Economics 101
Fall 2017
Homework #1
Due Tuesday, 26 September 2017

Directions:

- The home will be collected in a box **before** the lecture.
- Please place **your name, TA name, and section number** on top of the homework (legibly). Make sure you write your name as it appears on your ID so that you can receive the correct grade.
- Late homework will **not** be accepted so make plans ahead of time.
- **Show your work**. Good luck!

Please realize that you are essentially creating "your brand" when you submit this homework. Do you want your homework to convey that you are competent, careful, and professional? Or, do you want to convey the image that you are careless, sloppy, and less than professional? For the rest of your life you will be creating your brand: please think about what you are saying about yourself when you submit any work for someone else.

Part I: Math Review

1) Consider the following two equations:

Equation A: $y = 2x + 4$ and Equation B: $x = -(1/4)y + (5/2)$

a. Plot both equations on the same graph with x and y on the horizontal and vertical axes respectively. (Restrict your attention to the first quadrant: that is, consider only values equal to or greater than zero for x and y.)

b. Plot and find the new equation A' assuming that equation (A) shifted out 2 units horizontally at every y value. What vertical shift results in the same new equation A'?

c. Find the intersection of lines (A) and (B), ignoring the shift from the previous part.

d. Suppose we shift equation (B) by c units vertically down. Find an algebraic expression that expresses the intersection of (A) and this shifted version of (B) in terms of the size of the shift, c.

e. Suppose these equations stop at the edge of the first quadrant. Graph and find the algebraic expression for the horizontal sum of equation B and the equation $y = -2x + 4$.

f. Using only the values in the first quadrant, graph and find the horizontal sum of equation A and the equation $y = 6x$.

2) Last year, Alice earned $36,000 from her job. During the same year, she saved $9,000.

a. What was Alice's savings rate last year (measured as a percent)? Show your work.

b. Suppose Alice wishes to maintain that savings rate this year during which time she made $40,000. How much money should she save this year? Show your work.

Suppose Alice decides to move some of savings out of her mattress and into an interest-bearing account. She deposits $10,000 in the account at the beginning of the year. When Alice checks the account at the end of the year, she finds she now has $10,500 in her account.

c. What was the rate of return on this account? That is, what interest rate did she earn over the course of this year when she deposited her savings. Assume that we are not doing anything fancy here: just a simple interest rate (or rate of return).

d. If she does not deposit any more money and simply lets interest accrue, how much money will be in her account after 3 years? (You may want to use a calculator for this problem). Assume that each year she earns the same annual interest on the account. Keep this calculation simple!

For this next question, it is recommended you do some research on compound interest (the Wikipedia article on the topic is a good place to start), if you aren't already familiar with the topic. A calculator may be useful for these last two parts.

Suppose Alice decides to put some money in a new account that compounds twice per year. At the beginning of the year, before the first compounding, she deposits $10,000. At the end of the year, she finds $11,000 in the account.

e. What was the interest rate on this account?

<u>Part II: Opportunity Costs, Absolute vs. Comparative Advantage, and Production Possibility Frontiers</u>

3) Alice has found herself on a desert island and must gather supplies to survive. Alice has 8 hours of useful stamina that she can use towards gathering firewood or coconuts. She finds that she can gather 1 bundle of firewood every two hours, or 6 coconuts every 4 hours.

a. In terms of a number of coconuts, what is the opportunity cost of 1 bundle of wood? What is the opportunity cost of 12 coconuts in terms of bundles of wood?

b. Draw a plot of and give an algebraic expression for Alice’s production possibility frontier (PPF). Measure coconuts on the horizontal axis and bundles of wood on the vertical axis.

Bob just crash landed on the island too. He doesn't have quite the stamina that Alice does so he can only work 6 hours a day. He finds that he can gather a bundle of wood in 2 hours or 1 coconut per hour.

c. Repeat parts (a) and (b) for Bob.

d. Who has the absolute advantage in the production of firewood and coconuts, respectively? (In this case, we will say a person has the *absolute advantage* in the production of a good if he or she produces more when devoting all available resources to the production of that good, so compare Alice spending all 8 of her hours on each with Bob spending all 6 of his hours.)

Who has the comparative advantage in the production of firewood and coconuts, respectively?

e. At most how many coconuts would Bob be willing to pay Alice for a bundle of wood? What is the minimum number of coconuts Bob would accept to sell a bundle of wood? Would this trade ever occur? Why or why not?

f. Plot the joint PPF for Alice and Bob if they pool their resources. Give an algebraic expression for this joint PPF.

4) Allison is taking her econ 101 exam. The exam is composed of 40 binary-choice problems and 40 multiple-choice problems. She has 100 minutes to solve the exam. Binary-choice problems are all the same difficulty and can be correctly solved at a rate of 1 per minute. Multiple-choice problems have a mix of difficulties, but can, on average, be correctly solved at a rate of 1 every 4 minutes.

a. Can Allison solve the entire exam in the allotted time? How much time would she need?

b. In terms of a number of binary-choice problems answered, what is the opportunity cost of 1 multiple-choice problem answered.

c. Carefully plot Allison's PPF. Measure MC questions on the vertical axis and BC questions on the horizontal axis. When you draw this graph remember that Allison only gets 100 minutes to do the exam.

Suppose each correct binary-choice problem is worth 1 point and each correct multiple-choice problem is worth 3 points.

d. What is Allison's optimal test-taking strategy? That is, given the exam format and the amount of time she is given to do the exam, what test-taking strategy will give her the best outcome? Explain. What will be her score from following this strategy?

Now suppose Allison can spend 20 minutes at the start of the exam (leaving her 80 minutes to solve the exam) to read through and label questions as 'easy' or 'hard.' Binary-choice questions are all the same difficulty, and they can be correctly solved at a rate of one BC question per minute. In contrast, 30 of the multiple-choice problems are easy and take only 2 minutes per MC question to correctly solve while the remaining 10 MC questions take 10 minutes per MC question to correctly solve.

e. Not including the originally invested 20 minutes, how much time would Allison now need to solve the entire exam?

f. Plot Allison's PPF supposing she invests the 20 minutes reading through the exam first. (*Hint: What is the opportunity cost of solving a hard multiple-choice problem vs an easy one? Which type of multiple-choice problem should she solve first?)*

g. What is Allison's optimal strategy if she invests the 20 minutes in analyzing the difficulty of the exam? What is her score from following this strategy? Should she invest the 20 minutes?