

Second R Refresher

Getting started

Log-in to a PC in the usual way and open Rstudio. Once you've opened Rstudio you should see four panels – if there is no text editor open in the top-left panel, click on the green button with a white plus symbol and open a new R Script. Remember – to execute a line of code in the text editor, hit Ctrl- Enter.

In the questions below, the important part is **understanding** what's going on rather than just typing the R commands. Make sure you answer the questions under each piece of R code. If you can't answer the question, then ask! Where possible, write your answer down on the worksheet. You should create the folder Practical2 in a directory called MAS2906 – this is where you can save your R session and any other files associated with this practical.

Question 1

Type in the following code and then answer the questions below.

```
1 Fun1 = function(x=10){
2   return(x)
3 }
4
5 Fun2 = function(x){
6   return(x)
7 }
```

- (a) Type Fun1() and then Fun2(). Why does Fun2() give an error message?
- (b) Change Fun1 so that it returns $\sqrt{x}$.

Question 2

Type the following code and then answer the questions below.

```
1 v = 5
2 Fun3 = function(){
3   v = 0
4   return(v)
5 }
6
7 Fun3()
8 v
```

- (a) Why does line 8 above give 5 and not zero?
- (b) Delete line 3 in the above code. Now change the function to allow v to be passed as an argument, i.e. we can run Fun3(5). Call this function to make sure it works.
- (c) Now make the argument have a default value of 0.

Question 3

Type the following code and then answer the questions below.

```
1 Fun4 = function(x) {  
2   if(x==5) {  
3     y = 0  
4   } else {  
5     y = 1  
6   }  
7   return(y)  
8 }
```

- (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 $\text{mean}(x)$ is less than 0, and $\text{mean}(x)$ otherwise.
- (f) Change Fun4 so that if x is positive, it returns $\sqrt{x}$.

Question 4

Type the following code and then answer the questions below.

```
1 total = 0  
2 for(i in 1:5) {  
3   total = total + i  
4 }  
5 total
```

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 code above to calculate the following summations:

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

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

(iii) $\sum_{j=1}^{10} \exp(j^{1/j})$

(iv) $0, 3, 6, 9, \dots, 24$

(v) $\sum_{j=0}^{20} \frac{1}{2^j}$

Question 5

Type the following code and then answer the questions below.

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

- (a) Delete line 1 above and put the 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. so we can call Fun5(1,5).
- (c) Change Fun5 so that it has default arguments of a=1 and b=10.

Question 6

The following function calculates the sum of a vector:

```
1 Fun6 = function(x) {
2   n = length(x)
3   total = 0
4   for(i in 1:n) {
5     total = total + x[i]
6   }
7   return(total)
8 }
```

- (a) Alter Fun6 to calculate the mean of the vector x. Do not use the built-in mean function. Test your function. Call your function MyMean.
- (b) Alter Fun6 to calculate the standard deviation of the vector x. Do not use any built-in functions (although you may use MyMean). Test your function.

Question 7

Load the movies database. You can do this via the `ncldata` package, as demonstrated in the lecture notes, or by reading the datafile in from the MAS2906 webpage using the code below (do not copy-and-paste this code; you need to type it in carefully!):

```
1 movies = read.table("http://www.mas.ncl.ac.uk/~nlf8/teaching/mas2906/movies.txt")
```

- (a) Produce a histogram of the movie ratings (see page 17 of your lecture notes for help). Colour this histogram 'forest green', and make sure the title and axis labels are appropriate.
- (b) Use the `summary` command to find some useful summary statistics for the movie ratings. Also find the standard deviation.
- (c) Type the following code, making sure you understand what R has done; edit the code to ensure the title and axis labels are appropriate:

```
1 barplot(table(movies$mpaa), col=c("red", "orange", "yellow", "green"))
```

- (d) Type the following code, making sure you understand what R has done. What does the second plot tell us?

```
1 boxplot(movies$Length, col="wheat")
2 boxplot(movies$Length~movies$Horror, col=c("misty rose", "gold"))
```