Department of Economics

Carleton University

ECON 2009A – Managerial Economics

Quiz #2 - October 11, 2018 (45 minutes)

1. (20 points) Answer the following questions related to the concept of utility function discussed in class:

   (a) (5 points) In the consumer choice model, the utility function is a mathematical representation of [*complete the sentence*] ... quantities of goods (bundles) that give the consumer the same amount of happiness/satisfaction/utility.

   (b) (5 points) What do all the points (bundles) on an indifference curve have in common? They all provide the same level of utility.

   (c) (10 points) If a consumer's marginal rate of substitution (MRS) of pizzas for hot dogs is 3, such that $\frac{MU_{pizza}}{MU_{hotdog}} = 3$, how is this consumer willing to trade pizzas and hot dogs in order to remain equally happy/satisfied?
   The MRS given above assumes pizza is drawn on the x-axis, so it shows the amount of hot dogs the consumer is willing to give up for an extra pizza, i.e. three hot dogs per pizza.

2. (30 points) Tom's utility function is $U(x, y) = 5xy$, where x is the quantity of video games and y is the quantity of movies that Tom consumes. Tom's allowance for video games and movies is $\$100$ and the prices of video games and movies are $p_x = \$10$ and $p_y = \$5$.

   (a) (6 points) Write down Tom's budget constraint

$$I = p_x x + p_y y$$
$$100 = 10x + 5y$$

   (b) (6 points) Write down Tom's marginal rate of substitution
   The question does not specify which good should be drawn on the horizontal axis so either way of writing the MRS is correct.

$$MRS = \frac{MU_x}{MU_y}$$
$$MRS = \frac{5y}{5x} = \frac{y}{x}$$

Alternatively,

$$MRS = \frac{MU_y}{MU_x}$$
$$MRS = \frac{5x}{5y} = \frac{x}{y}$$

(c) (12 points) Find the number of video games and movies that maximize Tom's utility subject to his budget constraint.

Two conditions have to hold to maximize utility: the tangency condition and the budget constraint.

Tangency condition:

$$MRS = MRT$$
$$\frac{MU_x}{MU_y} = \frac{p_x}{p_y}$$
$$\frac{y}{x} = \frac{10}{5} \rightarrow \boxed{y = 2x} \tag{1}$$

Budget constraint:

$$100 = 10x + 5y$$
$$100 = 10x + 5(2x)$$
$$100 = 20x \rightarrow \boxed{x = 5}$$

Replacing $x = 5$ this back into (1), $y = 10$.

(d) (6 points) What is Tom's utility at this optimal bundle?

We replace the optimal bundle back into the utility function:

$$U = 5xy$$
$$U = 5 \times 5 \times 10 = 250$$

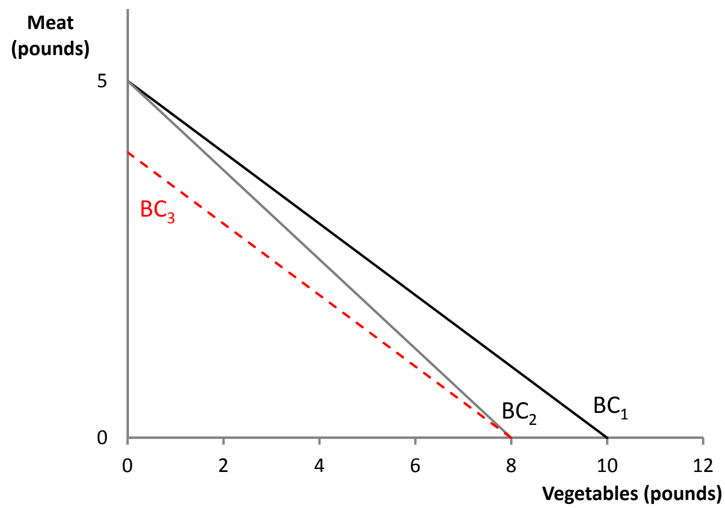
3. (30 points) Linda's budget for purchasing meat and vegetables is $\$40$. The price of a pound of meat is $p_M = \$8$ and the price of a pound of vegetables is $p_V = \$4$.

(a) (6 points) Write down Linda's budget constraint.

$$I = p_V V + p_M M$$
$$40 = 4V + 8M$$

(b) (6 points) Draw Linda's budget constraint showing pounds of vegetables on the x-axis and pounds of meat on the y-axis. Label it BC_1. Make sure you label all axes and intercepts.

Figure 1. Linda's budget line



(c) (8 points) On the graph above, draw Linda's budget constraint if the price of vegetables increases to $p_V = \$5$ and label it BC_2.

(d) (10 points) Compare Linda's situation in (c) where $p_V = \$5$, with the situation where $p_V = \$4$ but her income falls to $I = \$32$. Is Linda better off with the higher price or with the lower income? Explain (you can refer to your graph if it helps).

Linda's budget constraint with the lower income is shown as the red, dashed BC_3 on the graph (you did not have to draw this). Because every point on that budget constraint is below BC_2, except the lower corner which overlaps with it, the constraint with the higher price and higher income, BC_2 will lead to an optimal bundle on a higher indifference curve and will leave Linda better off than with the lower price and lower income.

You can also explain that if Linda wants to buy only meat, she can buy 5 pounds with the higher income but only 4 with the lower income. But she can still buy the same amount of vegetables in both situations if she spends her income only on them, 8 pounds. That means that the higher income more than compensates for the higher price of vegetables and Linda is better off in that situation.

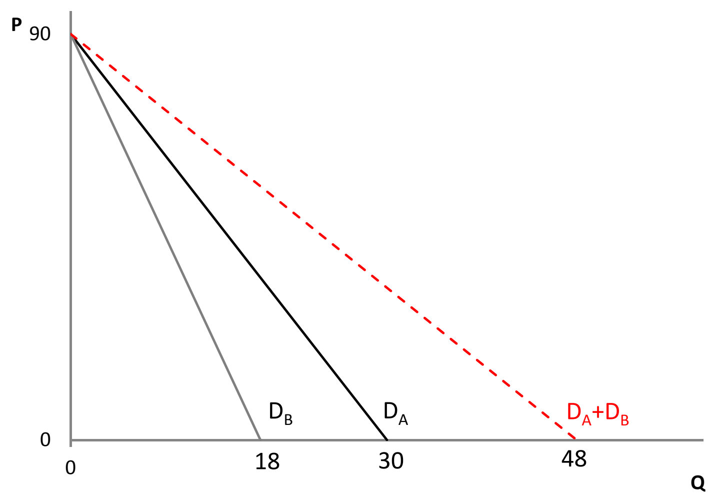
4. (20 points) Consumers A and B have the following inverse demand curves:

$$p = 90 - 3Q_A$$

$$p = 90 - 5Q_B$$

(a) (3 points) Draw both demand curves. Label them D_A and D_B. Make sure you also find the values for the intercepts.

Figure 2. Demand aggregation



(b) (7 points) On the same graph, draw the aggregate demand curve. Label it $D_A + D_B$.

(c) (10 points) Calculate the aggregate demand for both consumers mathematically.

Because we were given inverse demands, we need to rewrite them as demands to add up the quantities:

$$p = 90 - 3Q_A \quad \rightarrow \quad Q_A = 30 - \frac{1}{3}p$$
$$p = 90 - 5Q_B \quad \rightarrow \quad Q_B = 18 - \frac{1}{5}p$$

Now we can add up the demand curves:

$$Q_A + Q_B = 30 - \frac{1}{3}p + 18 - \frac{1}{5}p$$
$$Q_A + Q_B = 48 - \left(\frac{1}{3} + \frac{1}{5}\right)p$$
$$Q_A + Q_B = 48 - \frac{8}{15}p$$