Exercises for the course

"An introduction to R"

Sheet 01

Exercise 1: If `R` is not yet installed, then install it now, see the lecture notes. Use R to calculate

$$3^7, \quad \binom{22}{17}, \quad 8!, \quad \sqrt{\pi}.$$

Exercise 2: *Vectors are used for everything in R. So handling vectors is the first thing to learn.*

- Define the variable `v1` as the vector
$$(3, 7, -4, 0)$$
View the vector by entering `v1` on the R command line.
- Define the variable `v2` as the vector
$$(1, 2, 3, \ldots, 48, 49, 50)$$
- Define the variable `v3` as the vector
$$(3, 7, -4, 0, 1, 2, 3, \ldots, 48, 49, 50)$$
You may use `v1` and `v2` for this.
- Define the variable `v4` as the vector
$$(0.0, 0.1, 0.2, 0.3, \ldots, 1.8, 1.9, 2.0)$$
- Sum over all elements of `v1`. Sum over all elements of `v2`.
- What is the product of all elements of the vector
$$(10, 11, 12, 13, \ldots, 19, 20)?$$

Exercise 3: *It produces faster code and needs less typing to use* `sum()` *and* `prod()` *instead of using loops.*
Using the commands `sum()` and `prod()`, calculate

$$\sum_{i=30}^{200} i, \quad \sum_{i=1}^{100} \frac{1}{i}, \quad \sum_{i=0}^{100} i * e^{-i}, \quad \prod_{i=1}^{100} \left(2 \cdot i^2 - i\right)$$

Exercise 4: Create the following matrices:

$$\begin{pmatrix} 1 & 3 & 5 \\ 2 & 4 & 6 \end{pmatrix} \quad \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix} \quad \begin{pmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \end{pmatrix} \quad \begin{pmatrix} 2 & 3 & 4 \\ 7 & 8 & 9 \end{pmatrix}$$

$$\begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} \quad \begin{pmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{pmatrix} \quad \begin{pmatrix} 1 & 4 & 9 & 16 \\ 1 & 4 & 9 & 16 \\ 1 & 4 & 9 & 16 \\ 1 & 4 & 9 & 16 \end{pmatrix}$$

Exercise 5: *The most important R command is* `help()`. *It is good to get used to it as soon as possible.*
The commands `signif()` and `expm1()` have not been discussed in the course. Use `help()` (or `?`) to learn how to use them.

- Produce a vector which contains each element of the vector $(1:100)^8$ rounded to 3 significant digits. Recall that e.g. 42598 rounded to 3 significant digits is $4.26 * 10^4$.
- For each element x_i of the vector $(10^{-2}, 10^{-3}, 10^{-4}, 10^{-5}, \ldots, 10^{-17}, 10^{-18})$ calculate

  $$e^{x_i} - 1$$

  first by using the R command `exp()` and then by using the R command `expm1()`. Which result do you trust more?