

# Programming: Practical 1

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In the questions below, the important part is **understanding** what's going on rather than just typing the R commands. If you are unsure of what's going on, please ask.

## Course package

First we'll install the course R package.

```
##Windows & Linux users
install.packages("nclRprogramming",
                 repos="http://R-Forge.R-project.org")
##Apple users
install.packages("nclRprogramming",
                 repos="http://R-Forge.R-project.org",
                 type="source")
```

To load the package, use

```
library(nclRprogramming)
```

## 1 Practice questions

### 1. Basic functions

```
v = 5
Fun1 = function() {
  v = 0
  return(v)
}
Fun1()

## [1] 0

v

## [1] 5
```

- Why does the final line return 5 and not 0.
- Delete the third line in the above piece of code. Now change Fun1 to allow v to be passed as an argument, i.e. we can write Fun1(5). Call this function to make sure it works.
- Include an additional argument, w. Make the function return v+w. Experiment with different calling patterns, for example:

```
Fun1(1, 2)
Fun1(v = 1, 2)
Fun1(1, w = 2)
Fun1(w = 2, v = 1)
```

## 2. Default arguments:

```
Fun2 = function(x = 10) {
  return(x)
}
Fun3 = function(x) {
  return(x)
}
```

(a) Why does this work:

```
Fun2()
```

but this raises an error

```
Fun3()
```

(b) Change Fun2 so that it returns  $x \times x$ .

(c) Now change Fun2 so that it takes two arguments,  $x$  and  $y$ . Both arguments should have default value of 10. The function should return  $x \times y$ .

## 3. if statements.

```
Fun4 = function(x) {
  if (x == 5) {
    y = 0
  } else {
    y = 1
  }
  return(y)
}
```

(a) Call Fun4 a few times with different values of  $x$ .

(b) Change Fun4 so that it returns 0, if  $x$  is greater than 5.

(c) Change Fun4 so that it returns 0, if  $x$  is greater than or equal to 5.

(d) Change Fun4 so that it:

- returns 1 if  $x$  is positive;
- returns -1 if  $x$  is negative;
- returns 0 if  $x$  is zero.

(e) Suppose that  $x$  is a vector. Change the function so that it returns 0 if the mean( $x$ ) is negative and 1 otherwise.

## 4. for loops.

```
total = 0
for (i in 1:5) {
  total = total + i
}
total

## [1] 15
```

The for loop above calculates

$$\sum_{i=1}^5 i$$

- (a) What is the final value of total in the above piece of code?  
 (b) Change the above loop to calculate the following summations:

$$(i) \sum_{i=1}^{20} (i+1) \quad (ii) \sum_{j=-10}^{15} j$$

## 5. More for loops:

```
a = 2
total = 0
for (blob in a:5) {
  total = total + blob
}
```

- (a) Delete line 1. Now put the above code in a function called Fun5, where a is passed as an argument, i.e. we can call Fun5(1)  
 (b) Alter the code so that the for loop goes from a to b, rather than a to 5. Allow b to be passed as an argument, i.e. we can call Fun5(1,5).  
 (c) Change Fun5 so that it has default arguments of a=1 and b=10.

*Solutions*

Solutions are contained within this package:

```
library(nclRprogramming)
vignette("solutions1", package = "nclRprogramming")
```