4. Calling Functions in R

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Functions

- A function is a group of instructions (with a name) that:
  - takes input(s)
  - uses the input(s) to compute other value, and
  - returns a result (Matloff 2009)
  - result usually stored in a variable
- Functions are a fundamental building block of R
- Users of R should adopt the habit of creating simple functions which will make their work more effective and also more trustworthy (Chambers 2008).
- Two approaches:
  - Use R functions (Base R and other packages)
  - Write your own functions

R - A function “ecosystem”

John Chambers: “To understand computations in R, two slogans are helpful:

- Everything that exists is an object.
- Everything that happens is a **function call."**

```r
x <- 1:6
sqrt(x)
```

```
## [1] 1.000000 1.414214 1.732051 2.000000 2.236068 2.449490
```

```r
min(x)
```

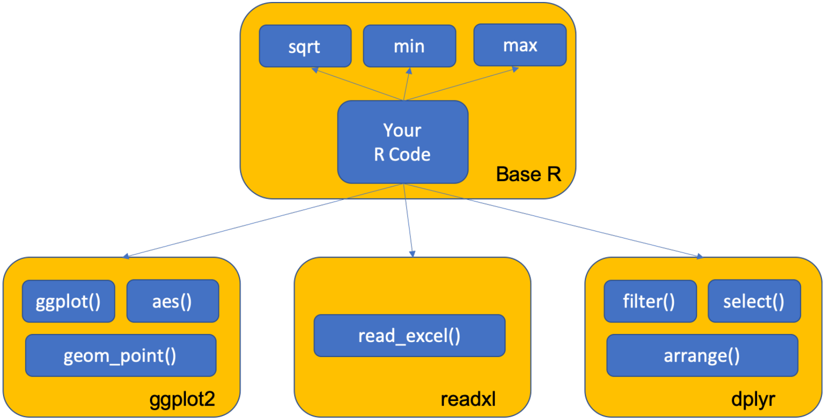
```
## [1] 1
```

```r
mean(x)
```

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

Coding with functions

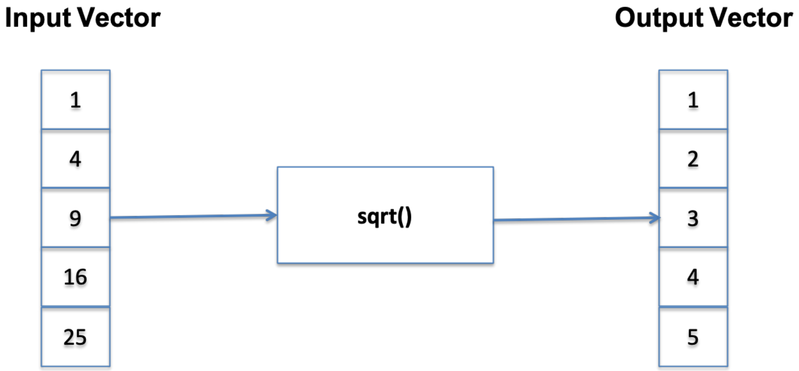
- “Stand on the shoulders of giants”
- Use Tools -> Install Packages from RStudio



Calling functions: input - process - output

```r
x <- c(1,4,9,16,25)
sqrt(x)
```

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



Challenge 4.1

- Use the sample function to generate 30 random numbers between 50 and 100 and call the function set.seed(100) before you call sample
- Use R functions to calculate the mean, max and min
- Show all the numbers greater that the mean
- Use length() to count the number great that the mean

```
set.seed(100)
x <- sample(30:100,30,replace=T)
x[1:12]
```

```
##  [1] 52 99 33 84 99 36 36 84 72 90 41 80
```

Function Arguments

- It is useful to distinguish between formal arguments and the actual arguments
  - Formal arguments are the property of the function
  - Actual arguments can vary each time the function is called.
- When calling functions, arguments can be specified by
  - Position
  - Complete name
- Guidelines (Wickham 2015)
  - Use positional mapping for the first one or two arguments (most commonly used)
  - Avoid using positional mapping for less commonly used attributes
  - Named arguments should always come after unnamed arguments

Fuel Economy Data Set (ggplot2::mpg)

This dataset contains a subset of the fuel economy data that the EPA makes available on http://fueleconomy.gov. It contains only models which had a new release every year between 1999 and 2008 - this was used as a proxy for the popularity of the car.

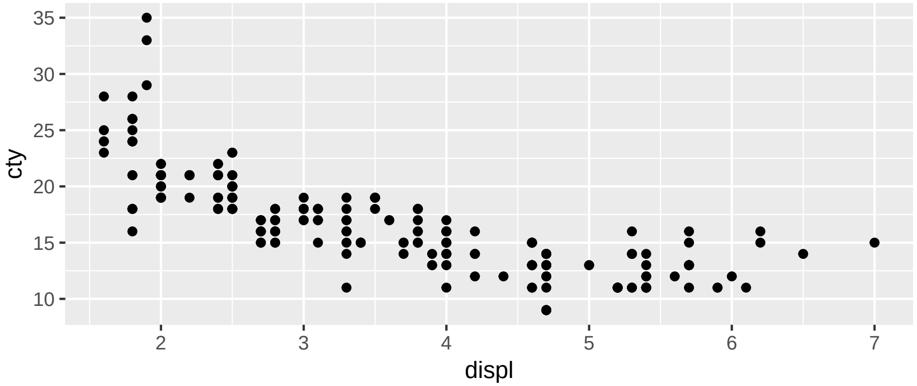
manufacturer	car manufacturer	**drv**	drive type
model	model name	**cty**	city miles per gallon
displ	engine disp (l)	**hwy**	highway miles per gallon
year	year of make	**fl**	fuel type
cyl	number of cylinders	**class**	“type” of car
trans	type of transm.		

Data Set Elements

manufacturer	model	displ	year	cyl	trans	drv	cty
audi	a4	1.8	1999	4	auto(l5)	f	18
audi	a4	1.8	1999	4	manual(m5)	f	21
audi	a4	2.0	2008	4	manual(m6)	f	20
audi	a4	2.0	2008	4	auto(av)	f	21
audi	a4	2.8	1999	6	auto(l5)	f	16
audi	a4	2.8	1999	6	manual(m5)	f	18
audi	a4	3.1	2008	6	auto(av)	f	18
audi	a4 quattro	1.8	1999	4	manual(m5)	4	18
audi	a4 quattro	1.8	1999	4	auto(l5)	4	16
audi	a4 quattro	2.0	2008	4	manual(m6)	4	20

Calling a function to create a plot (from package ggplot2)

```
library(ggplot2)
ggplot(data=mpg)+
  geom_point(mapping=aes(x=displ,y=cty))
```



Calling functions to filter data

```r
library(ggplot2)
library(dplyr)
f <- mpg %>% select(manufacturer,model,year,displ,cty) %>%
             filter(model=="a4") %>% arrange(desc(year))
f
```

```
## # A tibble: 7 x 5
##   manufacturer model  year displ   cty
##   <chr>        <chr> <int> <dbl> <int>
## 1 audi         a4     2008   2      20
## 2 audi         a4     2008   2      21
## 3 audi         a4     2008   3.1    18
## 4 audi         a4     1999   1.8    18
## 5 audi         a4     1999   1.8    21
## 6 audi         a4     1999   2.8    16
## 7 audi         a4     1999   2.8    18
```

Writing Functions

- **function** (*arguments*) *expression*
- arguments gives the arguments, separated by commas.
- Expression (body of the function) is any legal R expression, usually enclosed in { }
- Last evaluation is returned
- return() can also be used, but usually for exceptions.

```r
f <- function(x)x^2 # this function squares a vector
f(1:3)
```

```
## [1] 1 4 9
```

Summary

- Functions are a fundamental building block of R
- Functions:
  - are declared using the function reserved word
  - are objects
- Functions can access variables within the environment where they are created
- Functionals are functions that takes a function as an input and returns a vector as output (can be used as a looping structure)
- The apply family in R are functionals (**apply**, **sapply**, **lapply**)