Practical 1 solutions
Dr Colin S. Gillespie

I've added solutions to selected questions only.

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.[1]

[1] Fun1 uses the local variable c.

(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[2]

```
Fun3()
```

(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?[3]   [3] total = 15

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

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

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

## [1] 230
```

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

```
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
```