# Base R
Cheat Sheet

## Getting Help

### Accessing the help files

**?mean**
Get help of a particular function.
**help.search('weighted mean')**
Search the help files for a word or phrase.
**help(package = 'dplyr')**
Find help for a package.

### More about an object

**str(iris)**
Get a summary of an object's structure.
**class(iris)**
Find the class an object belongs to.

## Using Packages

**install.packages('dplyr')**
Download and install a package from CRAN.

**library(dplyr)**
Load the package into the session, making all its functions available to use.

**dplyr::select**
Use a particular function from a package.

**data(iris)**
Load a built-in dataset into the environment.

## Working Directory

**getwd()**
Find the current working directory (where inputs are found and outputs are sent).

**setwd('C://file/path')**
Change the current working directory.

**Use projects in RStudio to set the working directory to the folder you are working in.**

## Vectors

### Creating Vectors

| | | |
|---|---|---|
| c(2, 4, 6) | 2 4 6 | Join elements into a vector |
| 2:6 | 2 3 4 5 6 | An integer sequence |
| seq(2, 3, by=0.5) | 2.0 2.5 3.0 | A complex sequence |
| rep(1:2, times=3) | 1 2 1 2 1 2 | Repeat a vector |
| rep(1:2, each=3) | 1 1 1 2 2 2 | Repeat elements of a vector |

### Vector Functions

**sort(x)**
Return x sorted.
**rev(x)**
Return x reversed.
**table(x)**
See counts of values.
**unique(x)**
See unique values.

### Selecting Vector Elements

#### By Position

| | |
|---|---|
| x[4] | The fourth element. |
| x[-4] | All but the fourth. |
| x[2:4] | Elements two to four. |
| x[-(2:4)] | All elements except two to four. |
| x[c(1, 5)] | Elements one and five. |

#### By Value

| | |
|---|---|
| x[x == 10] | Elements which are equal to 10. |
| x[x < 0] | All elements less than zero. |
| x[x %in% c(1, 2, 5)] | Elements in the set 1, 2, 5. |

#### Named Vectors

| | |
|---|---|
| x['apple'] | Element with name 'apple'. |

## Programming

### For Loop

```
for (variable in sequence){
   Do something
}
```

Example

```
for (i in 1:4){
   j <- i + 10
   print(j)
}
```

### While Loop

```
while (condition){
   Do something
}
```

Example

```
while (i < 5){
   print(i)
   i <- i + 1
}
```

### If Statements

```
if (condition){
   Do something
} else {
   Do something different
}
```

Example

```
if (i > 3){
   print('Yes')
} else {
   print('No')
}
```

### Functions

```
function_name <- function(var){
   Do something
   return(new_variable)
}
```

Example

```
square <- function(x){
   squared <- x*x
   return(squared)
}
```

## Reading and Writing Data

Also see the **readr** package.

| Input | Ouput | Description |
|---|---|---|
| df <- read.table('file.txt') | write.table(df, 'file.txt') | Read and write a delimited text file. |
| df <- read.csv('file.csv') | write.csv(df, 'file.csv') | Read and write a comma separated value file. This is a special case of read.table/ write.table. |
| load('file.RData') | save(df, file = 'file.Rdata') | Read and write an R data file, a file type special for R. |

**Conditions**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| a == b | Are equal | a > b | Greater than | a >= b | Greater than or equal to | is.na(a) | Is missing |
| a != b | Not equal | a < b | Less than | a <= b | Less than or equal to | is.null(a) | Is null |

## Types

Converting between common data types in R. Can always go from a higher value in the table to a lower value.

| | | |
|---|---|---|
| `as.logical` | `TRUE, FALSE, TRUE` | Boolean values (TRUE or FALSE). |
| `as.numeric` | `1, 0, 1` | Integers or floating point numbers. |
| `as.character` | `'1', '0', '1'` | Character strings. Generally preferred to factors. |
| `as.factor` | `'1', '0', '1', levels: '1', '0'` | Character strings with preset levels. Needed for some statistical models. |

## Maths Functions

| | | | |
|---|---|---|---|
| `log(x)` | Natural log. | `sum(x)` | Sum. |
| `exp(x)` | Exponential. | `mean(x)` | Mean. |
| `max(x)` | Largest element. | `median(x)` | Median. |
| `min(x)` | Smallest element. | `quantile(x)` | Percentage quantiles. |
| `round(x, n)` | Round to n decimal places. | `rank(x)` | Rank of elements. |
| `signif(x, n)` | Round to n significant figures. | `var(x)` | The variance. |
| `cor(x, y)` | Correlation. | `sd(x)` | The standard deviation. |

## Variable Assignment

```
> a <- 'apple'
> a
[1] 'apple'
```

## The Environment

| | |
|---|---|
| `ls()` | List all variables in the environment. |
| `rm(x)` | Remove x from the environment. |
| `rm(list = ls())` | Remove all variables from the environment. |

**You can use the environment panel in RStudio to browse variables in your environment.**

## Matrices

`m <- matrix(x, nrow = 3, ncol = 3)`
Create a matrix from x.

`m[2, ]` - Select a row

`m[ , 1]` - Select a column

`m[2, 3]` - Select an element

`t(m)`
Transpose

`m %*% n`
Matrix Multiplication

`solve(m, n)`
Find x in: m * x = n

## Lists

`l <- list(x = 1:5, y = c('a', 'b'))`
A list is a collection of elements which can be of different types.

| `l[[2]]` | `l[1]` | `l$x` | `l['y']` |
|---|---|---|---|
| Second element of l. | New list with only the first element. | Element named x. | New list with only element named y. |

Also see the **dplyr** package.

## Data Frames

`df <- data.frame(x = 1:3, y = c('a', 'b', 'c'))`
A special case of a list where all elements are the same length.

| x | y |
|---|---|
| 1 | a |
| 2 | b |
| 3 | c |

**List subsetting**

`df$x`

`df[[2]]`

*Understanding a data frame*

| | |
|---|---|
| `View(df)` | See the full data frame. |
| `head(df)` | See the first 6 rows. |

**Matrix subsetting**

`df[ , 2]`

`df[2, ]`

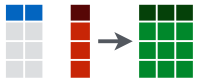
`df[2, 2]`

`nrow(df)`
Number of rows.

`ncol(df)`
Number of columns.

`dim(df)`
Number of columns and rows.

**`cbind`** - Bind columns.



**`rbind`** - Bind rows.

## Strings

Also see the **stringr** package.

| | |
|---|---|
| `paste(x, y, sep = ' ')` | Join multiple vectors together. |
| `paste(x, collapse = ' ')` | Join elements of a vector together. |
| `grep(pattern, x)` | Find regular expression matches in x. |
| `gsub(pattern, replace, x)` | Replace matches in x with a string. |
| `toupper(x)` | Convert to uppercase. |
| `tolower(x)` | Convert to lowercase. |
| `nchar(x)` | Number of characters in a string. |

## Factors

`factor(x)`
Turn a vector into a factor. Can set the levels of the factor and the order.

`cut(x, breaks = 4)`
Turn a numeric vector into a factor by 'cutting' into sections.

## Statistics

`lm(y ~ x, data=df)`
Linear model.

`glm(y ~ x, data=df)`
Generalised linear model.

`summary`
Get more detailed information out a model.

`t.test(x, y)`
Perform a t-test for difference between means.

`pairwise.t.test`
Perform a t-test for paired data.

`prop.test`
Test for a difference between proportions.

`aov`
Analysis of variance.

## Distributions

| | Random Variates | Density Function | Cumulative Distribution | Quantile |
|---|---|---|---|---|
| Normal | `rnorm` | `dnorm` | `pnorm` | `qnorm` |
| Poisson | `rpois` | `dpois` | `ppois` | `qpois` |
| Binomial | `rbinom` | `dbinom` | `pbinom` | `qbinom` |
| Uniform | `runif` | `dunif` | `punif` | `qunif` |

## Plotting

Also see the **ggplot2** package.

`plot(x)`
Values of x in order.

`plot(x, y)`
Values of x against y.

`hist(x)`
Histogram of x.

## Dates

See the **lubridate** package.