Exercise Sheet: Base R Concepts

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This version was compiled on April 24, 2019

This exercise sheet is designed to help you understand the key concepts that are essential to learning and using R. The key requirement is to have R installed. Follow the instructions below to learn more. Have fun!

Be Brave and Experiment. Making mistakes and experimenting is an essential part of learning R. You can recover from most mistakes (e.g. by restarting R). To do this "safely" start with a *fresh* R session without any other data loaded (otherwise you could lose it).

Start R. Double click in the R (or RStudio) icon to start it.

Warning. If an R command is not complete then R will show a plus sign (+) prompt on second and subsequent lines until the command syntax is correct.

```
+
```

To break out this, press the escape key (ESC).

Exercises: The following are exercises for you try with R..

1. Assign Values to an Object

Assign numbers to objects:.

```
year <- 1995
cases <- 523
year
cases
```

Assign characters to objects:.

```
country <- "Portugal"
country
```

Warning: R is case sensitive.

```
city <- "Coimbra"
CITY <- "Porto"
city
CITY
```

2. R as a Calculator

You can use R as a basic calculator.

```
72 + (34*51 - 4982)/(18*45)
sqrt(81)
9**2
```

Trigonometric and logarithmic functions.

```
# pi is a stored value
pi
sin(pi/3)
tan(pi/3)
log10(1000)
log(5.2)
exp(1)
```

Rounding & combining.

```
signif(1512337, 2)
round(16.15643, 2)
round(exp(sqrt(log(514))), 2)
```

3. Some More R Concepts

You can do some clever and useful things with using the assignment operator <-:

```
price <- 412.65
tax <- 94.91
total <- price + tax
total
```

Vectors. The objects presented so far have all been scalars (single values). Working with vectors is where R shines best as they are the basic building blocks of datasets. To create a vector we can use the `c()` (combine values into a vector) function.

```
vYear <- c(1995, 2000, 2005, 2010, 2015)
vCases <- c(523, 489, 511, 472, 439)
vCountry <- rep("Portugal", 5)
vYear
vCases
vCountry
```

Vector operations.

```
# Calculate the total by adding the tax to net
net <- c(108.99, 291.42, 16.28, 62.29, 31.77)
tax <- c(22.89, 17.49, 0.98, 13.08, 6.67)
total <- net + tax
total
# Convert from degrees centrigrade to fahrenheit
tempC <- seq(-40, 40, 10)
tempF <- (9*tempC)/5 + 32
tempC
tempF
```

Missing Values. Missing values are coded as `NA` in R.

```
height <- c(NA, 1.73, 1.53, 1.67, 1.66, 1.81)
weight <- c(63, 70, 95, 63, NA, 77)
bmi <- weight/(height**2)
height
weight
round(bmi, 1)
```

Comments. It is useful to put human readable comments in your programs. These comments could help the future you when you go back to your program. R comments start with a hash sign (#). Everything after the hash to the end of the line will be ignored by R.

```
# This comment line will be ignored when run.
weight # Weight in kg
height # Height in metres
```

```r
# bmi - Body Mass Index
signif(bmi, 3)
```

Managing Objects. Use function `ls()` to list the objects in your workspace. The `rm()` function removes (deletes) them.

```r
ls()
rm(cases, city, CITY, country, year, tempF, tempC)
ls()
```

R Functions. What do the following functions do?

```r
myNums <- c(454, 939, 740, 701, 394, 79, 30)
sort(myNums)
sort(myNums, decreasing = TRUE)
rank(myNums)
rev(myNums)
```

```r
# With missing values
naNums <- c(105, 81, 17, NA, 52, 394)
mean(naNums)
mean(naNums, na.rm = TRUE)
sd(naNums, na.rm = TRUE)
```

The useful `summary()` function.

```r
summary(naNums)
```

Pasting text and numbers.

```r
Names <- c("Leo", "Iris")
Age <- c(4, 5)
Text <- paste0(Names, " is ", Age, " years old,")
Text
toupper(Text)
tolower(Text)
```

4. Additional Materials

Selecting elements from a vector.

```r
colour <- c("red", "blue", "pink", "cyan", "gray")
colour[4]
colour[3:5]
colour[c(5, 1, 3)]
```

Evaluating logical expressions.

```r
xscale <- c(7, 10, 9, 6, 1, 8, 2)
xscale > 8
xscale[xscale > 8 | xscale <=2]
```

5. Summary

With these exercises you now have the building blocks to learn more.

Acknowledgments. The R project (https://www.r-project.org) for a great product.