

# R and R Studio®

## Programming Basics

### Understanding R code

#### Object assignment

```
my_var <- 4      b <- "banana"
my_var          b
[1] 4           [1] "banana"
```

#### Object\_name <- value(s)

Objects of single values, data structures, or results of a function are assigned to a variable name by an assignment operator (<-).

Variable names may contain numbers but must begin with a letter.

#### Commenting

```
n_st <- 100 #Number
of students
n_st
[1] 100
```

Comments follow a # and are not evaluated by R.

#### Getting help

##### args (function)

Display the argument names and default values of a function

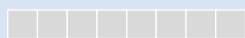
?function or ??function  
Get help for a particular function

##### example (function)

Show example of how to use a function

## Data Structures

### Vector



One-dimensional data of the same data type

```
> c("A", "Z", "H")
[1] "A" "Z" "H"
```

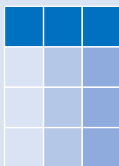
Join elements into a vector

```
> seq(from=2, to=3,
+ by=0.5)
[1] 2 2.5 3
```

Sequence

```
> rep(1, times=3)
[1] 1 1 1
```

Repeat a vector



### Data Frame

Two-dimensional of the same or different data type

```
> df<-data.frame(Var1=c("a", "b", "c"),
+ Var2=seq(5, 15, by=5))
> df
  Var1 Var2
1    a    5
2    b   10
3    c   15
```

df\$Var1  
Select column as vector

summary(df)  
Summary of each column

nrow(df) ncol(df)  
Number of rows Number of columns

rename(df, New\_name = Old\_name)  
Change name of individual columns (dplyr)

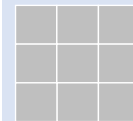
### Keyboard shortcuts

Ctrl	+	R	Run selected line(s), R		
Ctrl	+	Enter	Run selected line(s), RStudio		
Ctrl	+	Shift	+	C	(Un)Comment line
Alt	+	-	Inset <-		
For macOS, replace			Ctrl	with	Cmd

### Matrix

Two-dimensional data of the same data type

```
> matrix(seq(0, 9, by=3),
+ nrow=2, ncol=2)
     [,1] [,2]
[1,]    0    6
[2,]    3    9
```



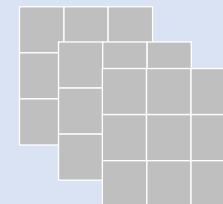
### Array

```
> array(c(m1, m2, m3), dim=c(2, 2, 3))
,,1
     [,1] [,2]
[1,]    0    6
[2,]    3    9

,,2
     [,1] [,2]
[1,]    1    7
[2,]    4   10

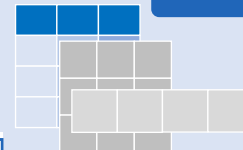
,,3
     [,1] [,2]
[1,]    3    9
[2,]    6   12
```

Three-dimensional matrix (rows, columns, and depth)



### List

Lists can be composed of different data types and structures



```
> list(1:10, matrix(c("a", "b",
+ "c", "d"), nrow=2, ncol=2))
[[1]]
[1] 1 2 3 4 5 6 7 8 9 10

[[2]]
     [,1] [,2]
[1,] "a"  "c"
[2,] "b"  "d"
```



## Major Data Types

### Numeric

Numbers with decimal values, also known as Double.

- Integer: numbers without decimal values

### Character

Text values defined within " or ""

- Factor: text categories for statistical analysis
- Date: calendar values

### Logical

Boolean values (TRUE or FALSE)

### Missing

Not available / missing values.  
Can be present in all data types

### Determine data type/structure

#### **class(x)**

Get the class of an object

```
var1 <- "pizza"
```

```
class(var1)
[1] "character"
```

Check if data is a specific type  
**is.<data type>(x)**

```
is.character(var1)
[1] TRUE
```

Or data structure  
**is.<structure>(x)**

```
is.data.frame(var1)
[1] FALSE
```

### Assign data type/structure

Data types may be specified with  
**as.<type or str>(x)**

```
var2 <- "8"
as.numeric(var2)
[1] 8
```

Change data structure with  
**as.<structure>(x)**

```
as.data.frame(var2)
var2
1 8
```

## Math functions

**x + y**

Addition

**x - y**

Subtraction

**x/y**

Division

**x^y**

Exponentiation

**x %% y**

Modulo (division remainder)

**abs(x)**

Absolute value of x

**sqrt(x)**

Square root of x

**log(x)**

Natural logarithm of x

**exp(x)**

Exponential (e<sup>x</sup>) of x

**max(x)**

Largest element in x

**min(x)**

Smallest element in x

**mean(x)**

Average value of x

**median(x)**

Median value of x

**sum(x)**

Sum of all elements in x

**sd(x)**

Standard deviation of x

**var(x)**

Variance of x

**round(x, n)**

Round x to n decimal places

**sin(x)**

Sine of x

**cos(x)**

Cosine of x

**tan(x)**

Tangent of x

## R environment

**ls()**

List all variables in the environment

**rm(x)**

Remove x from the environment

**rm(list=ls())**

Remove all variables from the environment

**rm(list=setdiff(ls(), c("x", "y")))**

Remove all variables from the environment except variables x and y

## Using Packages

**install.packages('package')**

Download and install a package

**library(package)**

Load the package, making all its functions available to use

**help(package = 'package')**

View R help documentation for the package

**browseVignettes('package')**

Package tutorials or workflows

**package::function()**

Use a function from a specific package

## Character functions

**toupper(x)** Convert to uppercase

**tolower(x)** Convert to lowercase

**nchar(x)** Number of characters in a string

**substr(x, start, finish)**

Subset a string from start to finish character number

Also see the **stringr** library

## See the data

**head(x)**

Show the first six values

**tail(x)**

Show the last six values

**View(x)**

Show all data

**str(x)**

Compact display of data types and values

Contact:

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