Complexity Economics: Problem Day 3 (Group 2)

Consider the following setting:

- An economy produces with the following production function $Y_t = K_t^{0.5} L_t^{0.5}$ (Y is income, K is the capital stock, L is the labor force).
- 30% of the income are invested and add to the capital stock in the following period, while 15% of the capital stock deprecates per period.
- The labor force grows at a constant rate of 0.001 (i.e., 0.1%).
- Table 1 summarizes all variables in the model.

Please proceed as follows:

1. (45 min)
   (a) Discuss in the group how this system could be investigated using a python program.
   (b) Write a python program to study the problem (one python program per group).
   (c) Exchange your python program with group 1. You will be given the python program written by group 1, which deals with a different dynamical system.
2. (30 min)
   (a) Analyze and understand the python program written by group 1.
3. (15 min)
   (a) Discuss the two python programs together with group 1.

Additional notes

- Claudius and Torsten will be around. If you have any questions or if you are stuck anywhere, please feel free to ask or talk to us.
- If you are done with your program and have lots of time left, consider adding further aspects such as visualizing your results. For visualizing, you may use python code similar to the example given in the code listing below.
- Consider commenting your code extensively. This will make it easier for the other group to understand your program.
- Also consider the per-capita time series (i.e. income divided by the size of the labor force; capital stock divided by the size of the labor force)

Income, production function	$Y_t = K_t^{0.5} L_t^{0.5}$
Capital stock	K_t
Intertemporal change of the capital stock	$\Delta K_t = 0.3 Y_{t-1} - \delta K_{t-1}$
Deprecation rate	$\delta = 0.15$
Labor force	L_t
Growth rate of the labor force	0.001
Initial values	$L_0 = 400$, $K_0 = 1000$

Tabelle 1: Variables and explanations.

Script: visualization of functions with matplotlib

```
1  import matplotlib.pyplot as plt
2  import numpy as np
3
4  x = np.arange(200) / 200.
5  y = x * (1 - x)
6  plt.figure()
7  plt.title("A function")
8  plt.xlabel("x")
9  plt.ylabel("y")
10 plt.plot(x, y)
11 plt.savefig("some_example_function.pdf")
12 plt.show()
```