

1. Functions -----

What is a function that displays all the objects currently stored in the memory? Write it below after deleting the line that reads “WRITE YOUR ANSWER (code) HERE”, and execute it.

```
ls()
```

Create a new object named x5 that is a number 100.

```
x5 <-100
```

Calculate the square root of x5 using the sqrt() function

```
sqrt(x5)
```

Calculate the square root of x5 by raising it to the power of 0.5.

Your numeric answer should be exactly the same as when you used the

sqrt() function. This is because taking the square root of something is equivalent to raising it to the power of 0.5.

```
x5^0.5
```

Create an object called x6 that is equal to 31.8734.

```
x6 <- 31.8734
```

Use the round() function to get the value of x6 rounded off to three decimal places

```
round(x6, digits = 3)
```

Functions `floor()` and `ceiling()` can also be used to trim a number down to an integer: apply both of these functions to `x6` and compare the outputs. Can you guess what these functions do?

```
floor(x6) ceiling(x6)
```

The floor function returns the largest integer not greater than the number provided.

The ceiling function returns the smallest integer not less than the number provided.

To find out if your hunch was right, refer to the help file of these functions. Write a code to open up the help file for the floor function.

```
?floor
```

2. Vectors ---

Create an object called “vec.a” which is a vector consisting of the numbers, 1, 3, 5, 7. You need to use the `c` function.

```
vec.a <- c(1,3,5,7)
```

Create a vector called “vec.b” consisting of the numbers, 2, 4, 6, 8.

```
vec.b <- c(2,4,6,8)
```

Subtract `vec.b` from `vec.a`

```
vec.a - vec.b
```

Create a new vector called `vec.c` by multiplying `vec.a` by vector `vec.b`

```
vec.c <- vec.a * vec.b
```

Create a new vector called `vec.d` by taking the square root of each member of `vec.c`

```
vec.d <- sqrt(vec.c)
```

What is the third element of the `vec.d` vector? Find out using square bracket. Note that since this is a vector, you only need to provide a single number inside the brackets.

```
vec.d[3]
```

Create a new vector called `vec.e` consisting of all the integers from 1 through 100. You should use the `seq` function, rather than writing

down all the 100 integers individually.

```
vec.e <- seq(from = 1, to = 100)
```

The `mean` function calculates the arithmetic mean of the numbers stored

in an object. Using the `mean` function, calculate the mean of the `vec.e` vector.

```
mean(vec.e)
```

As we saw in the joint exercise, the `sum` function calculates the sum of all

the elements in an object. Calculate the sum of the `vec.e` vector.

```
sum(vec.e)
```

The length function returns the number of elements stored in an object.

Using the length function, find the number of elements stored in the vec.e

vector.

```
length(vec.e)
```

The mean of an object can be obtained by $\text{sum}(X)/\text{length}(X)$ because

the definition of the mean is the sum of elements divided by the number of

elements. Now, using the sum and length functions, calculate the mean of

the vec.e vector. Compare the answer with that obtained with the mean function

```
sum(vec.e)/length(vec.e)
```

We have used the seq function in the joint and individual exercises.

In doing so, we have used the from and to arguments so far. There are

other arguments we can provide. First, the by argument specifies an increment. For example,

```
seq(from = 0, to = 10, by = 2)
```

This creates a sequence that starts from 0 and ends with 10, and with

an increment of 2.

Now, create a new object called olympic which is a sequence that starts from 1896 and ends with 2012, with an increment of 4.

```
olympic <- seq(from = 1896, to = 2012, by = 4)
```

How many elements does the olympic vector contain? That is, what is

the length of this vector? Find out by applying a function (not by manually counting the number of elements).

```
length(olympic)
```

So there are 30 elements in the olympic vector. Display all the elements contained in the olympic vector. These are the years where olympic games were (supposed to be) held. Display the contents of the olympic vector.

```
olympic
```

Find out how many olympic games will have been held by the year 2400. Use the length and seq functions.

```
length(seq(from = 1896, to = 2400, by = 4))
```

127 olympic games.

3. Matrices ---

Create a new vector called “v1” consisting of the following numbers:

1, 3, 5, 7, 9, 11

```
v1 <- c(1,3,5,7,9,11)
```

Find out the length of this vector (Don’t count the numbers by hand;

use an appropriate function).

```
length(v1)
```

We will convert this vector into a matrix. That is, we will rearrange this

vector so that it will have two dimensions (rows and columns).

Since this vector has 6 numbers, if we want the matrix to have two rows, how many columns will there be?

3 columns ($= 6/2$)

Create a matrix called `mat.v` using the following command:

```
matrix(data = v1, nrow = 2)
```

```
mat.v <- matrix(data = v1, nrow = 2)
```

Take a look at the content of this matrix.

How many columns are there?

```
mat.v
```

Notice how the numbers in `vec.v` are used to fill up the cells of `mat.v`.

We can see that R did it “by column”. That is, R first filled up the first column of `mat.v` with the first two elements of `vec.v`, then moved

on to the second and third columns.

You can use the `byrow` argument to change this. This argument takes

one of two values, `TRUE` or `FALSE` (or `T` or `F`). That is, we write `matrix(data = v1, nrow = 2, byrow = TRUE)`

Now, create an object called `mat.w` using the command above.

```
mat.w <- matrix(data = v1, nrow = 2, byrow = TRUE)
```

Compare `mat.v` and `mat.w`. Do you see that R filled up the cells “by row” to create the `mat.w` matrix ?

```
mat.v mat.w
```

Many functions in R have arguments that take `TRUE` or `FALSE` like

the `byrow` argument we just used. In most cases, functions have a default value. In the case of the `matrix` function, the default value for the `byrow` argument is `FALSE`, meaning that, if you don’t specify anything, R will automatically sets `byrow = FALSE`.

Find the number in the second row, second column of `mat.w`

```
mat.w[2,2]
```

Find the number in the second row, second column of `mat.v`

```
mat.v[2,2]
```

Finally, execute the entire contents of this R file by pressing `Ctrl + A` and then pressing `Ctrl + Enter`.

Make sure that you don’t get any error message. If you get an error message, it’s probably because you forgot to comment out something.

End of file