Introduction to R, Rstudio & Project Management

Berry Boessenkool, uni-potsdam.de, May 2017

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swc-bb.github.io/2017-05-17-r-workshop

Presentation template generated with `berryFunctions::createPres`

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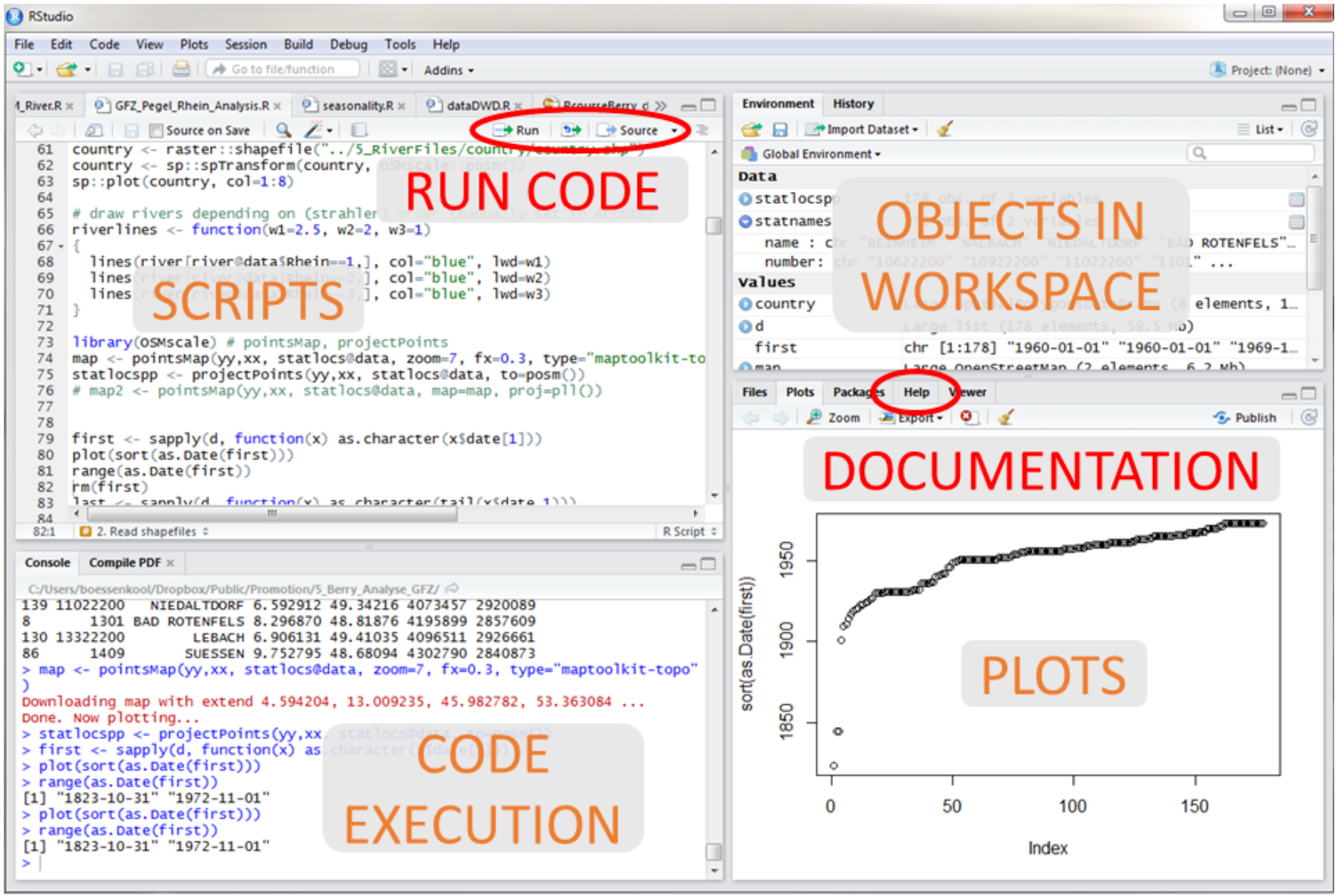
Survey

knowledge survey to determine focus for this session

bit.ly/knowR

RStudio


RStudio
File Edit Code View Plots Session Build Debug Tools Help
Run
Source
RUN CODE
SCRIPTS
OBJECTS IN WORKSPACE
DOCUMENTATION
PLOTS
CODE EXECUTION
Console
Compile PDF
Environment
History
Files
Plots
Packages
Help
Viewer
Zoom
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Publish
sort(as.Date(first))
Index

RStudio configuration

keyboard shortcuts (ALT+SHIFT+K)

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Recommended settings for reproducible research under
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ON: Restore previously open source documents at startup
OFF: Restore .Rdata into workspace at startup
Save workspace to .RData on exit: **NEVER**

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Tools - Global Options - Code - Display
ON: Show margin (Margin column:80) *People hate horizontal scrolling!*

Tools - Global Options - Code - Saving
Line ending conversion: **Windows (CR/LF)**

Assignments

- objects: assignment with $<-$

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- What's a good object name? $\rightarrow$ short, but explanatory, lowerCamelStandard.or.dot_or_underscore are good naming conventions
- comments: `# everything after a hashtag is not executed.`

Exercise

- Open Rstudio, start new script. Write comments about what you do, save the file in a useful place.
- Calculate 21+21 , 7*6 and $\frac{0,3}{4} * \sqrt{313600}$
- Is `0.5 - 0.2` equal to `0.3`? Is `0.4 - 0.1` equal to `0.3`?
- With the `c` command, create a vector with body sizes of people around you. You can also use the values 1.75, 1.76, 1.83, 1.84, 1.77, 1.76, 1.77, 1.66, 1.86, 1.76
- What does `3:6` create? What does `YourObject[3:6]` do?
- What does `YourObject[-4]` do?
- BONUS (for fast people): Analyze the descriptive statistics: `mean(YourObject), median, min, max, range, quantile`
- BONUS 2: Generate 150 random numbers from a normal distribution with $\mu = 170cm$ and $\sigma = 8cm$. Perform a Kolmogorov-Smirnov test for normality of that sample.

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- `str(YourObject)` must yield the column data types: `num, num, factor`.
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treesize <- read.table(file="treesize.txt", header=TRUE)
```

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General code for scatterplots: `plot(x, y, ...)`

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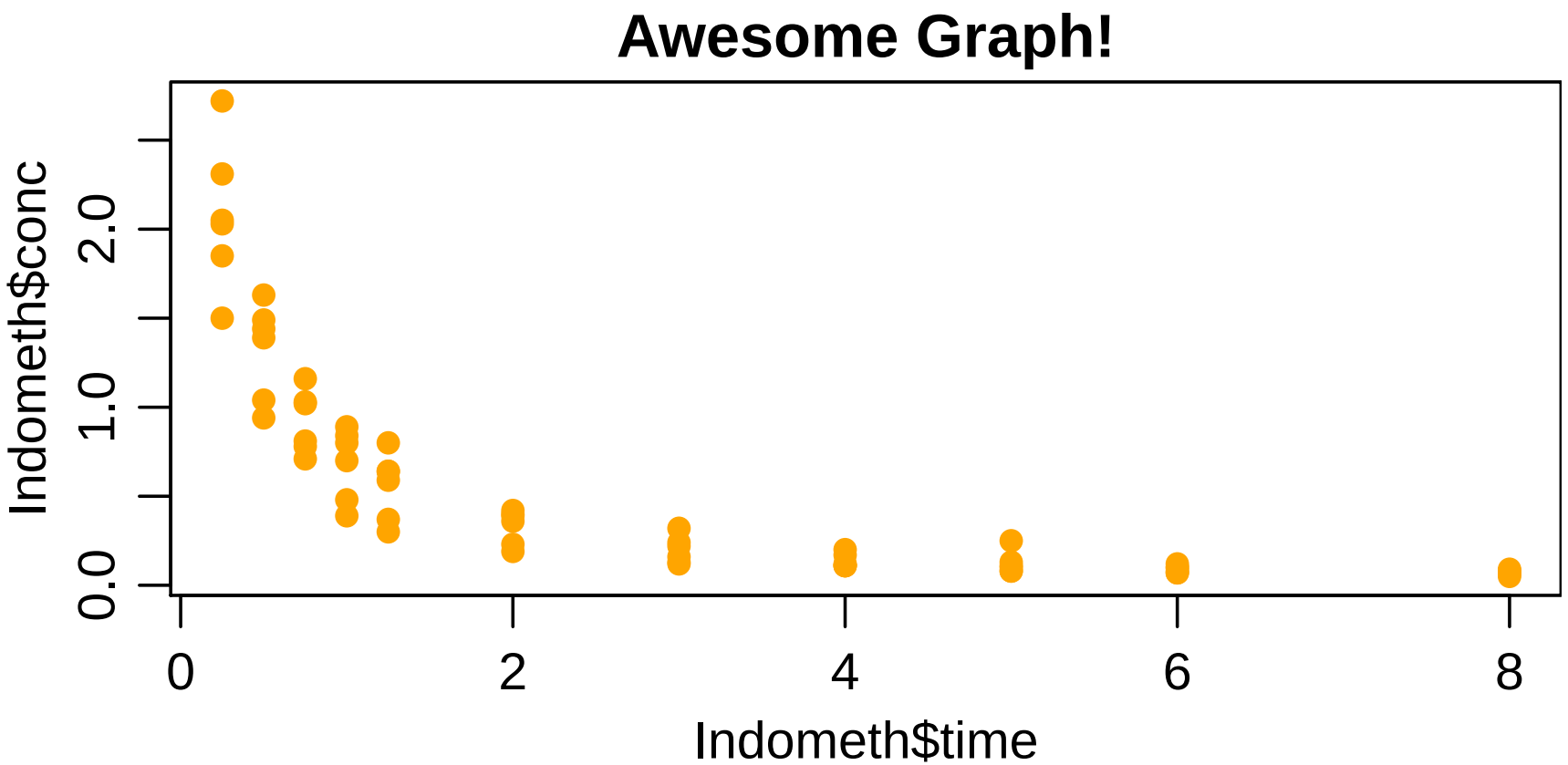
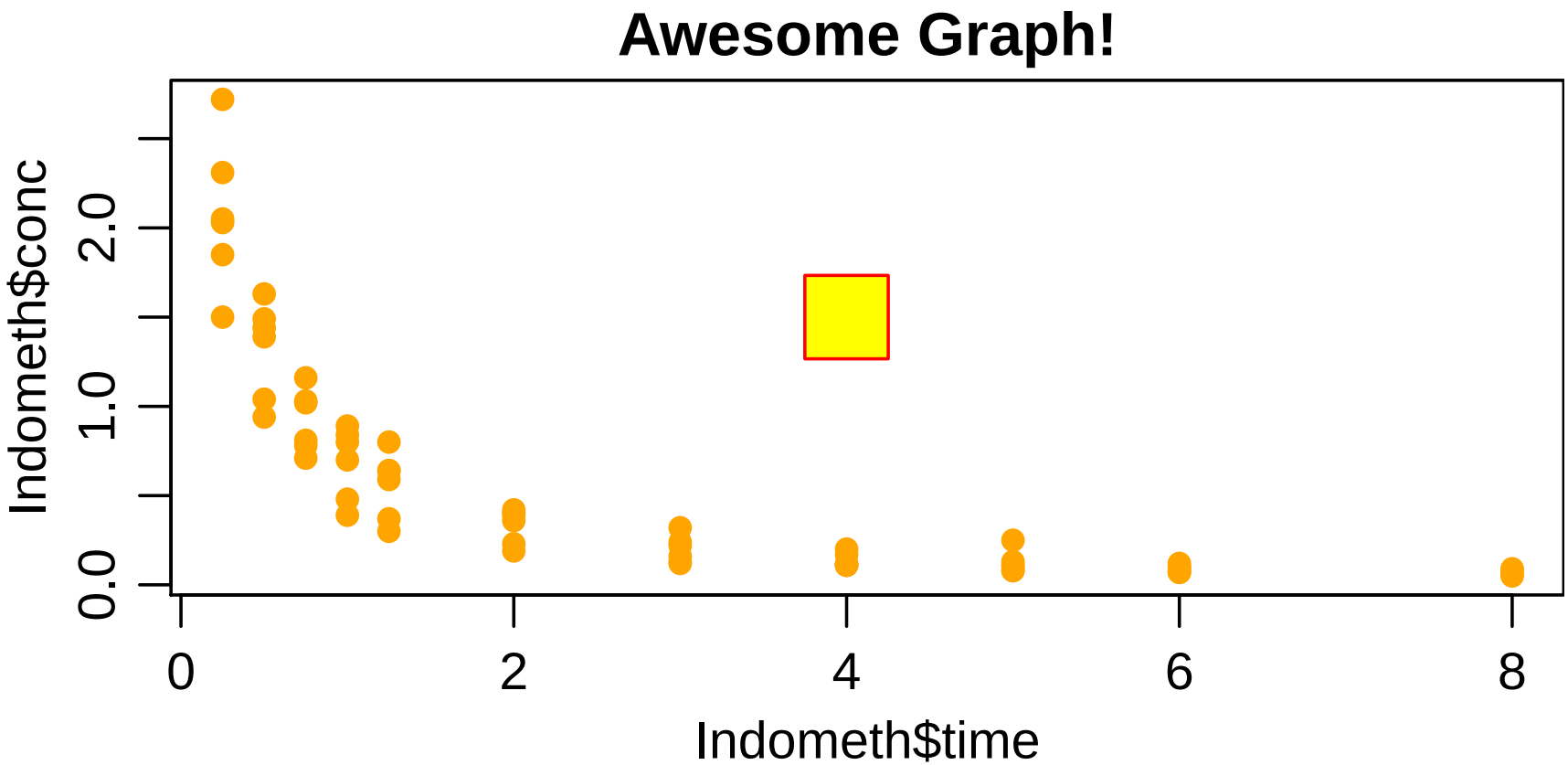
```
plot(x=Indometh$time, y=Indometh$conc,
     col="orange", pch=16, main="Awesome Graph!")
```



Plotting I

General code for scatterplots: `plot(x, y, ...)`

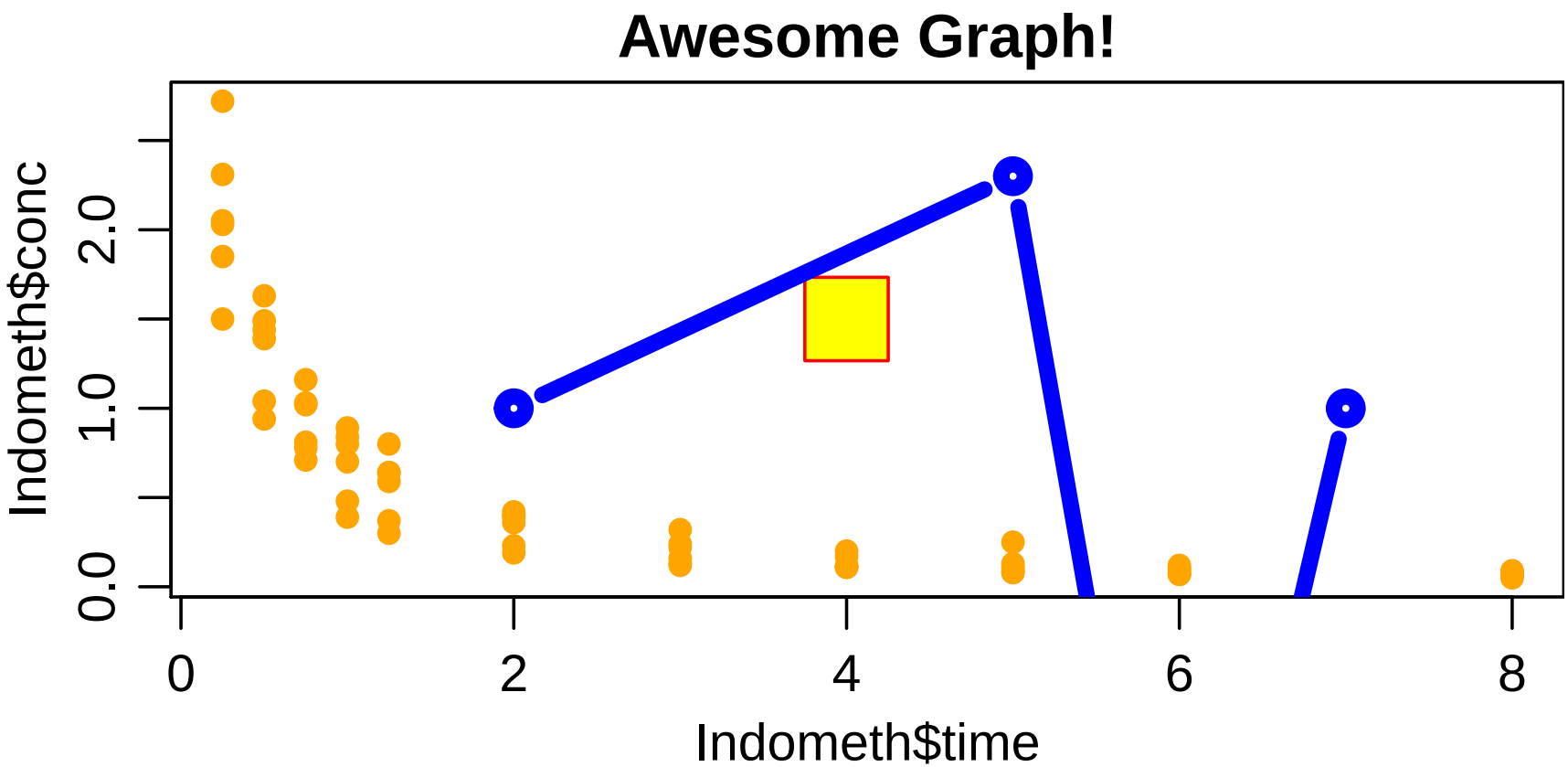
```
points(4, 1.5, pch=22, bg="yellow", cex=4, col="red")
# PointCHaracter, BackGround, Character EXpansion
```



Plotting I

General code for scatterplots: `plot(x, y, ...)`

```
lines(x=c(2,5,6,7), y=c(1,2.3,-3,1),
      col=4, type="b", lwd=5)
```



Plotting II: Our treesize dataset

```
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```

- Plot tree height over age.
- Add labels to the plot.
- Change the point character (`pch`) and color (`col`).
- BONUS 1: Use a vector for colors, e.g. subset by tree measurement
- BONUS 2: Compare the histogram (`hist`) of the heights with the `boxplot` and `quantile(x, probs=c(0.1, 0.8))`.

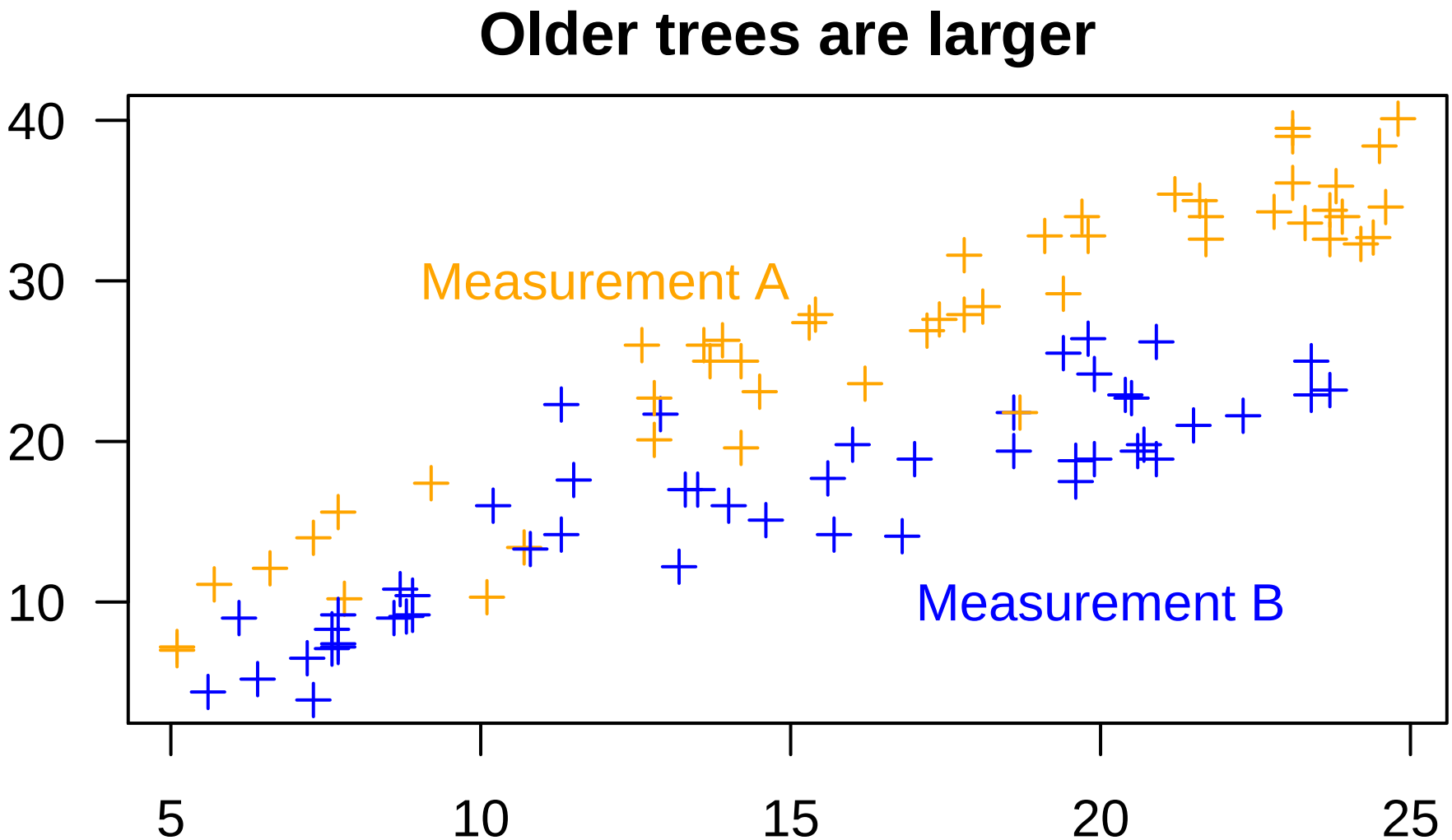
Solution for scatterplot exercise

```
treesize <- read.table(file="treesize.txt", header=TRUE)

plot(treesize$age, treesize$height)
cols <- c("orange", "blue")
plot(treesize$age, treesize$height, las=1, ylab="Tree height [m]",
     xlab="Tree age [years]", col=cols[treesize$measurement],
     main="Older trees are larger", pch=3)
text(x=c(12,20), y=c(30,10),
     labels=paste("Measurement", levels(treesize$measurement)), col=cols)
quantile(treesize$height, probs=c(0.1, 0.8))

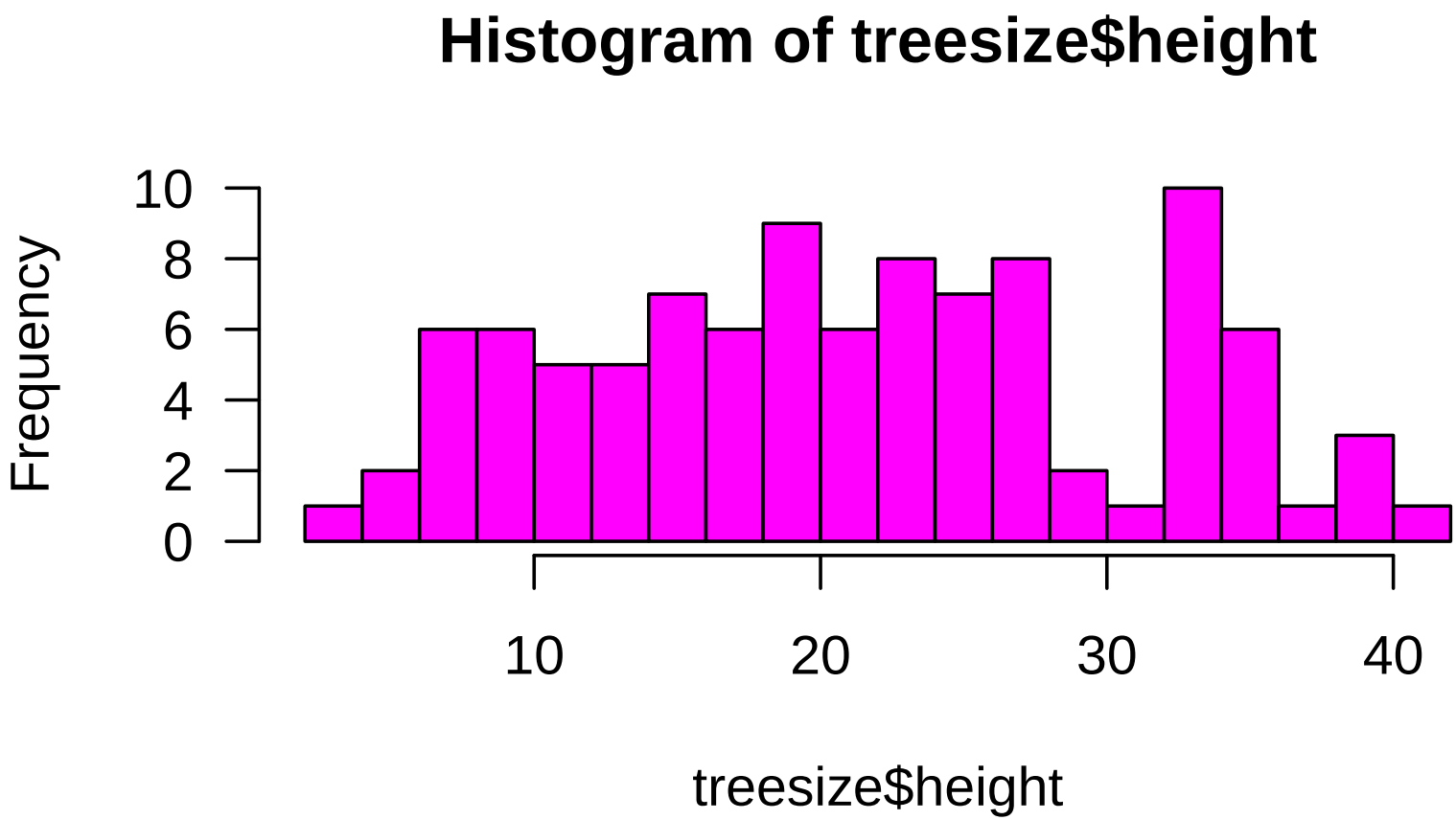
##    10%    80%
##   8.93  32.36
```

Solution for scatterplot exercise



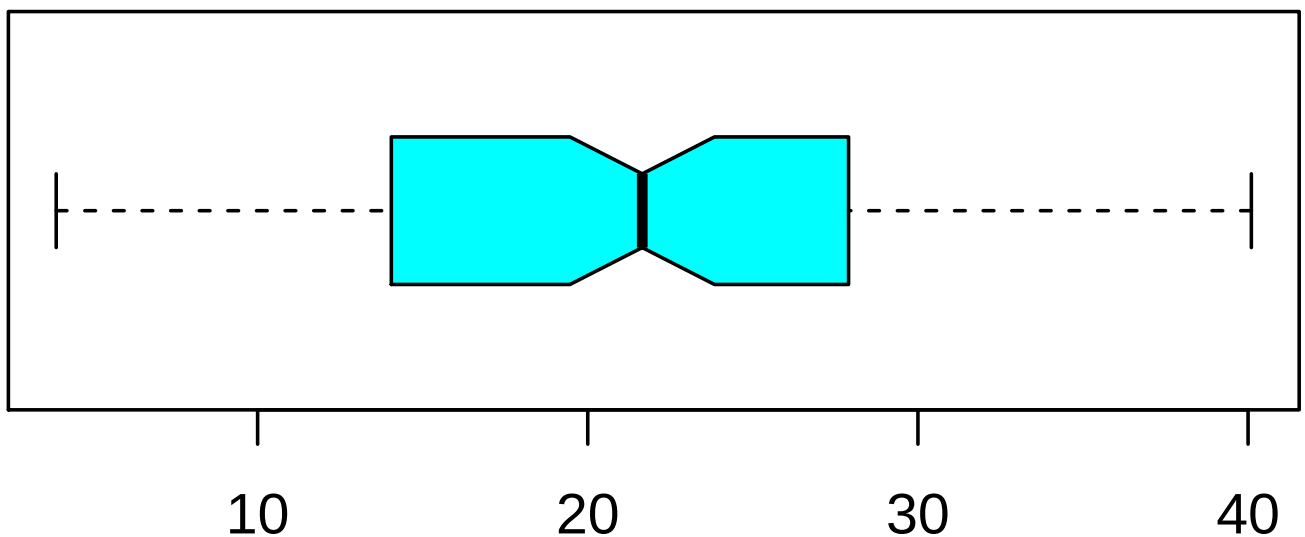
Solution for scatterplot exercise: Histogram

```
hist(treesize$height, col=6, breaks=20, las=1)
```



Solution for scatterplot exercise: Boxplot

```
boxplot(treesize$height, col=5, horizontal=TRUE, notch=TRUE)
```



commonly needed plot arguments

```
plot(x, y, # point coordinates
col="lightblue", # point color
pch=0, # point character (symbol)
xlab="My label  [km]", ylab="", # axis labels
main="Graph title", # title
cex=1.8, # character expansion (symbol size)
type="l", # draw lines instead of points
lwd=3, # line width (thickness of lines)
las=1, # label axis type (axis numbers upright)
xaxt="n" # axis type (none to suppress axis)
)
```

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- To make sure your script is reproducible (you may rename objects, for example, and miss one occurrence):
  restart R (`CTRL` + `SHIFT` + `F10`) every once in a while (Make sure Rstudio settings are reproducible as shown on slide 4).

Overview: data types

In order of coercion (if mixed, TRUE is converted to 1, 3.14 to "3.14" etc)

Description	example	`typeof`	`class`
empty set	NULL	NULL	NULL
not available	NA	logical	logical
logical	c(T, F, FALSE, TRUE)	logical	logical
category	factor("left")	integer	**factor**
integer number	4:6	integer	integer
decimal	8.7	double	**numeric**
complex	5+3i	complex	complex
character string	"homer rocks"	character	character
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matrix	matrix(9:15, ncol=2)	...	matrix
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data.frame	data.frame(C1=4:5, C2=c("a","b"))	list	data.frame
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`as.matrix(Object)` converts the class of an object by force.

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- All >10'500 available packages: cran.r-project.org/web/packages
- `install.packages("ggplot2")` to download and install.
  (only needs to be executed once, works on user level, no admin rights required)

  You can do this in Rstudio

R Packages

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- Rarely needed: `remove.packages("packagename")`

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- Briefly explain the `summary` of the linear model.

More things

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- Data.frames

Objects: data.frames

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  `data.frame(count=c(2,6,5), type=c("a","k","k"))`
- `read.table` also returns a data.frame
- If we have the object `df`, we can subset with `df[rows,columns]`
- `df[1,2:4]; df[2, ]; df[ ,"name"]; df$name`
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From the dataset `treesize` from the previous exercise, obtain:

- The first 5 values in column 2
- The maximum "Height" (the maximum of the values in that column)
- For each entry: is the measurement equal to (==) A?
- BONUS 1: The height entries for trees older than 23.5 years
- BONUS 2: All rows, excluding rows 3, 7,8,9,...,20