Working with R

transition: rotate

Lecture 6

What is R?

R is a free software environment for statistical computing and graphics.

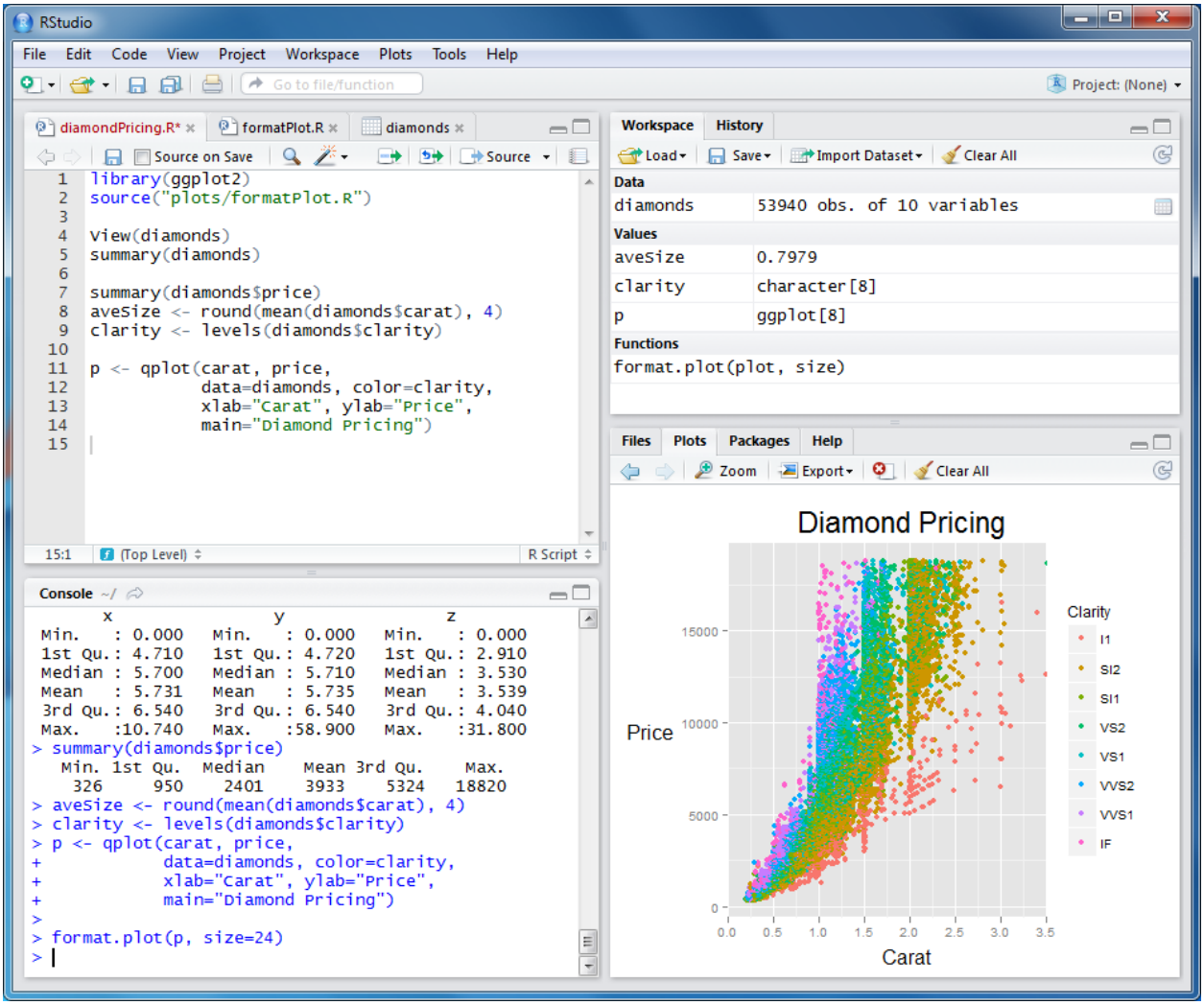
History

- 1976: In Bell Labs `S` language was created
- 1988: Commercial version `S-PLUS` appeared
- 1993: Fork `R` appeared
- ~2000: `R` getting more and more popular

Pure R

```
R version 3.0.2 (2013-09-25) -- "Frisbee Sailing"
Copyright (C) 2013 The R Foundation for Statistical Computing
Platform: x86_64-apple-darwin10.8.0 (64-bit)

R -- это свободное ПО, и оно поставляется безо всяких гарантий.
Вы вольны распространять его при соблюдении некоторых условий.
Введите 'license()' для получения более подробной информации.

R -- это проект, в котором сотрудничает множество разработчиков.
Введите 'contributors()' для получения дополнительной информации и
'citation()' для ознакомления с правилами упоминания R и его пакетов
в публикациях.

Введите 'demo()' для запуска демонстрационных программ, 'help()' -- для
получения справки, 'help.start()' -- для доступа к справке через браузер.
Введите 'q()', чтобы выйти из R.

> head(iris)
  Sepal.Length Sepal.Width Petal.Length Petal.Width Species
1          5.1         3.5          1.4         0.2  setosa
2          4.9         3.0          1.4         0.2  setosa
3          4.7         3.2          1.3         0.2  setosa
4          4.6         3.1          1.5         0.2  setosa
5          5.0         3.6          1.4         0.2  setosa
6          5.4         3.9          1.7         0.4  setosa
>
```

RStudio IDE



CRAN & packages

Free software "tradition":

- CTAN: Comprehensive TeX archive network
- CRAN: Comprehensive R archive network
- ...

Another sources:

- Bioconductor
- GitHub

Main IDE frames

Editor

Create and edit scripts

In regular R: separate editors could be used.

`Ctrl + Enter` to execute selected part

Console

Main window:

```
> a <- 5 * 5
```

Environment

All variables and types

\+ Viewer

Help & plots

In regular R:

- help inside console
- plots in separate windows

Primitives

```
# help on function
?lm

# math functions
2 + 3
10 / 3
sqrt(9)

# assigning
a <- 'Hello, world!'
```

Adding packages

```
install.packages("ggplot2")
library(ggplot2)
require(ggplot2)
```

Working directory

```
getwd()
```

```
[1] "/Users/quatsch/Documents/RIA_lectures"
```

```
# Set required WD
setwd('C:/Documents/my_R_project')

# Show files in current WD
dir()

# View raw file
file.show()
```

Loading tables

```
read.table(fname)

read.csv(fname)

read.csv2(fname)

read.delim(fname)

read.delim2(fname)

require(xlsx)
read.xlsx(fname, sheetName)
```

Writing files

```
write.table

write.csv

write.csv2
```

Demo data

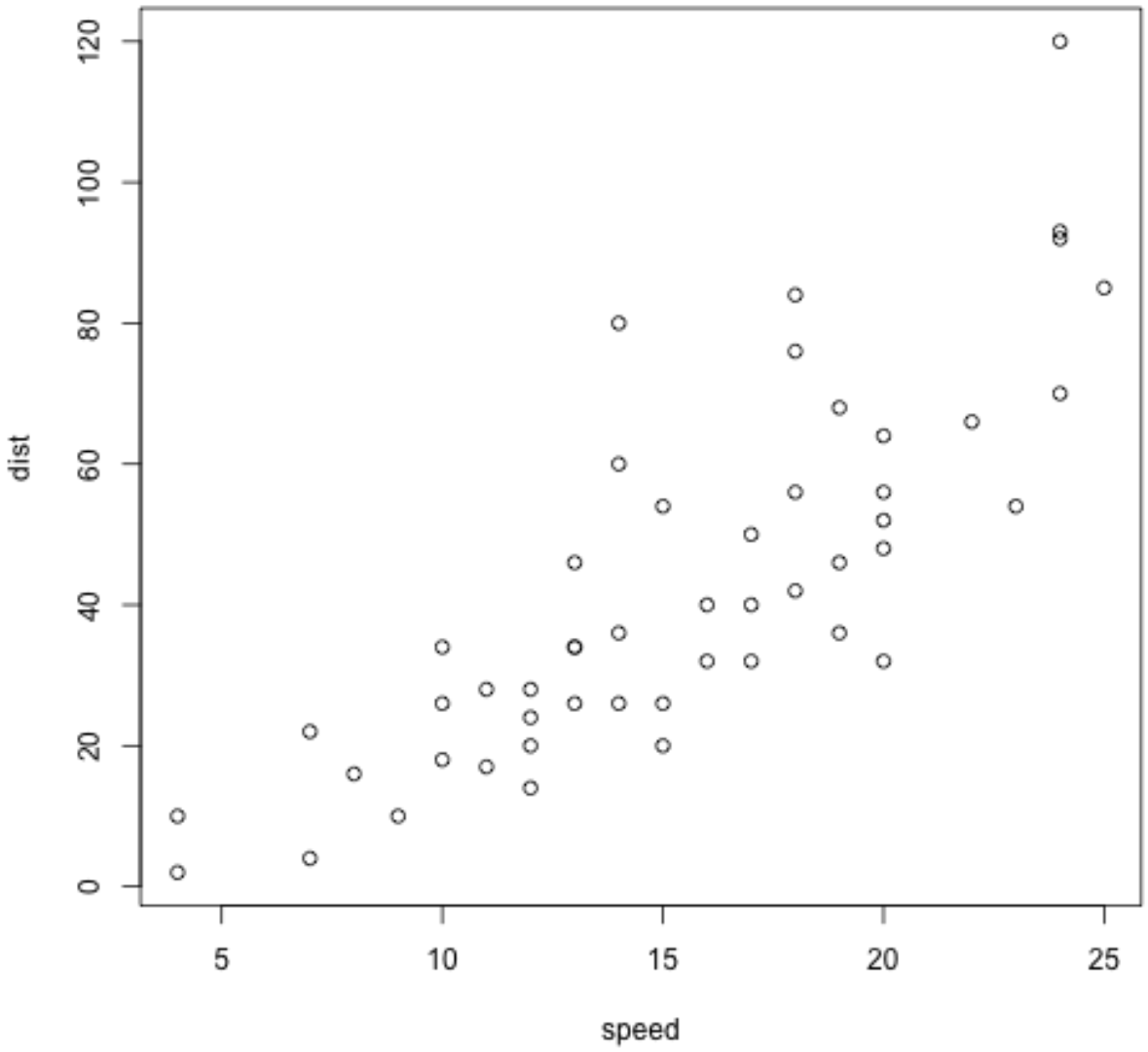
```
head(cars, 5)
```

```
  speed dist
1     4    2
2     4   10
3     7    4
4     7   22
5     8   16
```

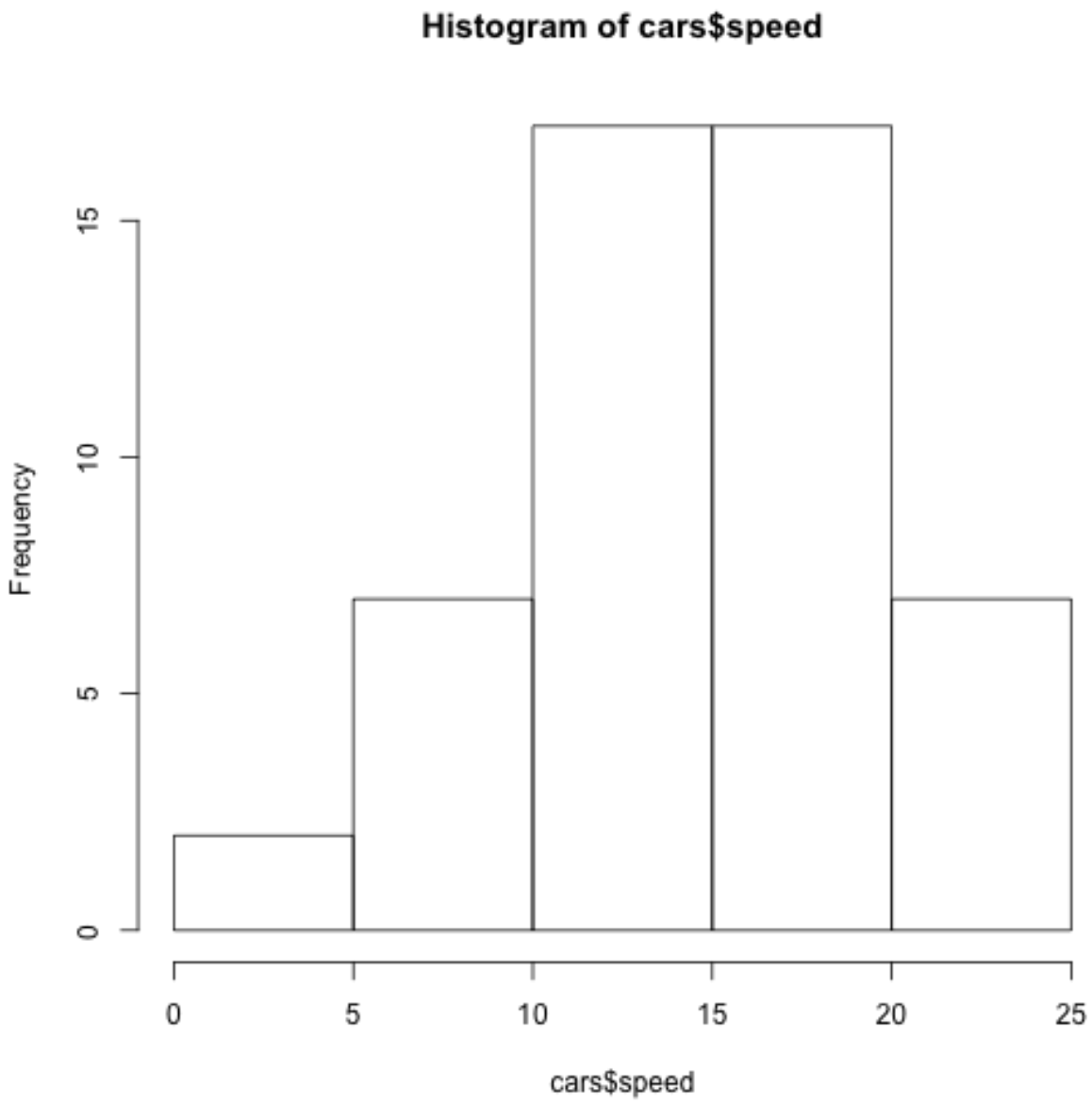
```
iris
mtcars
Titanic
# etc...
```

First graphic

```
plot(cars)
```



```
hist(cars$speed)
```



Basic data types

- Numeric `10.5` / Integer `10` / Complex `1 + 2i`
- Factor

```
factor(c('m', 'v', 'm', 'v', 'v'), levels = c('m', 'v'))
```

```
[1] m v m v v
Levels: m v
```

- logical `True (T) / False (F)`
- character

Missing & special data

```
# NA
vec <- c(3, 10, 8, NA, 5, 6)
mean(vec)
```

```
[1] NA
```

```
mean(vec, na.rm=T)
```

```
[1] 6.4
```

Missing & special data

```
# Additional: NaN, Inf, and -Inf
pi/0
```

```
[1] Inf
```

```
0/0
```

```
[1] NaN
```

```
as.logical(0/0)
```

```
[1] NA
```

Converting

```
vec <- factor(c('1982', '1983', '1982', '1984', '1985'))
```

```
# Wrong
as.numeric(vec)
```

```
[1] 1 2 1 3 4
```

```
# Right
as.numeric(as.character(vec))
```

```
[1] 1982 1983 1982 1984 1985
```

Sequences - Vector

```r
# concatenate
vec <- c(TRUE, 1, 0.5, 'item')

# vector elements should be of the same class
class(vec)
```

```
[1] "character"
```

```r
# slicing
vec[3:4]
```

```
[1] "0.5"  "item"
```

Sequences - Matrix

```r
v <- 1:9
v
```

```
[1] 1 2 3 4 5 6 7 8 9
```

```r
dim(v) <- c(3,3)
v
```

```
     [,1] [,2] [,3]
[1,]    1    4    7
[2,]    2    5    8
[3,]    3    6    9
```

Sequences - List

```r
test.list <- list(i1 = TRUE, i2 = 1, i3 = 0.5, i4 = 'item')

# every element is independent
class(test.list)
```

```
[1] "list"
```

```r
# slicing
test.list[4]
```

```
$i4
[1] "item"
```

```
test.list$i4
```

```
[1] "item"
```

Sequences - Data Frame

Imagine list of multiple vectors (columns):

```
df <- data.frame(var1 = c('f', 'm', 'm', 'f'),
                 var2 = c(1982, 1982, 1983, 1985),
                 var3 = c(TRUE, FALSE, FALSE, FALSE))

df
```

```
  var1 var2  var3
1    f 1982  TRUE
2    m 1982 FALSE
3    m 1983 FALSE
4    f 1985 FALSE
```

Data Frames Slicing

```
nrow(iris)
```

```
[1] 150
```

```
iris.filtered <- iris[iris$Species == 'setosa', ]
nrow(iris.filtered)
```

```
[1] 50
```

```
head(iris[, 'Species'])
```

```
[1] setosa setosa setosa setosa setosa setosa
Levels: setosa versicolor virginica
```

Vectorized computations

```
df <- data.frame(var1 = c(1, 2, 3, 4, 5, 6),
                 var2 = c(10, 20, 30, 40, 50, 60))
df$var3 <- df$var1 + df$var2
df$var4 <- df$var1 * df$var2
df
```

```
  var1 var2 var3 var4
1    1   10   11   10
2    2   20   22   40
3    3   30   33   90
4    4   40   44  160
5    5   50   55  250
6    6   60   66  360
```

apply VS for

```
#head(trees, 3)
apply(trees, 2, mean)
```

```
 Girth Height Volume
 13.25  76.00  30.17
```

```
for(row in names(trees)){
  print(paste(row, mean(trees[, row])))
}
```

```
[1] "Girth 13.2483870967742"
[1] "Height 76"
[1] "Volume 30.1709677419355"
```

Basic functions for stat analysis

```
mean()
median()
sd()
var() # sd() ^ 2
```

Your own functions

```
square <- function(vec)
{
  vec <- vec ^ 2
  return(vec)
}

my.vec <- c(1,2,3,4,5)
square(my.vec)
```

```
[1]  1  4  9 16 25
```

The End

type: sub-section

Questions & answers

http://www.r-tutor.com/elementary-statistics/qualitative-data/frequency-distribution-qualitative-data

http://www.statmethods.net/advstats/factor.html