INTERMEDIATE R

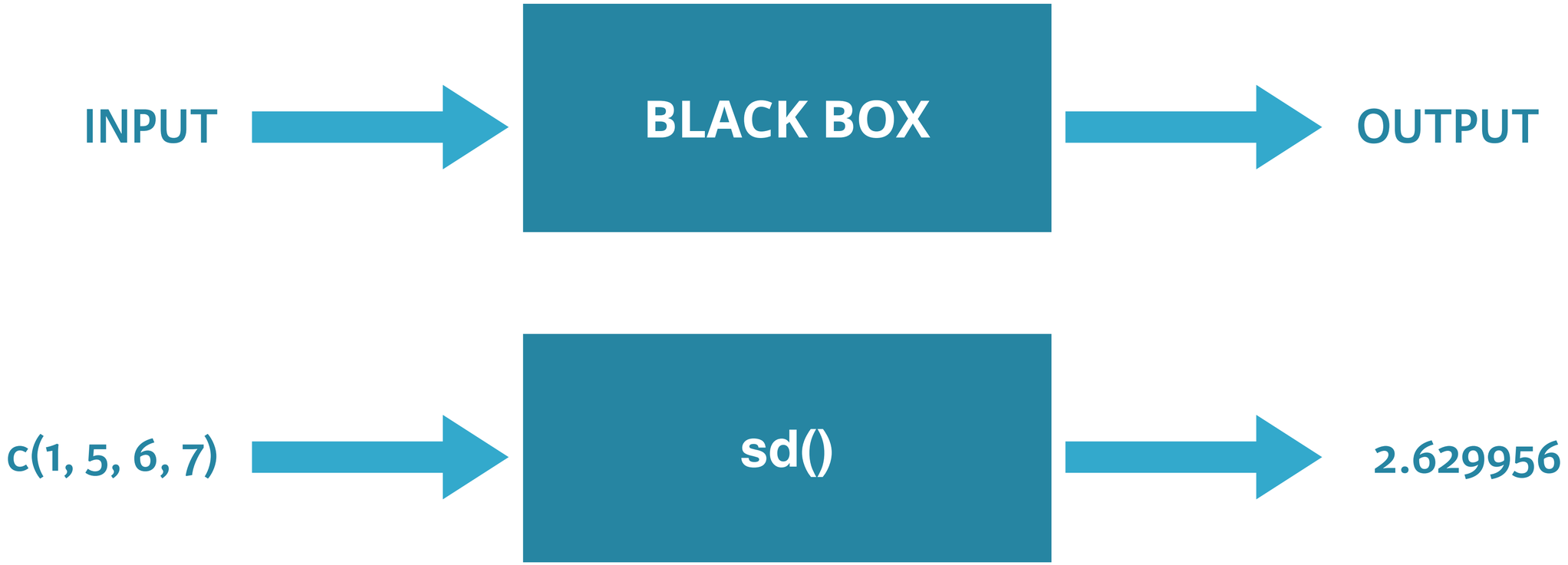
Functions

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**

- 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
```

Matching by position

by position **by name**

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

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

Useful trick

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

Wrap-up

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

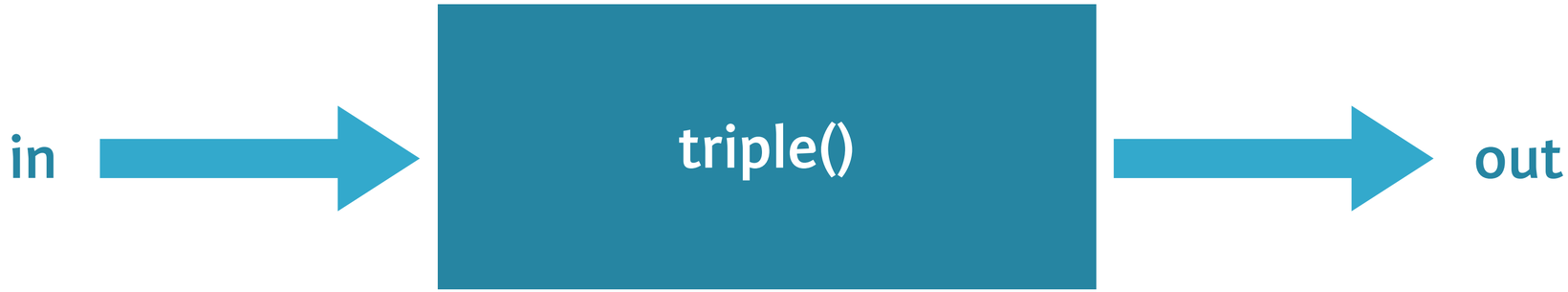
INTERMEDIATE R

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
}
```

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
```

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
}
```

```
> 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

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")
```

- 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

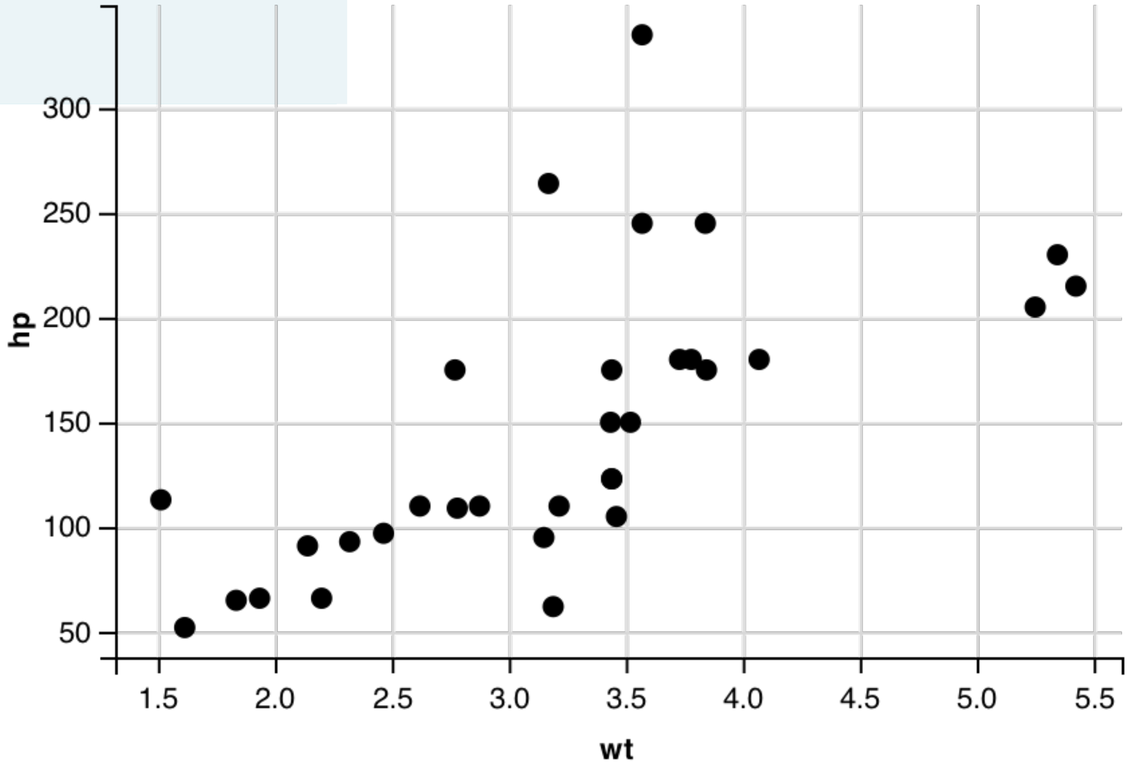
```
> ggvis(mtcars, ~wt, ~hp)
Error: could not find function "ggvis"
```

Load packages: library()

```
> library("ggvis")

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

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



Load packages: require()

```
> 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
```

Wrap-up

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