Economics 102
Spring 2013
Homework #1
Due: 2/11/2013

Directions: The homework 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 remember the section number for the section **you are registered**, because you will need that number when you submit exams and homework. Late homework will not be accepted so make plans ahead of time. Please **show your work eligibly and neatly**; otherwise you will not receive full credit. Good luck!

1. Math Review

a) Find the intersection of these two lines: $-2y = 5x - 33$ and $3x - y = 11$.

Rewrite the second line as: $y = 3x - 11$. Substituting this into the first line we have $-2(3x - 11) = 5x - 33$, rearranging the terms gives us $11x = 55$, thus $x = 5$. Then $y = 3(5) - 11 = 4$. Therefore, the intersection is **(5, 4).**

b) What is the equation for the line that passes through points (3,7) and (8,4)?

We know that a line has the form $y = mx + b$, where m is the slope and b the y - intercept. With two points given, we can write:

$7 = 3m + b$ and $4 = 8m + b$

Solving these two equations will give $m = -0.6$ and $b = 8.8$.

Thus the line is **y = - 0.6x + 8.8**, or **5y + 3x = 44**

c) Suppose a straight line's slope is 3 and this line passes through the point (11, 2). Does this line also pass through the point (7, 6)? Explain your answer fully and completely.

No. Since we know the slope, the line can be written as $2 = 11(3) + b$, which gives us $b = -31$. So the equation for this line is $y = 3x - 31$. When $x = 7$, $y = 3(7) - 31 = -10$, which is not 6. Thus, the point (7, 6) does not sit on this line.

d) If we shift $3x = 7y - 16$ up by 4 units, what is the equation of the new line?

Note: The solution below is the "standard" method; there are other ways to shift a line, so whichever one works for you is good.

Shifting up means shifting along the y - axis. So we need to rewrite the equation 3x = 7y - 16 as: y = 3/7x + 16/7. Then by shifting up, we have the new line as y = 3/7x + 16/7 + 4, which gives the equation **7y = 3x + 44**

e) A promotional deal is offered such that a bottle of water costs $1.20 instead of the usual price of $1.50. What is the percentage decrease in price given this information? A week later the promotion is over and the price of a bottle of water returns to the original $1.50. What is the percent increase in the price given this information?

The percentage decrease in price is [(1.20 - 1.50)/1.50]*(100%) = **-20%** and the percentage increase in price a year later is [(1.50 - 1.20)/1.20]*(100%) = **25%.** The goal here is to remind you to be careful about your choice of base when you calculate percentage changes.

2. Opportunity Cost

Tina can travel from Madison to Chicago in one hour by taking an airplane. The same trip takes 4 hours by bus. Airfare is $80 and the bus fare is $30. If she is not travelling, Tina can work to earn $25/hour.

Answer the following questions:

a) What is the opportunity cost if Tina travels by bus?

$30 + 4(25) =$ **$130**

b) What is the opportunity cost if Tina travels by plane?

$80 + 25 =$ **$105**

c) Which of these two travel options is cheaper for Tina if Tina considers the opportunity costs involved in this travel?

In terms of opportunity cost, travelling by air is cheaper for Tina.

d) Suppose Sam is considering the same trip but Sam only earns $7/hour when he is not travelling? Which of these two travel options is cheaper for Sam given this information? Explain the intuition behind the difference in answers you get for Sam and Tina.

For Sam, the opportunity cost of travelling by bus is $30 + 4(7) = 58 and the opportunity cost of travelling by air is $80 + 7 = 87. Thus travelling by bus is cheaper.

Even though the bus and plane tickets cost the same for Tina and Sam, Tina's time has a much higher value than Sam's. Thus Tina would rather spend less time on the road.

3. Comparative Advantages and PPF

In the war against the replicators, the Asgard and the human race are the major forces. To win the war, these two groups need to have their engineers produce both spaceships and defense shields. The Asgard has a total of 2400 engineers while the human race has a total of 2000 engineers. It takes 40 Asgard engineers to produce one spaceship and 30 Asgard engineers to produce one defense shield. For the human race, it takes 50 engineers to produce one spaceship and 40 to produce a defense shield. Assume for both the Asgard and the human race that the production possibility frontiers are linear with respect to spaceship and defense shield production.

a) Graph the PPFs for both the Asgard and the human race, with spaceships on the horizontal (x) axis and defense shields on the vertical axis (y).

PPF for the Asgard:
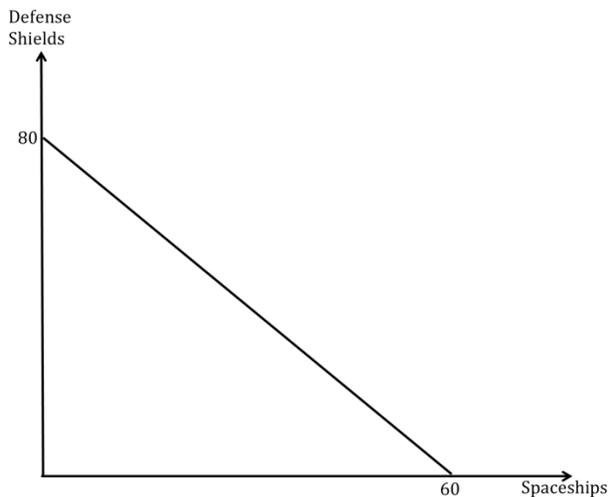
PPF for the human race
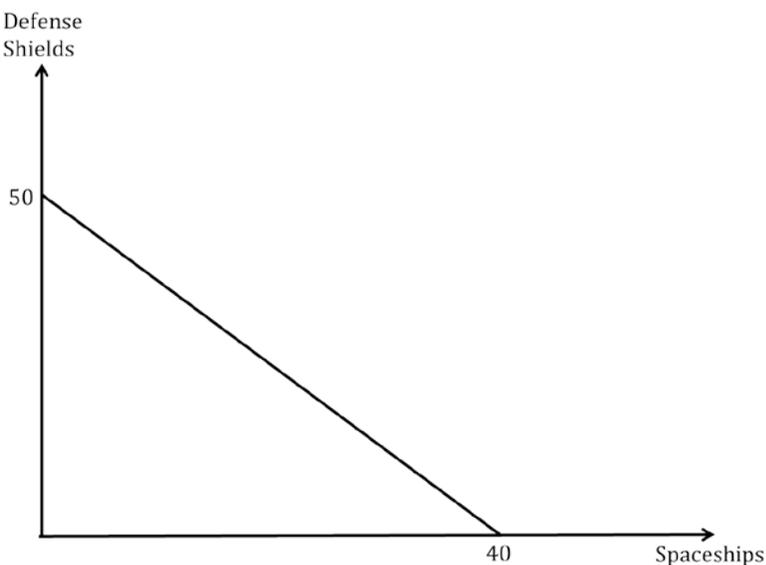
b) Write down the equations for the PPFs you have just graphed.

The Asgard: $y = \frac{-4}{3}x + 80$
The human race: $y = \frac{-5}{4}x + 50$

c) Fill in the following table of opportunity costs. How do these opportunity costs relate to the slopes of the slope of the specific PPF?

	Opportunity cost of spaceships	Opportunity cost of defense shields
The Asgard	4/3 defense shields	¾ spaceships
The Human Race	1.25 defense shields	0.8 spaceships

The opportunity costs of spaceships correspond to the absolute values of the slopes of the respective PPFs and the opportunity costs of defense shields correspond to the reciprocal of the absolute values of the slopes of the respective PPFs. One may also notice that for each race, the product of both opportunity costs is exactly 1.

d) Based on the table in part c), which group has the comparative advantage in producing spaceships and which group has the comparative advantage in producing defense shield?

The Asgard has the comparative advantage in producing defense shields and the human race has the comparative advantage in producing spaceships.

e) If the two groups are to collaborate in their effort fighting the replicators, how should they specialize? Find the acceptable range of trading prices for spaceships and defense shields.

Based on their comparative advantages, the Asgard should specialize in the production of defense shields and the human race should specialize in the production of spaceships.

Range of trading prices for 1 spaceship: between 1.25 defense shields and 4/3 defense shields
Range of trading prices for 1 defense shield: between 0.75 spaceships and 0.8 spaceships

f) Graph the combined PPF for these two groups. Write the equation for the combined PPF. (Hint: you should have one equation for each segment of your graph)
To get the combined PPF:
  i. Figure out the maximum number of defense shields that can be produced if both groups only produce defense shields: $80 + 50 = 130$
  ii. Figure out the maximum number of spaceships that can be produced if both groups only produce spaceships: $60 + 40 = 100$
  iii. Figure out the production bundle the two groups produce if they specialize completely based on their comparative advantages: the Asgard produces 80 defense shields and the human race produces 40 spaceships.
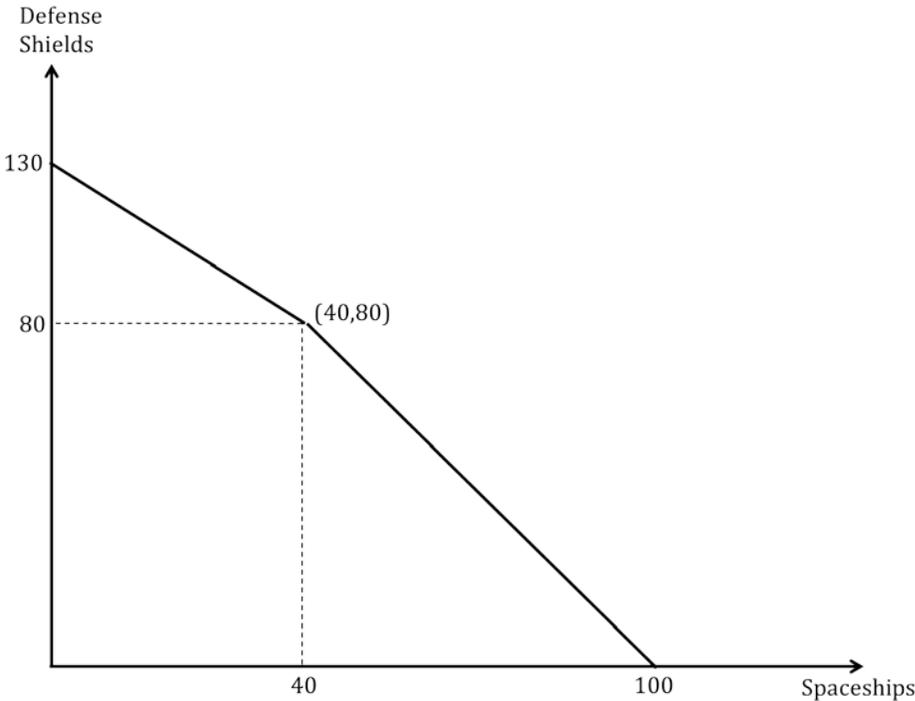
The equation for the combined PPF:

$$y = \begin{cases} \frac{-5}{4}x + 130, & if\ x < 40 \\ \frac{-4}{3}x + \frac{400}{3}, & if\ x \geq 40 \end{cases}$$

g) Based on your answers to the previous parts of this question, are these two groups better off fighting on their own against the replicators or collaborating with each other in their fight against the replicators? Briefly explain the reasoning behind your answer.

Collaborating is better than fighting on their own against the replicators. Intuitively, each group can focus on what they do best instead of spreading resources on doing something they are not so good at. Together they can produce each good more effectively, and hopefully stand a better chance of winning the war.

4. Web - Based Data Question

NOTE: To answer this question, you need to have internet access to retrieve data from the web. You do NOT need to include the data table when you hand in your homework.

Follow the instructions below:
1) Go to the website of the Bureau of Labor Statistics
2) Under <u>Databases and Tools</u>, go to <u>Pay and Benefits</u>.
3) Scroll down to find <u>Weekly & Hourly Earnings</u>, click on Top Picks icon
4) From the list, select the first 3: they give you the median weekly earnings for full time employees for all, men and women respectively
5) At the bottom of the page, click <u>Retrieve Data</u>

6) The page will give you wages from 2002 to 2012. You can download the Excel spreadsheets if you wish to do so.

Now answer the following question:

a) Calculate the percentage increases from 2002 to 2012 in median weekly earnings (annual) for all, men and women respectively.

The three tables you have are:

All

Year	Qtr1	Qtr2	Qtr3	Qtr4	Annual
2002	611	605	603	613	608
2003	620	616	618	625	620
2004	634	639	632	647	638
2005	653	643	649	659	651
2006	668	659	675	682	671
2007	693	690	695	700	695
2008	719	719	720	728	722
2009	738	734	738	748	739
2010	754	740	740	752	747
2011	755	753	753	764	756
2012	769	771	758	775	768

Men

Year	Qtr1	Qtr2	Qtr3	Qtr4	Annual
2002	682	677	671	686	679
2003	695	692	689	704	695
2004	711	714	704	722	713
2005	729	713	716	731	722
2006	744	731	749	749	743
2007	759	763	767	774	766
2008	790	800	796	807	798
2009	823	815	812	825	819
2010	844	810	813	830	824
2011	829	825	827	843	832
2012	848	865	828	875	854

Women

Year	Qtr1	Qtr2	Qtr3	Qtr4	Annual
2002	530	520	527	542	529
2003	551	547	550	561	552
2004	567	572	571	578	573
2005	586	580	585	588	585
2006	600	593	599	609	600
2007	615	607	616	618	614
2008	637	634	631	650	638
2009	649	652	657	670	657
2010	665	672	662	679	669
2011	683	689	673	688	684
2012	697	689	685	692	691

Change in wages for all: (768 - 608)/608 = 26.31%
Change in wages for men: (854 - 679)/679 = 25.77%
Change in wages for women: (691 - 529)/529 = 30.63%

b) Compare both the numbers and changes in the three tables. Are there any differences and similarities?

In absolute terms (i.e. actual numbers), men have a higher median weekly earning than women. The percentage increase however is higher for women than for men.

c) How would you interpret the differences and/or similarities you found in b)? And what other data would you suggest using to supplement or support your interpretation?

This is an open question and there is no right or wrong answer as long as you justify your reasoning accordingly. Some possible interpretations include:

It is possible that men and women have different levels of education, which could explain the difference in wages. Also if more and more women are getting more education in comparison to men, then this could account for the faster wage increase for women. To examine this, one would need data on education level by gender from 2002 to 2012.

It is possible that men and women have different levels of work experience, which could explain the difference in wages. If one observes that women's work experience increases faster than

men's work experience, this could explain the faster increase in women's salary over this time period. To examine this as a possible explanation you would need data on the level of experience by gender from 2002 to 2012.

It is possible that certain high paying jobs attract more men than women, for instance women might be more likely to work in service industries and less likely to engage in manual labor. If this is the case, then the difference in wages between men and women could be due to the difference in wages between these occupations. To study this, one would need the employment level for different occupations by gender and the wage data for different occupations from 2002 to 2012.

This is not an exhaustive list, there are many other possibilities, if you are interested, feel free to talk to Professor Kelly and/or your TAs more about it.