

Programming: practical 1 solutions

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.

1 Practice questions

1. Basic functions

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

```
## [1] 0
```

```
v
```

```
## [1] 5
```

(a) Why does the final line return 5 and not 0.

```
## Fun1 uses the local variable v
```

(b) Delete line 3 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.

```
Fun1 = function(v) {
  return(v)
}
Fun1(10)

## [1] 10
```

(c) Now make the argument in Fun1 have a default value of 0.

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

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()
```

```
## Fun1() has a default argument
```

(b) Change Fun2 so that it returns \sqrt{x} .

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

3. if statements.

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

(a) Change Fun4 so that it:

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

```
Fun4 = function(x) {
  rtn_value = 0
  if(x > 0) {
    rtn_value = 1
  } else if (x < 0) {
    rtn_value = -1
  }
  return(rtn_value)
}
```

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?

```
total

## [1] 15
```

(b) Change the above loop to calculate the following summations:

$$(i) \sum_{i=1}^{20} (i + 1)$$

```
total = 0
for(i in 1:20) {
  total = total + (i + 1)
}
total

## [1] 230
```

$$(ii) \sum_{j=-10}^{15} j$$

```
total = 0
for(j in -10:15) {
  total = total + j
}
total

## [1] 65
```

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)

```
Fun5 = function(a) {
  total = 0
  for(blob in a:5){
    total = total + blob
  }
  return(total)
}
Fun5(1)

## [1] 15
```

- (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).

```
Fun5 = function(a, b) {
  total = 0
  for(blob in a:b){
    total = total + blob
  }
  return(total)
}
Fun5(1, 5)

## [1] 15
```

- (c) Change Fun5 so that it has default arguments of a=1 and b=10.

```
Fun5 = function(a=1, b=10) {
  total = 0
  for(blob in a:b) {
    total = total + blob
  }
  return(total)
}
Fun5(5)

## [1] 45
```

Solutions

Solutions are contained within the nclRprogramming package. To obtain the package, we need to use drat, which can be installed via

```
install.packages("drat")
```

Then

```
drat::addRepo("rcourses")  
install.packages("nclRprogramming", type="source")
```

The solutions can be viewed via

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