

R programming for beginners

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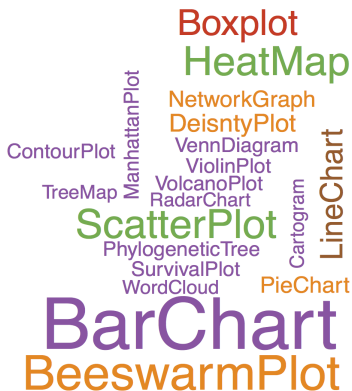
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Graphics in R

"A picture is worth a thousand words"

- Various inbuilt functions and packages to present your data
- Build elegant and complicated plots with little effort
- High quality and high resolution graphs for publication



Graphics in R

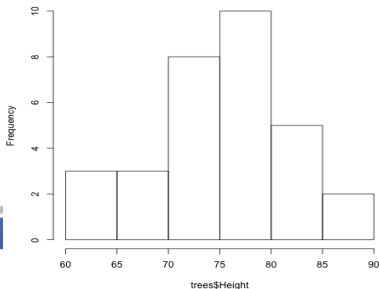
Let's look at the demos of the basic plots that can be generated in R

```
#demo(graphics)
```

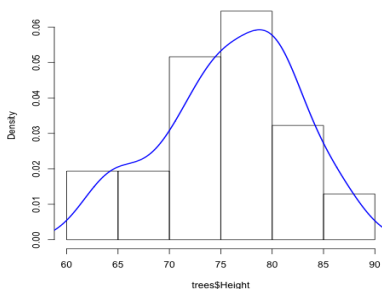
There are two kinds of graphical functions:

- High-level functions
Initializing graphical device and create a **new** plot
- Low-level functions
Plotting functions add more information to an **existing** plot

Hight distribution of 31 trees



Hight distribution of 31 trees



Hig-level graphics functions

Frequently used high-level graphics functions:

plot()	Depend on input data type
boxplot()	Show the distribution of a vector
barplot()	Show in bars values in a vector
pie()	Illustrate numerical proportion
hist()	Show histogram of a numeric vector
pairs()	Scatter plot for each column in matrix
curve()	Draw a curve corresponding to a function
qqplot()	Scatter plot of qualtiles for two vectors

Usually calling a highly-level graphical function will erase the current plot. Some functions can detect the type of its input object and generate plot accordingly, for example let's try:

```
plot(iris$Sepal.Length)
plot(iris$Species)
plot(iris$Species, iris$Sepal.Length)
plot(iris$Sepal.Width, iris$Sepal.Length)
```



Low-level graphics functions

Sometimes high-level plotting functions cannot produce the exact kind of plot you desire. In this case, low-level plotting commands can be used to add extra pices (such as points, lines or text) to the current plot. Some of the most used low-level plotting functions are:

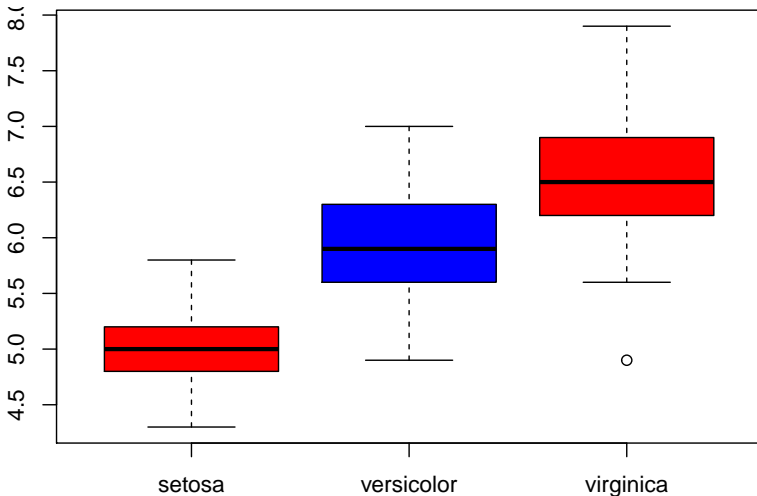
<code>points(x, y)</code>	Add points to the current plot
<code>lines(x, y)</code>	Add connected lines to the current plot
<code>abline(a, b)</code>	Add a line of slope b and intercept a to the current plot
<code>abline(h=y)</code>	Add a horizontal linen
<code>abline(v=x)</code>	Add a vertical line
<code>legend(...)</code>	Add a legend to the current plot
<code>title(...)</code>	Add a title to the current plot
<code>axis(...)</code>	Add an axis to the current plot



Graphics in R

Example: Box plot with `boxplot()`

```
boxplot(iris$Sepal.Length ~ iris$Species, col=(c("red","blue")))
```



Graphics in R

Arguments to function `boxplot()`:

```
?boxplot
```

```
boxplot(x, ..., range = 1.5, width = NULL, varwidth = FALSE,  
        notch = FALSE, outline = TRUE, names, plot = TRUE,  
        border = par("fg"), col = NULL, log = "",  
        pars = list(boxwex = 0.8, staplewex = 0.5, outwex = 0.5),  
        horizontal = FALSE, add = FALSE, at = NULL)
```

Exercises:

- Plot the same bar plot with three colors: gold, darkgreen and skyblue.
- Name the plot 'Sepal length in 3 species'
- Add a horizontal line to the plot shows the average sepal length



Save your plot

3 steps to save your plot to file:

- 1 Choose the format that you want to use and initialize the device, e.g. `png("c:/MyFirstPlot.png", res=300, width = 480, height = 480)`, here you can make adjustment to the size and resolution
- 2 Draw a plot with high-level and low-level graphical functions, you will not actually see the plot, because its saved in the choosen disvice
- 3 Close the device: `dev.off()`

Some useful devices:

- screen graphics: when you use interactive R
- pdf: Adobe Portable Document Format
- png: PNG graphics
- jpeg: small size, not recommended



Introduction

Exercises:

- Draw the function

$$E = mc^2$$

when $0 < m < 10$ ($c = 299792458$ m/s)

- Draw a histogram of 1000 random numbers from a normal distribution, give it a title
- Suppose your monthly expenditure is as follows,

Housing	Food	Cloths	Entainment	Other
600	200	250	350	200

Present it in a pie chart.

- In the scatter plot Sepal.Length VS. Sepal.Width in iris, extend the x axis to include a new observation, Sepal.Length=3.2, Sepal.Width=2.5
- Save the scatter plot as 'lengthVSwidth.pdf'

