# Assignment 1, Mathematical Simulation, 2019/2020

Hand in a single .m file called "assignment1.m" that solves this assignment on student portal. Do not put it in a .zip file and do not use subfunctions in separate files. Place your motivations and reflections in the comments.
Logically order your code according to tasks and parts using cell mode. All the code should be in Matlab. We will also allow Octave code (mention explicitly that you use that), but nothing else.
Also, do not put any personal information in the .m file like your name or student ID! By submitting it you agree that it will be accessible by other parties like teaching assistants and plagiarism checking tools.
This is an individual assignment. Cooperating is not allowed. Copying code from others, other sources or getting assistance, is not allowed.
This assignment is to show your skills, hence don't let Matlab run tests for you, but do them yourself. In the cases when you can use toolboxes, this is explicitly mentioned.
Deadline: 28/4/2020 at 13.30h CET.

## Task 1

### Part a

Load the data `dat0` from `dataAss1.mat`. Use data exploration techniques to analyze, clean and visualize the data. Use at least three different visualization techniques. Don't forget the summary statistics. You are allowed to use toolboxes for the visualizations. Describe what the findings are from this step and what your actions have been.

### Part b

Based on the data exploration, form a hypothesis from which distribution this data is coming and explain why you think this. This hypothesis should of course be reasonable.

### Part c

Estimate the relevant parameters of the hypothesized distribution. You are free to choose whether you do this in an L2 sense or in an MLE.

### Part d

Make a density-histogram plot of the fitted distribution and the data and ensure that you get the scaling right. From this representation, does the hypothesis seem ok?

### Part e

Perform a $\chi^2$ test ($\alpha$=0.05) to test your hypothesis. What are your conclusions?

## Task 2

### Part a

In Java the following LCG is used[1]: multiplier a= 25214903917, increment c=11, modulus $m=2^{24}$. Of the random integers Z that are generated by this LCG, only bits 47 down to 16 are used. Implement this LCG in Matlab and generate 10,000 U(0,1) random numbers with this generator.

[1] https://en.wikipedia.org/wiki/Linear_congruential_generator

## Part b

Perform the Kolmogorov-Smirnov test ($\alpha$=0.05) on the generated data from the Java random number generator. Also, clearly state what your $H_0$ hypothesis is and what your conclusion is.

## Part c

Perform the poker test ($\alpha$=0.05) to test the generated data from the Java random number generator. Also, clearly state what your $H_0$ hypothesis is and what your conclusion is.