

# Exercises for Lecture 4

## Statistical Computing with R, 2023-24

### Exercise 1: writing your solutions in R Markdown

Create an R Markdown file where you will write your solutions to the exercises from this session.

1. Choose a title for the document, insert your name and surname in the author field and set the date to today.
2. Choose pdf as default output
3. Use section headers to separate the solutions of different exercises
4. Use subsection headers to separate answers to different questions that are part of the same exercise.

The (format of the) output pdf should look similar to the one below:

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## Solution to exercise 1

### Question 1

Some text and code here

### Question 2

Some text and code here

## Solution to exercise 2

### Question 1

Some text and code here

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**Important:** section and subsection headers make it easier to navigate through a document. From now on, please use this format to write your solutions to exercises, both during the course and at the exam. If you don't like to work directly in R Markdown (or don't yet feel comfortable enough to do it), you may first write and test your code in a script, and then

write an R Markdown file where you copy the code from the script, and add your explanations and comments.

## Exercise 2

Let's consider again the `heights` dataset from the `brlgar` package that we already used previously.

1. Load the data frame in R.
2. Write a function that given a country name as input, returns as output a data frame containing only the rows in `heights` that refer to the country of interest. If the input name is not the name of one of the countries present in `heights`, the function should return a warning that says that no data are available for the requested input name. You can use the function `warning( )` to generate a warning in R (see `?warning`)
3. Add to the function created at point (2) a `min.year` argument. The function should return only values from years  $\geq \text{min.year}$ . If for the country of interest there are no data on heights from `min.year`, the function should return a warning that explains that.

## Exercise 3

Let

$$f(x) = \begin{cases} -5 & \text{if } x \leq -3 \\ \log(x+5) & \text{if } -3 < x < 1 \\ 2 & \text{if } x = 1 \\ \sqrt{x+3} & \text{if } 1 < x \leq 14 \\ \log(x) & \text{if } x > 14 \end{cases}$$

1. Write a function in R that evaluates  $f(x)$
2. Compute  $f(x)$  for  $x = -6, -4, -2, 0, 2, 4, 6, 8, 10$

## Exercise 4

Write a function that takes a matrix as input and does the following:

1. Checks if the matrix is square. If the matrix is not square, return the text “This matrix is not square”.
2. If the matrix is square, calculate the determinant. If the determinant is equal to 0, return the text “This matrix is square and has determinant 0”. If the determinant is unequal to 0, return the inverse of the matrix.

Create a matrix to check your function with.

## Exercise 5

Write a function that takes a dataframe as input and outputs differently sized matrices based on the dimension of the dataframe. Let the output be a matrix.

1. If the dataframe has  $< 5$  rows and  $< 5$  columns, print all values.
2. If the dataframe has  $< 5$  rows, and  $5 - 10$  columns, print all rows and the last 5 columns.
3. If the dataframe has  $< 5$  rows, and  $\geq 10$  columns, print all rows and the first 5 columns.
4. If the dataframe has  $\geq 5$  rows and  $< 5$  columns, print the last 5 rows and all columns.
5. If the dataframe has  $\geq 5$  rows and  $5 - 10$  columns, print the last 5 rows and the last 5 columns.
6. If the dataframe has  $\geq 5$  rows and  $\geq 10$  columns, print the last 5 rows and the first 5 columns.

Create a dataframe to check your function with.