Wintersemester 2023/24
Please complete these problems before the exercise session on
Tuesday 5 December, 2023, 8:30. Please be prepared to present
your solutions to any problems that you completed successfully.

1. Let $x_1, \ldots, x_n$ be i.i.d. copies of the random variable $x \sim \mathcal{N}(\mu, \sigma^2)$ with $\mu = 10$, $\sigma = 5$, and sample size $n = 50$.

   Generate 100 *different* random samples $x_1, \ldots, x_n$ using a random number generator. Then, for each sample, compute a 95% confidence interval of the mean. For the simulation of the confidence intervals, assume that the population mean μ and population variance σ^2 used to generate the samples are *unknown*. How many confidence intervals contain the true population parameter $\mu = 10$ in your experiments?

2. The masses of a certain brand of cookie packages are approximately normally distributed with expected value μ. A set of randomly chosen packages were weighted and the following data (measured in grams) was obtained:

   398.5, 399.9, 400.0, 398.8, 402.8, 394.7, 398.6, 397.5, 400.7, 401.1.

   (a) Compute a 95% confidence interval for the mean mass of the cookie packages.

   (b) Compute a 95% confidence interval for the variance of the mass of the cookie packages.

3. Download the data file `height.txt` from the course webpage. The file contains height data for 100 adult males.

   (a) Calculate the following statistics of the heights: sample mean, standard deviation, variance, minimum, maximum, median, median absolute deviation, mode, skewness, and kurtosis.

   (b) Visualize the data as a histogram.

   (c) Compute a 95% confidence interval for the mean height.

4. Download the data file `FT2.txt` from the course webpage. The file contains the durations of 272 consecutive eruptions of the Old Faithful geyser in Yellowstone National Park, Wyoming, USA.

   Compute a 95% confidence interval for the mean, variance, and median of the eruption length.