

# Lab 1 - Introduction to R

## Vectors

1. Create a vector `u` that has values -10, -9, -8, . . . ,0. How many different ways can you use?
2. Create another vector `v` that has values -0.1, 0.4, 0.9, 1.4, . . . , and there are 11 numbers (aka terms) in `v`. How many different ways can you use?
3. Calculate the vector of `u + v` and `u * v`.
4. Increase all terms in `u` by 1, and then take away 20% from all terms in `v`.
5. Create a vector `w` that contains all the numbers from `u` and then `v`. Assign the length of `w` to a variable `len`.
6. Use a command to return the 14th, 15th and 16th value of `w`. What about the 2nd, the 5th, 9th and 21st value of `w`? What is the 23rd value?
7. Replace the 3rd term of `w` by 100. Then replace the 7th, 15th and 22nd terms by 200, 300 and 400 simultaneously.
8. Remove `u`.
9. Remove all the objects in the environment.

[The following exercises are optional.]

Explore functions `exp()` and `cos()` by looking at the help.

10. Create a vector `p` of the values of  $e^x \cos(x)$  at  $x = 3, 3.1, 3.2, \dots, 6$ .

Explore functions `max()`, `min()`, `sort()` and `which()` by looking at the help.

11. Find the maximum/minimum value in `p` and the index (position) of that value in `p`.
12. Sort `p` in the descending order.

Explore the function `rep()` by looking at the help.

13. Create (4, 6, 3, 4, 6, 3, . . . , 4, 6, 3) where there are 10 occurrences of 4.
14. Create (4, 4, . . . , 4, 6, 6, . . . , 6, 3, 3, . . . , 3) where there are 10 occurrences of 4, 20 occurrences of 6 and 30 occurrences of 3.

## Matrices

Example:

```
a_matrix <- matrix(
  1:12,
  nrow = 4,                #ncol = 3 works the same
  dimnames = list(
    c("one", "two", "three", "four"),
    c("eins", "zwei", "drei")
  )
)
```

```
a_matrix
```

```
##      eins zwei drei
## one   1   5   9
## two   2   6  10
## three 3   7  11
## four  4   8  12
```

1. Create the following matrix and assign it to the variable `b_matrix`.

```
##   a  b  c  d  e
## A  1  3  5  7  9
## B 11 13 15 17 19
## C 21 23 25 27 29
## D 31 33 35 37 39
```

2. Extract a sub-matrix from `b_matrix` named `subB` as follows. Try to use as many possible ways as you can (positive and negative indices).

```
##   b  c
## A  3  5
## B 13 15
## D 33 35
```

3. In R, `%%` is an operator for matrix multiplication. Compute `a_matrix %% b_matrix` and `a_matrix %% subB`. Discuss the results you get from R.

**[The following exercise is optional.]**

Explore the function `cbind()` (bind by columns) and `rbind()` (bind by rows) by looking at the help.

4. Create three vectors `x,y,z` with integers and each vector has 3 elements. Combine the three vectors to become a  $3 \times 3$  matrix `A` where each column represents a vector. Change the row names to `a,b,c`.

## Exercise on R markdown

Create a html/pdf/doc file to report your solutions with title, author and date information.