write an expression for Janice's budget constraint.
 - Calculate the optimal quantities of X and Y that Janice should choose, given her budget constraint. Graph your answer.
 - Suppose that the government rations purchases of good X such that Janice is limited to 10 units of X per time period. Assuming that Janice chooses to spend her entire income, how much Y will Janice consume? Construct a diagram that shows the impact of the limited availability of X . Is Janice satisfying the usual conditions of consumer equilibrium while the restriction is in effect?
 - Calculate the impact of the ration restriction on Janice's utility.

7. Suppose a consumer has income of \$200 per period, and faces prices $P_x = 4$ and $P_z = 5$. Her goal is to maximize her utility, described by the function $U = 20X^{0.5}Z^{0.5}$. Calculate the utility maximizing bundle (X^*, Z^*) using the Lagrangian method.

8. Suppose that the price of gasoline has risen by 50%. What happens to a consumer's level of well-being, given he spends some of his income on gasoline? Diagram the impact of the increase in gas prices in a commodity space diagram, and show the relevant indifference curves. Now, if the individual's income rises just enough so that his original consumption bundle exactly exhausts his income, will the individual purchase more or less gasoline (this level of income implies the consumer can afford his original consumption bundle)? Is the individual better-off at the higher price level of gasoline with the higher income level or the original price of gas and income?

9. Tammy and Tad's father has given each of them a debit card and allows each of them to use the card to spend \$500 each month. Tammy and Tad use their \$500 to buy only CDs and gasoline. In February, the price of a CD was \$10 and the price of gasoline was \$1 per gallon. At these prices, Tammy purchased 45 CDs and 50 gallons of gas. Ted consumed 20 CDs and 300 gallons of gas. For the month of March, Tammy and Tad's father lost the records indicating who had which debit card. From the bank statement in March, their father learned that the price of a CD was \$12 and a gallon of gas cost \$0.80. The first debit card was used to purchase 235 gallons of gas and 26 CDs. The second debit card was used to purchase 265 gallons of gas and 24 CDs. Using revealed preference theory, identify which card Tammy must possess.

10. Confirm that if a consumer's utility function is described by $U = 2X + Z$, and prices are $P_x = 2$ and $P_z = 1$, there is no unique utility maximizing solution regardless of income level. What does this tell you about X and Z as commodities? (Hint: draw a graph showing a budget constraint and indifference curve using the information provided.)