Homework #1 Answers

1. Which of the following statements regarding the production possibilities frontier is true?
   a. Points outside the frontier are attainable.
   b. Points inside the frontier are attainable.
   c. Points on the frontier are less efficient than points inside the frontier.
   d. None of the above because all of the above statements are false.

2. Refer to the production possibilities frontier in the figure below. Which point indicates that resources are NOT fully utilized or are misallocated?
   a. Point a.
   b. Point b.
   c. Point c.
   d. Point e.

3. Refer to the production possibilities frontier in the figure above. Suppose a country is at point a. A movement to point ____ means that the country ____.
   a. d; must give up 20 million capital goods
   b. e; is not operating efficiently
   c. d; gives up 10 million consumer goods.
   d. b; is producing at an inefficient point.
4. Most students attending college pay tuition and are unable to hold a full-time job. For these students, tuition is
   a. *part of the opportunity cost of going to college. So are their forgone earnings from not holding a full-time job.*
   b. part of the opportunity cost of going to college. Their forgone earnings from not holding a full-time job are not.
   c. *not part of the opportunity cost of going to college, but their forgone earnings from not holding a full-time job are.*
   d. not part of the opportunity cost of going to college. Neither are their forgone earnings from not holding a full-time job.

   *This question has more than one right answer. Using the definition of the opportunity cost provided in the book we might only count foregone earnings as the opportunity cost of attending college (because it is what you are giving up to attend school). However, using the framework discussed in Chapter 2 (in particular see Reading Between the lines on pages 46-7) the opportunity cost of attending school could be looked at as the consumption foregone as a result of attending school. Here your consumption decreases by the amount of tuition, fees, and foregone earnings so it is correct to look at tuition as an opportunity cost. Either answer is correct, but when we talk about the education investment decision later in the course we will refer to foregone earnings as the opportunity cost of college and tuition and fees as the direct costs of college.*

5. Jane produces only corn, measured in tons, and cloth, measured in bolts. For her, the opportunity cost of one more ton of corn is
   a. the same as the opportunity cost of one more bolt of cloth.
   b. **the inverse of the opportunity cost of one more bolt of cloth.**
   c. the ratio of all the bolts of cloth she produces to all the tons of corn she produces.
   d. the ratio of the acres of land she uses to graze sheep to the acres she uses to grow corn.
6. There are two small islands, each with a single inhabitant. The first is inhabited by the Gilligan and the second by Mary Ann. The castaways can either gather coconuts or fish in the ocean. Each has a linear trade-off between the productivity of two activities that can be expressed as a PPF.

Gilligan’s PPF \[ F = -C + 10 \]

Mary Ann’s PPF \[ F = -(1/2)C + 8 \]

where \( F \) is the number of fish caught per day and \( C \) is the number of coconuts harvested per day.

a. Draw each individual’s PPF on its own set of axis. Put fish on the vertical axis. Indicate the feasible set, the efficient and feasible set and the unattainable set of fish and coconuts.

The PPF line is the feasible and efficient set.

b. Suppose that Gilligan chooses to eat 4 coconuts a day. If he is efficient how many fish can he eat? If Mary Ann eats 4 coconuts a day how many fish can she eat?

Gilligan’s PPF \[ F = -C + 10 \]

If \( C=4 \) we have, \( 6=F = -4 + 10 \), that is, Gilligan can eat 6 fish.

Mary Ann’s PPF \[ F = -(1/2)C + 8 \]

If \( C=4 \) we have, \( 6=F = F = -(1/2)4 + 8 \), that is Mary Ann can eat 6 fish.
c. Who has comparative advantage in fish catching? What about in coconut gathering? Is this relationship always true for two person exchange economies?

Recall from above that the opportunity cost of catching a fish (the good on the y-axis) is given by the reciprocal of the absolute value of the slope. The opportunity cost of Gilligan catching an addition fish is 1 coconut. The opportunity cost of Mary Ann catching an additional fish is 2 coconuts. Gilligan has the lower opportunity cost, and thus, a comparative advantage in catching fish.

The opportunity cost for gathering coconuts (the good on the x-axis) is just the absolute value of the slope of the PPFs. Thus, Gilligan’s opportunity cost of gathering an additional coconut is 1 fish and Mary Ann’s opportunity cost is ½ fish. Mary Ann has the lower opportunity cost, and thus, a comparative advantage in coconut gathering.

As was noted above, if we are in a two person setting, each person will have comparative advantage in one of the two goods unless the slopes of their PPF are the same.

d. Given that both castaways choose to produce and consume the combinations in b, are there gains to be had from trading? What would each have to do to take advantage of those potential gains?

In part b) Gilligan and Mary Ann are consuming a total of 12 fish. Since Gilligan has comparative advantage in is catching fish he should spend all of his time catching fish. If Mary Ann catches two fish, she still has time to gather 12 coconuts. So using this scheme they can have the same number of fish and more coconuts. So, there are gains from trade to be had. In order to take advantage of those gains they need to specialize in the production of the good which each individual has comparative advantage. That is, Gilligan should catch mostly fish and Mary Ann should mostly gather coconuts.

e. If each castaway specializes in the production of the food that they are best at, how many fish and coconuts can be produced in total?

If Gilligan specializes in fish catching and Mary Ann specializes in coconut collecting then together they can catch 10 fish and collect 16 coconuts.

f. Find a consumption bundle for Gilligan and Mary Ann that they cannot produce by themselves but is possible through trade and does not require that each fully specialize. What quantity of fish and coconuts would each castaway have to produce in order for the total amount produced to equal the total amount consumed? How are they trading?
If the output that Gilligan and Mary Ann produce together is to be efficient then one or the other needs to specialize completely. I will choose a bundle in which Gilligan specializes and Mary Ann produces 4 fish and 8 coconuts. The two castaways then trade so that each gets 7 fish and 4 coconuts. It can be checked that neither individual can produce this allocation. There are many other possible allocations that fit the criteria of the question.

Gilligan starts with 10 fish and no coconuts. He ends up with 7 fish and 4 coconuts. He must be trading 3 fish for 4 coconuts. It can be said that the price of a fish is 4/3 coconuts in this economy.

7. You are the manager of a firm that manufactures shirts and pants. Employees can either make either shirts or pants with their time. You are interested in assigning your workers to the two tasks of sewing pants and sewing jackets so that their time is used most efficiently. You have observed your workers over different time intervals and recorded their output. Assume that the individual workers have linear PPF, that is it takes the form $S=mP+b$. The data are given below.

<table>
<thead>
<tr>
<th>Arnold</th>
<th>Betty</th>
<th>Carl</th>
<th>Deloris</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obs 1</td>
<td>Obs 2</td>
<td>Obs 1</td>
<td>Obs 2</td>
</tr>
<tr>
<td>Shirts</td>
<td>5</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>Pants</td>
<td>0</td>
<td>48</td>
<td>3</td>
</tr>
<tr>
<td>Time</td>
<td>1 hour</td>
<td>8 hrs</td>
<td>1 hr</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Obs 1</th>
<th>Obs 2</th>
<th>Obs 1</th>
<th>Obs 2</th>
<th>Obs 1</th>
<th>Obs 2</th>
<th>Obs 1</th>
<th>Obs 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shirts</td>
<td>6</td>
<td>3</td>
<td>2</td>
<td>9</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pants</td>
<td>2</td>
<td>0</td>
<td>4</td>
<td>3</td>
<td>18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>2 hrs</td>
<td>1 hr</td>
<td>1 hr</td>
<td>3 hrs</td>
<td>6 hrs</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Which worker has absolute advantage in the production of shirts? What about pants?

The first step in solving this question is to convert all of the observations into observations over the same time interval. The easiest choice is a single hour. The once the output levels are standardized to the same unit of time you should have a chart that looks like the following.

<table>
<thead>
<tr>
<th>Arnold</th>
<th>Betty</th>
<th>Carl</th>
<th>Deloris</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obs 1</td>
<td>Obs 2</td>
<td>Obs 1</td>
<td>Obs 2</td>
</tr>
<tr>
<td>Shirts</td>
<td>5</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Pants</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Time</td>
<td>1 hour</td>
<td>1 hrs</td>
<td>1 hour</td>
</tr>
</tbody>
</table>

The second step is to find the PPFs for each worker. With two points given it should not be a problem for you to find the equation of the line that goes through the two points. This was covered on the math review.

Arnold’s PPF: $S=-2P+5$
Betty’s PPF: $S=-(1/3)P+3$
Carl’s PPF: $S=-3P+14$
Deloris’ PPF: $S=-P+4$
If you graph these lines (putting S on the vertical axis and P on the horizontal axis) you will see that Carl has an absolute advantage in the production of shirts and Betty has an absolute advantage in the production of pants.

b. Which worker has comparative advantage in the production of shirts? What about pants?

The person with the lowest opportunity cost of producing shirts is the person with comparative advantage in the production of shirts. The opportunity cost of the good that is on the horizontal axis (Pants) can be is the absolute value of the slope of the PPF. Thus, Arnold’s opportunity cost of a pair of pants is 2 shirts, Betty’s is 1/3 of a shirt, Carl’s is 3 shirts and Deloris’ is 1 shirt. Because Deloris has the lowest opportunity cost of producing a pair of pants, she has a comparative advantage in producing shirts.

The opportunity cost of the good on the vertical axis (shirts) is the inverse slope of the PPF. Thus, Arnold’s opportunity cost of making a shirt is 0.5 pair of pant, Betty’s is 3 pants, Carl’s is 1/3 of pair of pants, and Deloris’ is 1 pant. The opportunity cost of the good that is on the horizontal axis can be is the absolute value of the slope of the PPF. Because Arnold has the lowest opportunity cost of producing one shirt he has a comparative advantage in the production of shirts.
c. Graph the PPF for each individual and for the firm. Label the y-axis shirts and x-axis pants. Give the coordinates of the kinks.

The important thing to note in constructing the factory’s PPF is the order of increasing opportunity cost of pants production. We will start with every worker making shirts then switch workers over one-by-one to pants production in the order of increasing opportunity cost of pants production. That order is Betty, Deloris, Arnold, and then Carl.
d. In general, is it possible for a worker to have absolute advantage in the production of one good but not comparative advantage in either? Explain.

This is possible as long as there are 3 or more workers. For example, suppose that we had the following 3 PPFs

- **Carl:** \( S = -P + 10 \)
- **Deloris:** \( S = -(1/2)P + 2 \)
- **Ethan:** \( S = -2P + 8 \)

It can be verified that Carl has an absolute advantage in the production of both goods, but Deloris has a comparative advantage in the production of pants and Ethan has a comparative advantage in the production of shirts.
e. Can a worker have comparative advantage in more than one good?

No. If the slope of one worker’s PPF is shallower then she will have a comparative advantage in the production of the good on the horizontal axis. If she has a comparative advantage in the production of the good on the horizontal axis, it cannot be true that the inverse of her slope is smaller than the inverse slope for any other worker. Because having a smaller inverse slope than any other worker is a necessary condition in having a comparative advantage in the production of the vertical axis good, she cannot have a comparative advantage in the vertical axis good and a comparative advantage of the good on the horizontal axis.

f. If there were only two workers, what can you say about comparative advantage in each of the goods?

Unless they PPF with the same slope, one worker will have a comparative advantage in one good and the other worker will have a comparative advantage in the other good.