Comparative advantage 1

(by Filippo Simini)

The manager of a furniture company that manufactures tables hires you to increase productivity.

Four table legs and one table top are needed to produce one table.
On average, after a day worth of effort one worker produces $l = 10$ legs or $t = 5$ table tops.

Suppose that n out of the N workers of the company are assigned to the production of legs, and the remaining $(N - n)$ to the production of tops.

How many full tables will be produced in one day, on average, as a function of n ?

Comparative advantage 2

(by Filippo Simini)

To maximise the production, workers should be assigned to the production of legs or tops in order to manufacture 4 legs in the time needed to complete 1 table top.

How many workers should produce legs and how many should produce tops, in order to maximise the production of tables ?

Comparative advantage 3

(by Filippo Simini)

We found that the average number of tables produced in one day is equal to $P = N5/3$. Is it possible to further increase the production of tables?

Previously we assumed that the productivity of each worker is exactly equal to the average productivity. This may not be true in general, as it is common to find more and less productive workers.

Suppose that you find out that in the company there are some workers that are faster than the average at producing table tops, and some other workers that are faster at producing legs.
Considering this information, you are able to form two groups:
Group 1 has $2/3$ of the workers and they produce 12 legs and 4 tops per day, on average; Group 2 has $1/3$ of the workers and they produce 6 legs and 7 tops per day, on average.

Average number of units produced by one worker per day			
	Group 1	Group 2	All
fraction of workers	2/3	1/3	1
legs	12	6	10
tops	4	7	5

How can you use this new information to increase the productivity ?

Comparative advantage 4

(by Filippo Simini)

Suppose instead that you were not able to split workers into two groups such that each group is more efficient than the other at producing one item, tops or legs.
This can happen when there are some workers that are more efficient than others at both tasks, while all other workers are less efficient than the average at both tasks.

Dividing the workers into two groups of equal size according to their efficiency, you are able to form the following two groups:
Group 1 is formed by the most efficient workers that produce 14 legs and 6 tops per day, on average; Group 2 comprises the least efficient workers that produce 6 legs and 4 tops per day, on average.

Average number of units produced by one worker per day			
	Group 1	Group 2	All
fraction of workers	1/2	1/2	1
legs	14	6	10
tops	6	4	5

How should the work be divided among the two groups in order to have balanced production, such that one table top and four legs are produced at the same rate ?

Comparative advantage 5

(by Filippo Simini)

We found that the production is balanced (i.e. tops and 4-legs are produced at the same rate) if x workers of group 1 are assigned to produce legs, and $y_{eq}(x)$ workers of group 2 are assigned to produce legs, where

$$y_{eq}(x) = \frac{t_1 + t_2}{l_2 + t_2} - x\frac{l_1 + t_1}{l_2 + t_2}$$

In this case the productivity per worker is

$$P_3(x) = 1/2\,[l_1 x + l_2 y_{eq}(x)]$$

Is it still possible to divide the production among the two groups in order to increase the productivity with respect to the solution found in part 2 ?