Economics 101
Spring 2018
Answers to Homework #1
Due Thursday, February 8

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.
- Please **staple** your homework: we expect you to take care of this prior to coming to the large lecture. You do not need to turn in the homework questions, but your homework should be neat, orderly, and easy for the TAs to see the answers to each question.
- 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: $x = 24 - 8y$ and Equation B: $y = -2x + 18$

Take careful note of the algebraic form of each equation. (I.e. is each in x-intercept or y-intercept form?)

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 both x and y.)

b) Find the intersection point of these two lines.

c) Suppose the line represented by equation A shifts *vertically* up by 1 unit. Plot and find the new equation (labelled A') for this line. Give the expression in both x-intercept and y-intercept form.

d) Suppose the line represented by equation B shifts *horizontally* left by 4 units. Plot and find the new equation (labelled B') for this line. Give the expression in both x-intercept and y-intercept form.

e) Using only the values from the first quadrant, plot and find the equation for the horizontal sum of equations A and B. Give the equation in both x-intercept and y-intercept form.

2) Suppose you are running a shoe-making firm. This firm has two factories: Factory R can **only** make **right** shoes, and Factory L can **only** make **left** shoes.

Factory R produces right shoes for a cost of $3 per shoe, and has a $10 maintenance cost that must be paid regardless of the number of shoes produced.
Factory L produces left shoes for a cost of $4 per shoe, and has no maintenance costs.

a) Given the above information, write an equation for the total cost of producing shoes at each factory. (There should be two different equations and each equation should be of the form C = aN + b, where C is the total cost, and N is the number of shoes produced.)

b) Plot the equations from the previous part with total cost (C), on the vertical axis, and number of shoes (N) on the horizontal axis.

c) As the manager of these factories, you only care about how many **pairs** of shoes you can produce. Given the above information, plot and give an equation for the total cost of producing N **pairs** of shoes.

Part II: Percentages and Interest Rates

3) Suppose Dave earned $50,000 last year, and saved 25% of his income.

a) How much money did Dave save in total last year?

b) Suppose this year, Dave earns $50,000 and saves $10,000. What is his savings rate this year?

4) The "rule of 70" is a handy rule of thumb for estimating the amount of time it takes for an initial investment that grows with interest rate r, to double. To estimate this doubling time, simply divide 70 by the interest rate. For example, if an investment grows at 5% per year, it would take approximately 70/5 = 14 years to double in value.

a) Suppose you invest $1000 this year with a 7% annual return. Using the rule of 70, give an approximation for how much this investment will be worth in 15 years. Then, use a calculator (but still show your work!) to find the exact value after 15 years. Hint: after the first year the value of this investment would be equal to (1000)(1 + .07); after the second year, the value of this investment would be (1000)(1 + .07)(1 + .07), etc. Compare this to your approximation.

b) Suppose 20 years ago you invested $1000. You now find that you have $4000 in the account. Approximately, using the Rule of 70, what was the annual rate of return on this account? Use a calculator (but still show your work!) to find the exact interest rate. Compare this to your approximation.

Suppose your employer offers you 2 pension plans. Plan A initially invests $100,000 which then grows 2% per year until you retire. Plan B initially invests $50,000 which then grows at 4% per year until you retire.

c) If you intend to retire in 20 years, which plan should you choose? (Hint: how long would it take for you to be indifferent between the two plans?)

Part III: Opportunity Costs, Absolute vs. Comparative Advantage, and Production Possibility Frontiers

5) Alice and Steve can each produce widgets (W) and gadgets (G). Both have 12 hours each day that they can devote to the production of these goods. Alice can produce 6 widgets every 3 hours, or 1 gadget per hour. Steve can produce 5 widgets in 6 hours or 5 gadgets in 2 hours.

a) With widgets on the vertical axis, and gadgets on the horizontal axis, plot the production possibility frontiers for Alice and Steve on two separate graphs, and provide an equation for each of these graphs.

b) In terms of the number of widgets, what is the opportunity cost of 1 gadget for Alice and Steve respectively? What is the opportunity cost of 1 widget in terms of the number of gadgets for these two individuals?

c) Who has the absolute advantage in the production of each good? Who has the comparative advantage in the production of each good?

d) Suppose Alice and Steve wish to trade gadgets and widgets. In terms of the number of widgets, what is the range of possible trading prices for 1 gadget? In terms of the number of gadgets, what is the range of possible trading prices for 1 widget?

e) (Challenge) Suppose the trading price for 1 gadget is the one most favorable to Steve (is this the highest or lowest possible price?). Plot the possible bundles of widgets and gadgets that Steve can consume if he makes efficient use of his own productive capacity and the possibility of trade with Alice.

f) Plot and give an expression for the joint PPF of Alice and Steve.

6) Sally lives alone on her own little separate island. She has 10 hours a day to either catch fish or gather coconuts. If she spends her time catching fish, she can catch 1 fish per hour. If she instead spends her time gathering coconuts, she can gather 4 coconuts per hour until she has gathered 8 coconuts. After that, only coconuts high in the trees remain, and she can only gather 1 coconut every 4 hours.

a) Consider the following production bundles for Sally:

i) 5 coconuts and 9 fish
ii) 8 coconuts and 6 fish
iii) 9 coconuts and 4 fish

Label each as either feasible or infeasible, and, if feasible, efficient or inefficient. Justify your solution by showing how much time it would take for Sally to produce each bundle.

b) With coconuts (C) on the horizontal axis and fish (F) on the vertical axis, plot Sally's production possibility frontier and then give an algebraic expression for Sally's PPF.

c) Suppose if Sally goes to the mainland, she can buy or sell as many coconuts as she wants at a price of 2 fish per coconut. Given this trade possibility, how many coconuts and fish will she produce?