Basics of R

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Contents

1.1.3 Basics of R

1.1.3.1 Math operations

```
2 + 2
```

```
## [1] 4
```

```
8 / 4
```

```
## [1] 2
```

```
2 * 3
```

```
## [1] 6
```

```
3 ^ 3
```

```
## [1] 27
```

```
a = 3
b = 3
a + b
```

```
## [1] 6
```

- Assignment operator should ALWAYS be used instead of =
- It is directional
- And it meets Google's R style guide
  - You can findd the style guide in 3-readings>3-CheatSheets
- = works in most cases too but may cause problems

```
a <- 3
b <- 6

a <- b
a
```

```
## [1] 6
```

```r
  a <- 3
  b <- 6

  a -> b
  a
```

```
## [1] 3
```

1.1.3.2 Object Classes

```r
  # numerics
  a <- 5
  class(a)
```

```
## [1] "numeric"
```

```r
  # integers
  b <- as.integer(42)
  class(b)
```

```
## [1] "integer"
```

```r
  # logicals
  c <- TRUE
  class(b)
```

```
## [1] "integer"
```

```r
  # characters
  d <- "hello world"
  class(c)
```

```
## [1] "logical"
```

```r
  # factors
  e <- as.factor(c("1", "1", "a", "1", "c", "a"))
  class(e)
```

```
## [1] "factor"
```

```r
  e
```

```
## [1] 1 1 a 1 c a
## Levels: 1 a c
```

```r
  # quick note it you want to convert a factor to a numeric
  # You have to convert it to a character first, then a numeric
```

1.1.3.3 Indexing

- R uses brackets to reference a data index
- data[“row”,“column”]
- Standard organization for data set has varaibles as columns and observations as rows
- Keep in mind that R indexing starts from 1, not 0
- We can load a test data set for indexing

```r
  data("iris")

  iris[1,2]
```

```
## [1] 3.5
```

```
  # Leaving a row or column input blank puts all values
  # First column
  iris[,1]
```

```
##   [1] 5.1 4.9 4.7 4.6 5.0 5.4 4.6 5.0 4.4 4.9 5.4 4.8 4.8 4.3 5.8 5.7 5.4
##  [18] 5.1 5.7 5.1 5.4 5.1 4.6 5.1 4.8 5.0 5.0 5.2 5.2 4.7 4.8 5.4 5.2 5.5
##  [35] 4.9 5.0 5.5 4.9 4.4 5.1 5.0 4.5 4.4 5.0 5.1 4.8 5.1 4.6 5.3 5.0 7.0
##  [52] 6.4 6.9 5.5 6.5 5.7 6.3 4.9 6.6 5.2 5.0 5.9 6.0 6.1 5.6 6.7 5.6 5.8
##  [69] 6.2 5.6 5.9 6.1 6.3 6.1 6.4 6.6 6.8 6.7 6.0 5.7 5.5 5.5 5.8 6.0 5.4
##  [86] 6.0 6.7 6.3 5.6 5.5 5.5 6.1 5.8 5.0 5.6 5.7 5.7 6.2 5.1 5.7 6.3 5.8
## [103] 7.1 6.3 6.5 7.6 4.9 7.3 6.7 7.2 6.5 6.4 6.8 5.7 5.8 6.4 6.5 7.7 7.7
## [120] 6.0 6.9 5.6 7.7 6.3 6.7 7.2 6.2 6.1 6.4 7.2 7.4 7.9 6.4 6.3 6.1 7.7
## [137] 6.3 6.4 6.0 6.9 6.7 6.9 5.8 6.8 6.7 6.7 6.3 6.5 6.2 5.9
```

```
  # First row
  iris[1,]
```

```
##   Sepal.Length Sepal.Width Petal.Length Petal.Width Species
## 1          5.1         3.5          1.4         0.2  setosa
```

```
  # Data frames have associated column names
  colnames(iris)
```

```
## [1] "Sepal.Length" "Sepal.Width"  "Petal.Length" "Petal.Width"
## [5] "Species"
```

```
  # Columns can be called by name using $
  # Rstudio features tab completion for thing like column names
  iris$Sepal.Length
```

```
##   [1] 5.1 4.9 4.7 4.6 5.0 5.4 4.6 5.0 4.4 4.9 5.4 4.8 4.8 4.3 5.8 5.7 5.4
##  [18] 5.1 5.7 5.1 5.4 5.1 4.6 5.1 4.8 5.0 5.0 5.2 5.2 4.7 4.8 5.4 5.2 5.5
##  [35] 4.9 5.0 5.5 4.9 4.4 5.1 5.0 4.5 4.4 5.0 5.1 4.8 5.1 4.6 5.3 5.0 7.0
##  [52] 6.4 6.9 5.5 6.5 5.7 6.3 4.9 6.6 5.2 5.0 5.9 6.0 6.1 5.6 6.7 5.6 5.8
##  [69] 6.2 5.6 5.9 6.1 6.3 6.1 6.4 6.6 6.8 6.7 6.0 5.7 5.5 5.5 5.8 6.0 5.4
##  [86] 6.0 6.7 6.3 5.6 5.5 5.5 6.1 5.8 5.0 5.6 5.7 5.7 6.2 5.1 5.7 6.3 5.8
## [103] 7.1 6.3 6.5 7.6 4.9 7.3 6.7 7.2 6.5 6.4 6.8 5.7 5.8 6.4 6.5 7.7 7.7
## [120] 6.0 6.9 5.6 7.7 6.3 6.7 7.2 6.2 6.1 6.4 7.2 7.4 7.9 6.4 6.3 6.1 7.7
## [137] 6.3 6.4 6.0 6.9 6.7 6.9 5.8 6.8 6.7 6.7 6.3 6.5 6.2 5.9
```

1.1.3.4 Built-in Functions

- Functions are processes that take an input and give an output
- Rstudio has tab completion for function inputs

```
  max(iris$Petal.Length)
```

```
## [1] 6.9
```

```
  mean(iris$Sepal.Width)
```

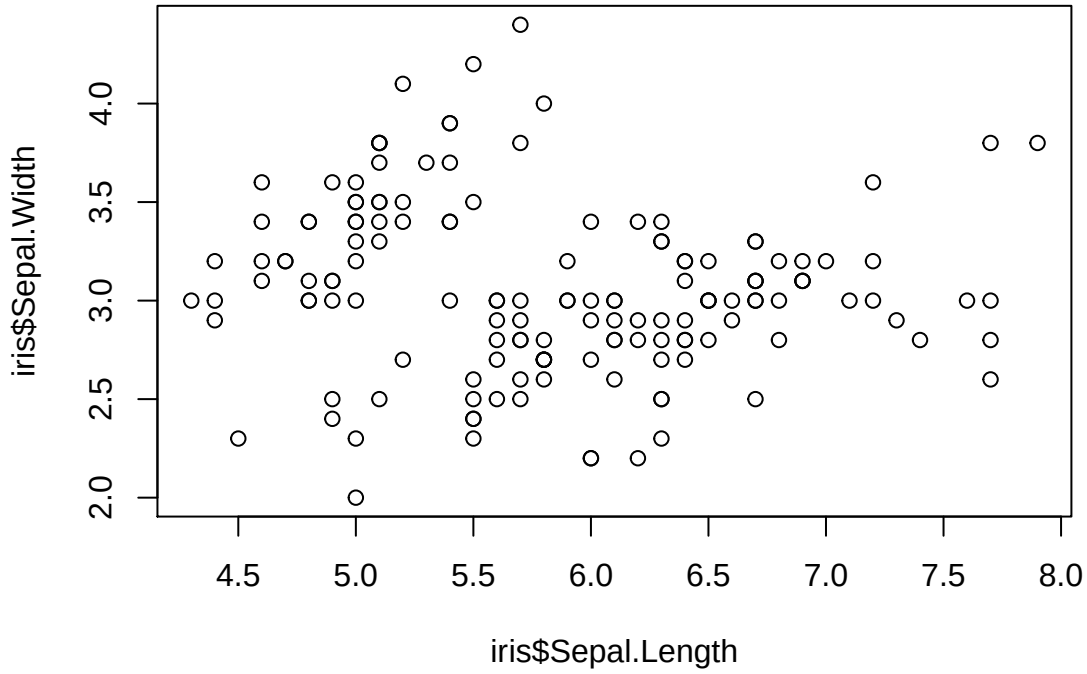
```
## [1] 3.057333
```

```
  sd(iris$Petal.Width)
```

```
## [1] 0.7622377
```

```r
# Functions can take multiple inputs, they can be named in the call or placed in order
plot(x = iris$Sepal.Length, y = iris$Sepal.Width)

# x and y can be specified with x = ... in any order or the inputs can be given in order
# This plot is the same as the previous
plot(iris$Sepal.Length, iris$Sepal.Width)
```



1.1.3.5 Matrix operations

```r
mat <- matrix(data = 1:9, nrow = 3, ncol = 3)
mat
```

```
##      [,1] [,2] [,3]
## [1,]    1    4    7
## [2,]    2    5    8
## [3,]    3    6    9
```

```r
# Element multiplication
mat*mat
```

```
##      [,1] [,2] [,3]
## [1,]    1   16   49
## [2,]    4   25   64
## [3,]    9   36   81
```

```r
# Matrix multiplication
mat %*% mat
```

```
##      [,1] [,2] [,3]
## [1,]   30   66  102
## [2,]   36   81  126
## [3,]   42   96  150
```

```
  # t() function is for transposing
  t(mat)
```

```
##      [,1] [,2] [,3]
## [1,]    1    2    3
## [2,]    4    5    6
## [3,]    7    8    9
```

```
  mat %*% t(mat)
```

```
##      [,1] [,2] [,3]
## [1,]   66   78   90
## [2,]   78   93  108
## [3,]   90  108  126
```

```
  # Inverse matrix
  mat[2,3] <- 18
  solve(mat)
```

```
##       [,1] [,2]        [,3]
## [1,] -1.05  0.1  0.61666667
## [2,]  0.60 -0.2 -0.06666667
## [3,] -0.05  0.1 -0.05000000
```

```
  solve(mat) %*% mat
```

```
##      [,1]          [,2]         [,3]
## [1,]    1  0.000000e+00 8.881784e-16
## [2,]    0  1.000000e+00 2.220446e-16
## [3,]    0 -5.551115e-17 1.000000e+00
```

1.1.3.6 Structures in R

```
  # for loops
  for (i in 1:5) {
    print(i)
  }
```

```
## [1] 1
## [1] 2
## [1] 3
## [1] 4
## [1] 5
```

```
  # While loops
  i <- 10
  while (i > 5) {
    i <- i - 1
    print(i)
  }
```

```
## [1] 9
## [1] 8
## [1] 7
```

```
## [1] 6
## [1] 5
```

```
  # if statments
  dave <- TRUE
  # if (dave) {} also works
  if (dave == TRUE) {
    print("good morning dave")
  }
```

```
## [1] "good morning dave"
```

```
  # User defined functions
  math <- function(a,b) {
    c <- a + b*2
    # return defines what the output of the function is
    return(c)
  }
  math(2,6)
```

```
## [1] 14
```

1.1.4 Recommended Functions

This is a list of functions in base R I would recommend knowing.

- There are countless more functions and packages to use,
  - but these are cover most of the basics of data manipulation.
- Additional information can be found by entering ? in the R console.

1.1.4.1 Useful R Functions

- install.packages()
- library()
- read.csv()
- readlines()
- class()
- min()
- max()
- median()
- mean()
- sd()
- c()
- rbind()
- merge()
- paste()
- ifelse()
- subset()
- complete.cases()
- is.na()
- which()
- grep()
- grepl()
- gsub()
- as.numeric()

- as.character()
- as.factor()
- list.files()
- plot()
- abline()
- points()
- lm()
- summary()