Econ 303 - Intermediate Microeconomic Theory
College of William and Mary October 2, 2012
John Parman

Midterm 1

You have until 12:20pm to complete the exam, be certain to use your time wisely. Answer all questions directly on the exam. You must show all of your work to receive full credit. Non-graphing calculators may be used (no graphing calculators or phones can be used). You may leave answers as fractions. Unless a problem says otherwise, you can assume that firms can produce fractions of units and charge non-integer prices (so a firm could produce 82.4 units and sell at a price of \$5.325 per unit). Remember to put your name on the exam. Good luck!

Name: **ID Number:**

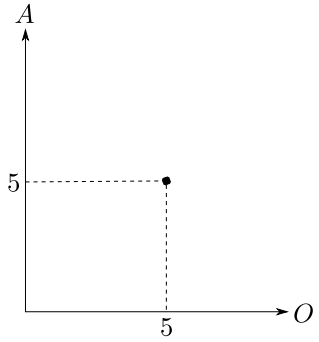
1. (15 points) Suppose that tap water (T) and bottled water (B) are the only two goods a consumer buys and tap water is a Giffen good. Both the marginal utility of tap water and the marginal utility of bottled water are always positive.

   (a) Graph the price offer curve obtained by varying the price of tap water. Include all curves and lines necessary to show at least three points on the price offer curve and be certain to label everything clearly.

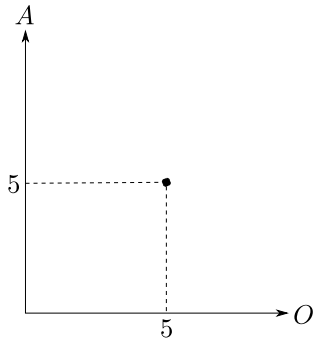
   (b) Use your graph and a written explanation to argue whether tap water and bottled water are complements or substitutes.

2. (15 points) Each scenario below describes a different set of preferences for bundles of apples (A) and oranges (O). For each scenario, draw the indifference curve passing through the bundle (5 *apples*, 5 *oranges*) consistent with the description. Also give the numerical value of the slope of the indifference curve at the bundle (5 *apples*, 5 *oranges*).

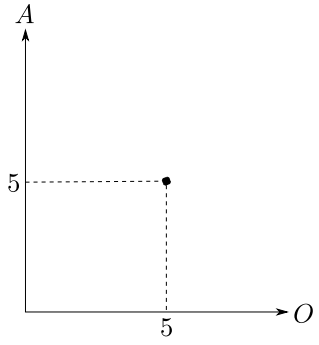
   (a) Arnold always consumes apples and oranges together in fruit salad. His recipe for fruit salad calls for one orange for every two apples. He always follows the recipe and gets no enjoyment out of apples or oranges unless they are in fruit salad.



   (b) Betsy like apples and dislikes oranges. Every apple she consumes increases her utility by ten utils while every orange she consumes decreases her utility by twenty utils.



   (c) Carl's utility from apples and oranges is given by the utility function $U(A, O) = A + O^2$.



3. (25 points) David's utility from shirts (S) and hats (H) is given by the following utility function:

$$U(S,H) = 5S^{\frac{3}{4}}H^{\frac{3}{4}} \tag{1}$$

His marginal utility from shirts and marginal utility from hats are given by:

$$MU_S(S,H) = \frac{15}{4}S^{-\frac{1}{4}}H^{\frac{3}{4}} \tag{2}$$

$$MU_H(S,H) = \frac{15}{4}S^{\frac{3}{4}}H^{-\frac{1}{4}} \tag{3}$$

   (a) Assuming that David has \$400 to spend on hats and shirts, derive an expression for David's optimal number of hats as a function of the price of hats and the price of shirts ($H(p_H, p_S)$).

   (b) Based on your answer to part (a), determine whether hats are an ordinary good. Be certain to justify your answer.

   (c) Suppose that the price of a shirt is \$10 and the price of a hat is \$10. What is the optimal number of hats?

   (d) The price of a shirt decreases to \$5 leading to a change in the combination of shirts and hats purchased. Decompose the change in the number of hats purchased into the change due to the income effect and the change due to the substitution effect. You should be able to give exact numerical values.

4. (25 points) Suppose that you have 20 hours to study for two midterms, one in economics and one in calculus. If you study for a total of H_E hours for economics, your midterm score in economics (S_E) will be:

$$S_E(H_E) = 100 - \frac{20}{H_E} \tag{4}$$

If you study for a total of H_C hours for calculus, your midterm score in calculus (S_H) will be:

$$S_C(H_C) = 100 - \frac{40}{H_C} \tag{5}$$

   (a) Suppose that you care about your average exam score between the two classes. Write down a utility function that captures your preferences over combinations of H_E and H_C.

   (b) Given your answer to (a), are your preferences convex? Be certain to fully justify your answer.

   (c) Suppose that instead of the preferences in part (a), you care about your lowest score. In other words, you are happier the higher your lowest score is. The higher of your two midterm scores does not affect your happiness. Write down a utility function that captures these preferences over combinations of H_E and H_C.

   (d) On a graph with hours of studying for economics on the horizontal axis and hours of studying for calculus on the vertical axis, show your budget line and the indifference curve passing through your optimal bundle (using the preferences from part (c)). Be certain to label the optimal bundle and any relevant intercepts with their numerical values.

5. (20 points) Suppose that you are always will to trade two cans of Sprite for three cans of ginger ale. You currently have $20 to spend on Sprite and ginger ale as well as five coupons for a free can of Sprite (each coupon gets you one free can of Sprite).

   (a) On a graph with cans of Sprite (S) on the horizontal axis and cans of ginger ale (G) on the vertical axis, show your set of affordable bundles of Sprite and ginger ale if the price of a can of Sprite is $1 and the price of a can of ginger ale is $1.

   (b) On the same graph, show at least one indifference curve. Label the slope of the indifference curve with its numerical value.

   (c) What is the utility maximizing combination of Sprite and ginger ale?

   (d) Now suppose that the price of ginger ale decreases to $0.50 a can. What is your new optimal bundle?