EconS 301 – Intermediate Microeconomics
Review Session #1

1. Suppose the market demand curve for a product is given by $Q^d = 1000 - 10P$ and the market supply curve is given by $Q^s = -50 + 25P$.
    a. What are the equilibrium price and quantity?
    b. What is the Inverse Form of the demand curve?
    c. At the market equilibrium, what is the price elasticity of demand?
    d. Suppose the price in this market is \$25. What is the amount of excess demand?

2. Suppose demand for good *A* is given by $Q_A^d = 500 - 10P_A + 2P_B + 0.70I$ where P_A is the price of good *A*, P_B is the price of some other good *B*, and *I* is income. Assume that P_A is currently \$10, P_B is currently \$5, and *I* is currently \$100.
    a. What is the elasticity of demand for good *A* with respect to the price of good *A* at the current situation?
    b. What is the cross-price elasticity of the demand for good *A* with respect to the price of good *B* at the current situation?
    c. What is the income elasticity of demand for good *A* at the current situation?

3. Consider two goods, *A* and *B*. For each of the following scenarios, develop the utility function *U*(*A*,*B*) that matches the given information.
    a. The consumer believes that good *A* and *B* are perfect substitutes with one unit of *A* equivalent to four units of *B*.
    b. The consumer believes that good *A* and *B* are perfect compliments and always uses three unites of *B* for every unit of *A*.

4. Consider the utility function $U(x, y) = 3x^2 + 5y$ with $MU_x = 6x$ and $MU_y = 5$.
    a. Is the assumption that "more is better" satisfied for both goods?
    b. What is the $MRS_{x,y}$ for this utility function?
    c. Is the $MRS_{x,y}$ diminishing, constant, or increasing as the consumer substitutes *x* for *y* along an indifference curve?

5. For the following sets of goods draw two indifference curves, U_1 and U_2, with $U_2 > U_1$. Draw each graph placing the amount of the first good on the horizontal axis.
    a. Hot dogs and chili (the consumer likes both and has a diminishing marginal rate of substitution of hot dogs for chili).
    b. Sugar and Sweet'N Low (the consumer likes both and will accept an ounce of Sweet'N Low or an ounce of sugar with equal satisfaction).
    c. Peanut butter and jelly (the consumer likes exactly two ounces of peanut butter for every ounce of jelly).
    d. Nuts (which the consumer neither likes nor dislikes) and ice cream (which the consumer likes).
    e. Apples (which the consumer likes) and liver (which the consumer dislikes).

Answers

Exercise 1.

a. In equilibrium, we know the quantity supplied must equal the quantity demanded. So we simply set the supply equal to demand, and solve for price.

$$Q^d = Q^s$$
$$1000 - 10P = -50 + 25P$$
$$1050 = 35P$$
$$\left(\frac{1050}{35}\right) = P$$
$$30 = P$$

Now that we know the equilibrium price, we can plug it into either the demand or supply to solve for the equilibrium quantity.

Plugging price into Q^d yields:

$$Q^d = 1000 - 10(30)$$
$$Q^d = 1000 - 300$$
$$Q^d = 700$$

Plugging price into Q^s yields:

$$Q^s = -50 + 25(30)$$
$$Q^s = -50 + 750$$
$$Q^s = 700$$

Calculating the equilibrium quantity using both Q^d and Q^s is a simple way to check your algebra, as the quantity demanded should equal quantity supplied.

b.

The inverse demand curve can be useful when drawing the supply and demand graph.

$$Q^d = 1000 - 10P$$

$$10P = 1000 - Q^d$$

$$P = 100 - .1Q^d$$

b. Price elasticity can be thought of as the percentage change in quantity demanded as a result of a one percent change in price. So we have,

$$\varepsilon_{Q,P} = \frac{\text{percentage change in quantity demanded}}{\text{percentage change in price}} = \frac{\Delta Q \big/ Q}{\Delta P \big/ P} = \frac{\Delta Q}{\Delta P}\frac{Q^{-1}}{P^{-1}} = \frac{\Delta Q}{\Delta P}\frac{P}{Q}$$

where $\frac{\Delta Q}{\Delta P} = \frac{\partial Q}{\partial P}$. Thus $\varepsilon_{Q,P} = \frac{\partial Q}{\partial P}\frac{P}{Q}$. In our exercise $\frac{\partial Q}{\partial P}$, the partial derivative of quantity with respect to price, is equal to -10.

$$\varepsilon_{Q,P} = \frac{\partial Q}{\partial P}\frac{P}{Q} = -10\left(\frac{30}{700}\right) = -0.429$$

So given a one percent increase in the price, we will have e 0.429 percentage decrease in quantity demanded.

c. Plugging the price of $25 into the demand function:

$$\begin{aligned} Q^d &= 1000 - 10(25) \\ Q^d &= 1000 - 250 \\ Q^d &= 750 \end{aligned}$$

Plugging the price of $25 into the supply function:

$$\begin{aligned} Q^s &= -50 + 25(25) \\ Q^s &= -50 + 625 \\ Q^s &= 575 \end{aligned}$$

So we have a demand of 750 units and a supply of 575 units. Thus, the excess demand is simply $Q^d - Q^s = 750 - 575 = 175$.

Exercise 2.

a. We know the current market prices and income, so we can calculate the market quantity for good *A*.

$$Q_A^d = 500 - 10(10) + 2(5) + 0.70(100) = 480$$

Using that quantity, we can now calculate the price elasticity of demand for good *A*.

$$\varepsilon_{Q_A,P_A} = \frac{\partial Q_A}{\partial P_A}\frac{P_A}{Q_A}$$
$$\varepsilon_{Q_A,P_A} = -10\left(\frac{10}{480}\right)$$
$$\varepsilon_{Q_A,P_A} = -0.208$$

b. The cross-price elasticity determines how the quantity demanded of good *A* varies with the price good *B.*

$$\varepsilon_{Q_A,P_B} = \frac{\partial Q_A}{\partial P_B}\frac{P_B}{Q_A}$$
$$\varepsilon_{Q_A,P_B} = 2\left(\frac{5}{480}\right)$$
$$\varepsilon_{Q_A,P_B} = 0.021$$

Simply put, from the price elasticity of demand, we just replace P_A with P_B in both the partial derivative and the numerator of the second term.

c. Similarly, income elasticity determines how the quantity demanded varies with income.

$$\varepsilon_{Q_A,I} = \frac{\partial Q_A}{\partial I}\frac{I}{Q_A}$$
$$\varepsilon_{Q_A,I} = 0.79\left(\frac{100}{480}\right)$$
$$\varepsilon_{Q_A,I} = 0.146$$

Exercise 3.

a. These types of questions are more intuitive than anything. We know that one unit of good A will provide the same level of utility as four units of good B. That is, good A provides four times the utility as good B. And we know the goods are perfect substitutes, so the *MRS* will be constant, and the utility function will be linear. So the utility function can be characterized by,

$$U(A,B)= 4A+ B$$

b. Recall the indifference curves for perfect compliments are straight vertical and horizontal lines at a right angle to each other (with the right angle closest to the origin). This is because a consumer does not derive any extra utility from additional units of one good without the other. In our exercise, one unit of good A is always used with three units of good B. The utility function will take the form,

$$U(A,B) = \min(3A, B)$$

The "min" simply means "take the minimum" of 3*A* and *B*.

For example, suppose we have 10 units of good *B* and 3 units of good *A*. Then we will have,

$$U(A,B) = \min(9,10) = 9 .$$

So we use 9 units of good *B* and 3 units of good *A*.

Exercise 4.

a. It's worth nothing that the marginal utility of a good is simply the partial derivative of utility function with respect to the good. The marginal utilities are given, and both are positive, so increasing consumption of either good will increase utility. Thus, more is always better.

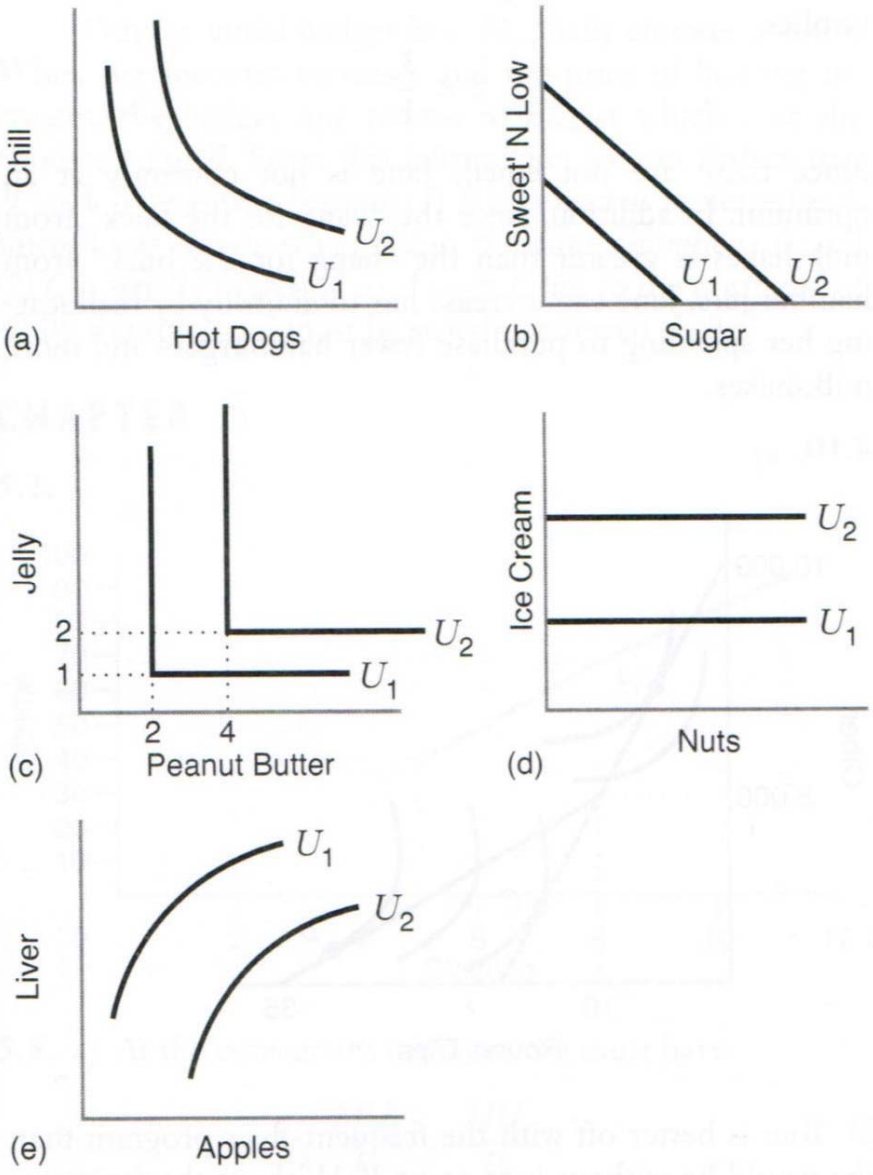
b. $$MRS_{x,y} = \frac{\partial U / \partial x}{\partial U / \partial y} = \frac{MU_x}{MU_y} = \frac{6x}{5}$$

c. The *MRS* is increase as the consumer substitutes towards more *x* and less *y*. This is simply because *x* appears in the numerator of the *MRS*.

d. We know the utility function is not linear, so the indifference curves will not be straight lines. And we know that the $MRS_{x,y}$ is increasing, so the indifference curve will be bowed away from the origin, thus concave to the origin.

Exercise 5 (next page).

5.


Chill
U_2
U_1
(a)
Hot Dogs
Sweet' N Low
U_1
U_2
(b)
Sugar
Jelly
2
1
U_2
U_1
2
4
(c)
Peanut Butter
Ice Cream
U_2
U_1
(d)
Nuts
Liver
U_1
U_2
(e)
Apples