



# Bootstrap Methods in Data Processing.

## Problems to solve.

PWP Interdisciplinary Doctoral Studies in Mathematical Modeling  
UDA-POKL.04.01.01-00-026/13-00

Projekt jest współfinansowany przez Unię Europejską w ramach Europejskiego Funduszu Społecznego

**Problem 1.** Perform the simulation of bootstrap sample for two-point distribution with values  $\{-1, 1\}$  and the sample consisting of  $N = 10$  values with  $k = 1, 2, 3, \dots, 9$  "ones" and  $N - k$  "minus ones". Perform  $R = 10\ 000$  bootstrap samples. Use `boot` package in R.

**Problem 2.** Consider the data sample with three values  $(0, 1, 1)$ . Find the bootstrap distribution of the mean.

**Problem 3.** Consider the data sample with three values  $(0, 1, 2)$ . Find the bootstrap distribution of the mean.

**Problem 4.** Consider the data sample with four values  $(-2, -1, 1, 2)$ . Find the bootstrap distribution of the mean.

**Problem 5.** Consider the data sample with two values  $(0, 1)$ . Find the bootstrap distribution of the standard deviation.

**Problem 6.** Consider the data sample with three values  $(-1, 0, 1)$ . Find the bootstrap distribution of the standard deviation.

**Problem 7.** Consider the data sample with three values  $(0, 1, 10)$ . Find the bootstrap distribution of the standard deviation.

**Problem 8.** The set of 4 values is collected given in the table below. Write R code generating the full bootstrap distribution of this sample.

1	2	3	4
4.21	4.60	1.82	3.61

**Problem 9.** The set of 6 values is collected given in the table below. Write R code generating the full bootstrap distribution of this sample.

1	2	3	4	5	6
4.21	4.60	1.82	3.61	4.26	9.5

**Problem 10.** Prepare R code for the following experiment:

1. Generate 10 element random sample from the  $t$ -Student distribution with 5 degrees of freedom.
2. Generate the 10 000 bootstrap samples (from the 10 element random sample) and based on this present the histogram of the bootstrap distribution of the mean.
3. Find the interval (centered at  $t^*$ ) containing 95% of the bootstrap distribution.

**Problem 11.** Prepare R code for the following experiment:

1. Generate 10 element random sample from the  $t$ -Student distribution with 5 degrees of freedom.

2. Generate the 10 000 bootstrap samples (from the 10 element random sample) and based on this present the histogram of the bootstrap distribution of the standard deviation.
3. Find the interval (centered at  $t^*$ ) containing 95% of the bootstrap distribution.