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**Selected Aspects of Stochastic Processes**

**Introductory experiments in R**

Create on your network disk a new folder and give it the name: *Lab\_01*. This is the folder for the first project of this lab. All the exercises, experiments and scripts made during the laboratory classes are to be saved in the *Lab\_01* project.

Prepare the report from your experiments, in which all tasks are presented and the results are enclosed. The report has the following sections, all formatted adequately:

* Beginning: authors, affiliation, date, the report title.
* Section devoted to a white noise experiment.
* Section devoted to a random walk experiment.
* Section devoted to a selected time series experiment.

In each section of the experimental part, place the R script used.

In the task of drawing graphs, use the functions: *plot* and *lines* (check also in Internet), for example:

*plot(1:50, dane1, type = "l", col = 2, xlab = "Czas", ylab = "Wartości")*

*lines(dane2, type = "l", col = 4)*

1. **White noise**

Write a program that generates the realizations of the white noise process. Illustrate the generated series on a graph. Check the list of available in R distributions; enter the word *Distributions* in the Help search window or type ?*Distributions* in the console. You can also search on the Internet. In the description of the experiment, give the formula for the distribution functions used.

All generated realizations of the white noise are to be of length 100 (100 values of each series). Each team is to have different parameters of the generated series. Be sure to record the seed value in order to replicate the experiment.

* Two normally distributed series with the mean equal to zero and two different standard deviations that differ by an order of magnitude. Illustrate the series in one coordinate system, distinguishing them by colours.
* Two series with the same distribution, different from the normal distribution (possible distributions: lognormal, uniform, t-Student
1. **Random walk**

Based on the Gaussian white noise data obtained in task 1, generate two random walk series with different valuesof the mean *z*. Locate the graphs of both series in one frame (the graph below the graph) consisting of one column and two rows - use the *par* function: *par(mfrow = c(2,1)*. Give each graph an appropriate title.

Tips

Write out (on a piece of paper) the relationship for several initial random walk values to know the target values of the series at the initial time points.

You can modify the result by rounding the values of the generated normal distribution numbers to integers

1. **Selected time series**

Find a time series on the Internet and download it to your network drive. A string of values should be selected for which the basic parameters of the series are known. Load data into the project and create a time series from it. Using standard functions characterizing the series (see lecture 1) describe its properties and create its graph.