INTERMEDIATE R

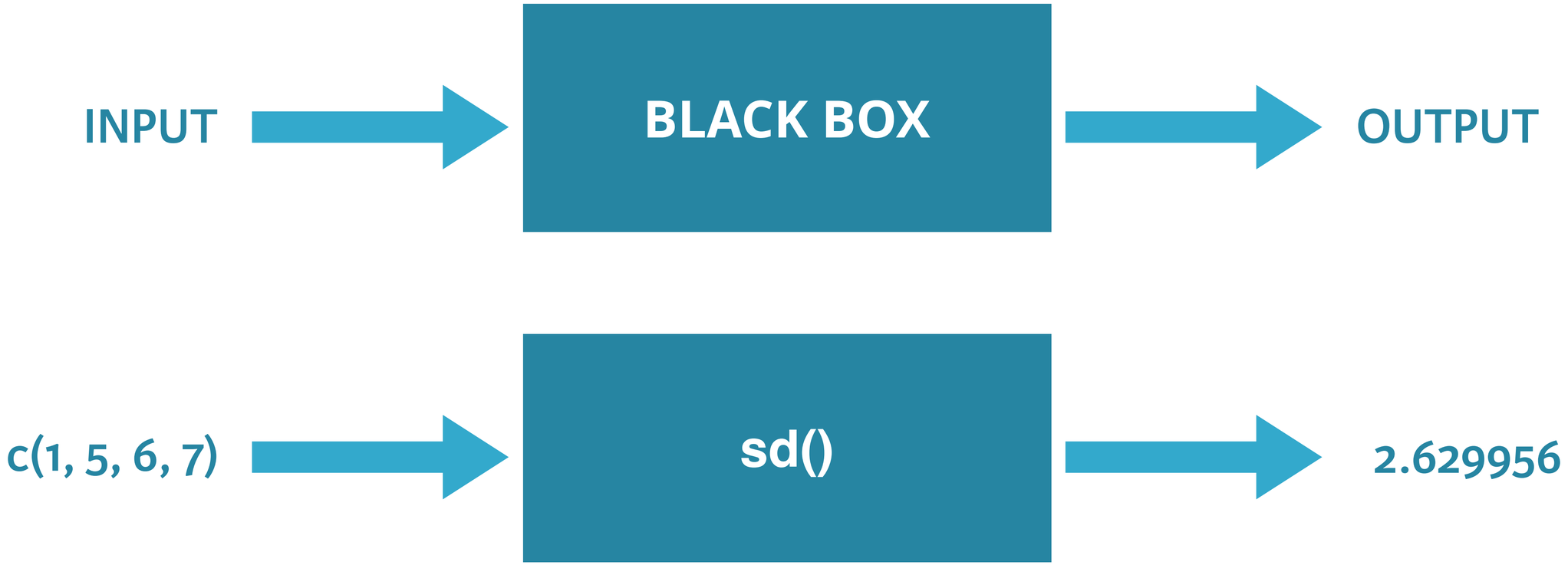
Functions

Functions

- You already know 'em!
- Create a list: `list()`
- Display a variable: `print()`

Black box principle

Black box principle



Call function in R


```
> sd(c(1, 5, 6, 7))
[1] 2.629956

> values <- c(1, 5, 6, 7)

> sd(values)
[1] 2.629956

> my_sd <- sd(values)

> my_sd
[1] 2.629956
```

Function documentation

```
> help(sd)

> ?sd
```

```
sd(x, na.rm = FALSE)
```

sd {stats} R Documentation

Standard Deviation

Description

This function computes the standard deviation of the values in `x`. If `na.rm` is `TRUE` then missing values are removed before computation proceeds.

Usage

```
sd(x, na.rm = FALSE)
```

Arguments

`x`	a numeric vector or an `R` object which is coercible to one by `as.vector(x, "numeric")`.
`na.rm`	logical. Should missing values be removed?

Details

Like `var` this uses denominator *n - 1*.

The standard deviation of a zero-length vector (after removal of `NA`s if `na.rm = TRUE`) is not defined and gives an error. The standard deviation of a length-one vector is `NA`.

See Also

`var` for its square, and `mad`, the most robust alternative.

Examples

```
sd(1:2) ^ 2
```

Questions

```
sd(x, na.rm = FALSE)
```

- Argument names: `x`, `na.rm`
- `na.rm = FALSE`
- `sd(values)` works?

Argument matching

```
sd(x, na.rm = FALSE)
```

x in first position

- By position

```
> sd(values)
```

values in first position → **R assigns values to x**

When you call an R function, R has to match your input values to the function's arguments.
However, it doesn't have to be this way.
It would be perfectly equivalent to match the arguments by name, by specifically saying that we want the x argument to be values.

- By name

```
> sd(x = values)
```

explicitly assign values to x

na.rm argument

na.rm: logical. Should missing values be removed?

```
> values <- c(1, 5, 6, NA)

> sd(values)
[1] NA


> sd(values, TRUE)
[1] 2.645751

     by position    by name
> sd(values, na.rm = TRUE)
[1] 2.645751
```

Matching by position

sd {stats} R Documentation

Standard Deviation

Description

This function computes the standard deviation of the values in `x`. If `na.rm` is `TRUE` then missing values are removed before computation proceeds.

Usage

```
sd(x, na.rm = FALSE)
```

Arguments

`x`	a numeric vector or an `R` object which is coercible to one by `as.vector(x, "numeric")`.
`na.rm`	logical. Should missing values be removed?

Details

Like `var` this uses denominator *n - 1*.

The standard deviation of a zero-length vector (after removal of NAs if `na.rm = TRUE`) is not defined and

na.rm is FALSE by default

```
sd(x, na.rm = FALSE)
```

sd(values) works?

```
> values <- c(1, 5, 6, 7)

> sd(values)
[1] 2.629956

> sd()
Error in is.data.frame(x) : argument "x" is missing,
with no default
```

```
sd(x, na.rm = FALSE)
```

x has no default

na.rm is FALSE by default

Function arguments for which no default is specified, have to be specified by the user of the function, otherwise an error is likely to occur.

Useful trick

```
> args(sd)
function (x, na.rm = FALSE)
NULL
```

This is a function to learn about the arguments of a function without having to read through the entire documentation.

Wrap-up

- Functions work like a black box
- Argument matching: by position or by name
- Function arguments can have defaults

INTERMEDIATE R

Let’s practice!

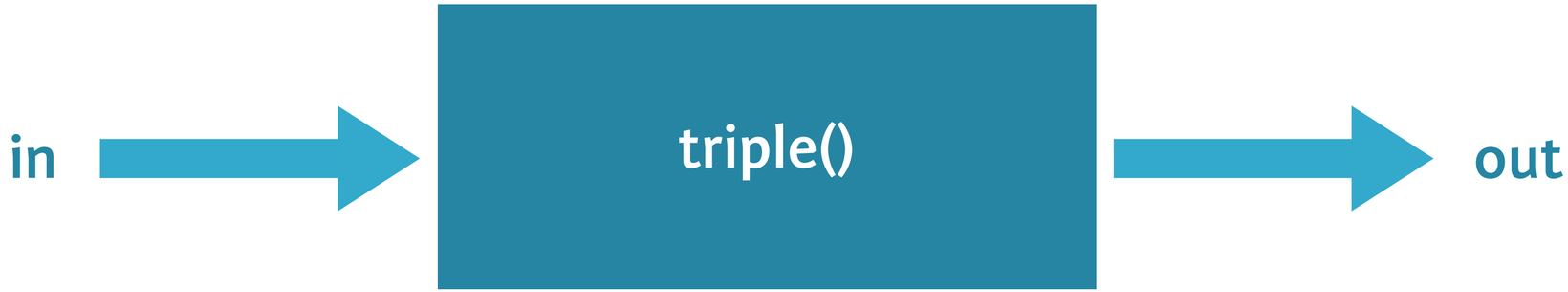
INTERMEDIATE R

Writing Functions

When write your own?

- Solve a particular, well-defined problem
- Black box principle
- If it works, inner workings less important

The triple() function



The triple() function


```
my_fun <- function(arg1, arg2) {
  body
}
```

create a new function, my_fun, that take arg1 and arg2 as arguments and perform the code in the body on these arguments, eventually generate an output

The triple() function


```
triple <- function(arg1, arg2) {
  body
}
```

The triple() function


```
triple <- function(x) {
  body
}
```

The triple() function


```
triple <- function(x) {
  3 * x
}
```

The triple() function

```
> triple <- function(x) {
    3 * x
  }


> ls()
[1] "triple"


> triple(6)
[1] 18
```

ls() is a function in R that lists all the object in the working environment.

Numeric 6 matched to argument x (by pos)
Function body is executed: 3 * 6
Last expression = return value

return()

```
> triple <- function(x) {
    y <- 3 * x
    return(y)
  }

> triple(6)
[1] 18
```

The math_magic() function

The math_magic() function

```
my_fun <- function(arg1, arg2) {
  body
}
```

The math_magic() function

```
math_magic <- function(arg1, arg2) {
  body
}
```

The math_magic() function

```
math_magic <- function(a, b) {
  body
}
```

The math_magic() function

```
math_magic <- function(a, b) {
  a*b + a/b
}
```

```
> math_magic(4, 2)
[1] 10

> math_magic(4)
Error in math_magic(4) : argument "b" is missing, with
no default
```

Optional argument

```
math_magic <- function(a, b = 1) {
  a*b + a/b
}
```

adding a default value

```
> math_magic(4)
[1] 8

> math_magic(4, 0)
[1] Inf
```

Use return()

```
math_magic <- function(a, b = 1) {
  if(b == 0) {
    return(0)      return 0 and exit function
  }
  a*b + a/b        not reached if b is 0
}
```

```
> math_magic(4, 0)
[1] 0
```

INTERMEDIATE R

Let’s practice!

INTERMEDIATE R

R Packages

R Packages

- Where do mean(), list() and sample() come from?
- Part of R packages
- Code, data, documentation and tests
- Easy to share
- Examples: base, ggvis

Install packages

- base package: automatically installed
- ggvis package: not installed yet

```
> install.packages("ggvis")
```

install.packages: a function of the utils pacakage

- CRAN: Comprehensive R Archive Network

Load packages

- load package = attach to search list

```
> search()
[1] ".GlobalEnv"  ...  "Autoloads"   "package:base"
```

- 7 packages are attached by default
- ggvis not attached by default

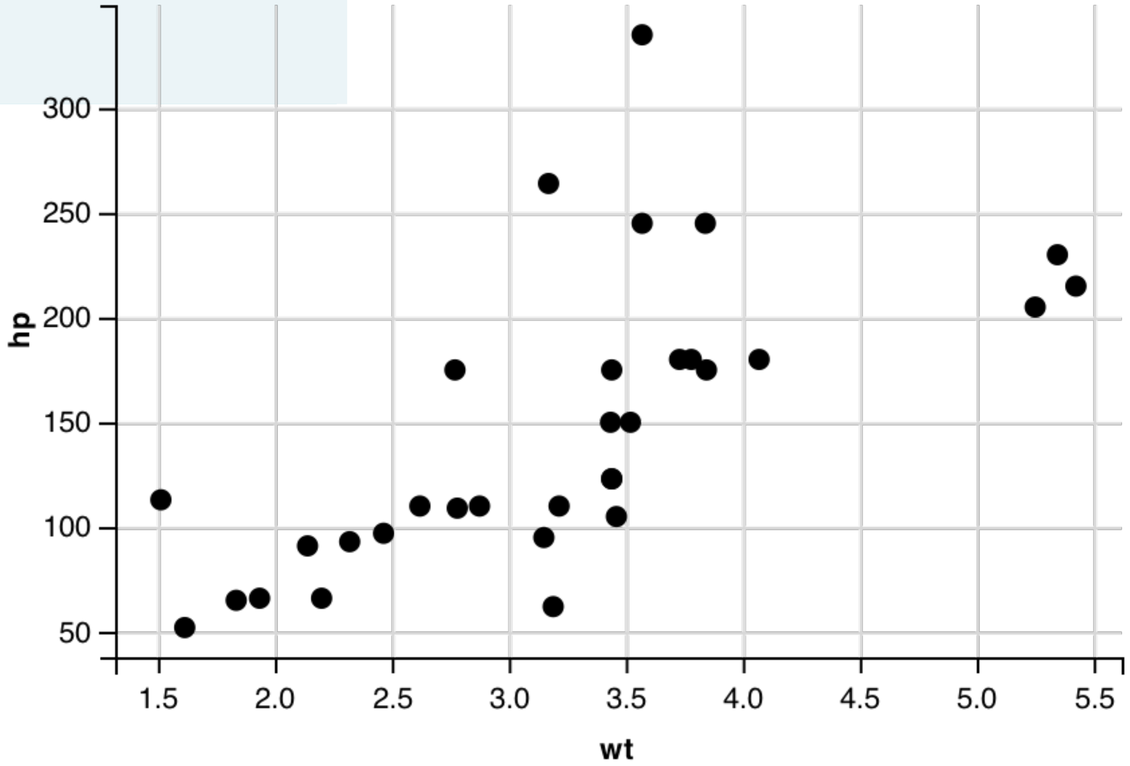
```
> ggvis(mtcars, ~wt, ~hp)
Error: could not find function "ggvis"
```

Load packages: library()

```
> library("ggvis")

> search()
 [1] ".GlobalEnv"  "package:ggvis" ... "package:base"

> ggvis(mtcars, ~wt, ~hp)
```



Load packages: require()

The only difference appears when you're trying to load a package that is not yet installed.

```
> library("data.table")
Error in library("data.table") : there is no package called
'data.table'

> require("data.table")
Loading required package: data.table
Warning message: ...

> result <- require("data.table")
Loading required package: data.table
Warning message: ...

> result
[1] FALSE
```

The result of this require function will be FALSE if attaching the package failed. This is a good alternative when you want to avoid errors, for example when you are attaching packages dynamically inside functions.

Wrap-up

- Install packages: install.packages()
- Load packages: library(), require()
- Load package = attach package to search list
- Google for cool R packages!

The library() and require() functions are not very picky when it comes down to argument types: both library(rjson) and library("rjson") work perfectly fine for loading a package.

INTERMEDIATE R

Let’s practice!