# Assignment: Data Visualization in R

A quick introduction to base R graphics

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## Contents

## 1 README

- This assignment is based on Pearson's archived DataCamp course "Data Visualization in R" (2016), chapter "A quick introduction to base R graphics".
- We've done most of these in class already, so this is a hopefully welcome repetition of stuff you've seen and should know.

- Each chapter comes with one video (of 4 minutes length), which you should watch before completing the exercises. There are also slides available (GDrive).
- For the exercises, create or complete R code blocks as needed.
- When you completed all exercises and watched all videos, update the `#+AUTHOR:` information with your name and `(pledged)`, and submit here.
- Upload your completed file to Canvas.
- Total time: ca. 45 minutes.

## 2 DONE The world of data visualization

Watch the video and/or look at the slides (GDrive) - 4 min

## 3 DONE Creating an exploratory plot array

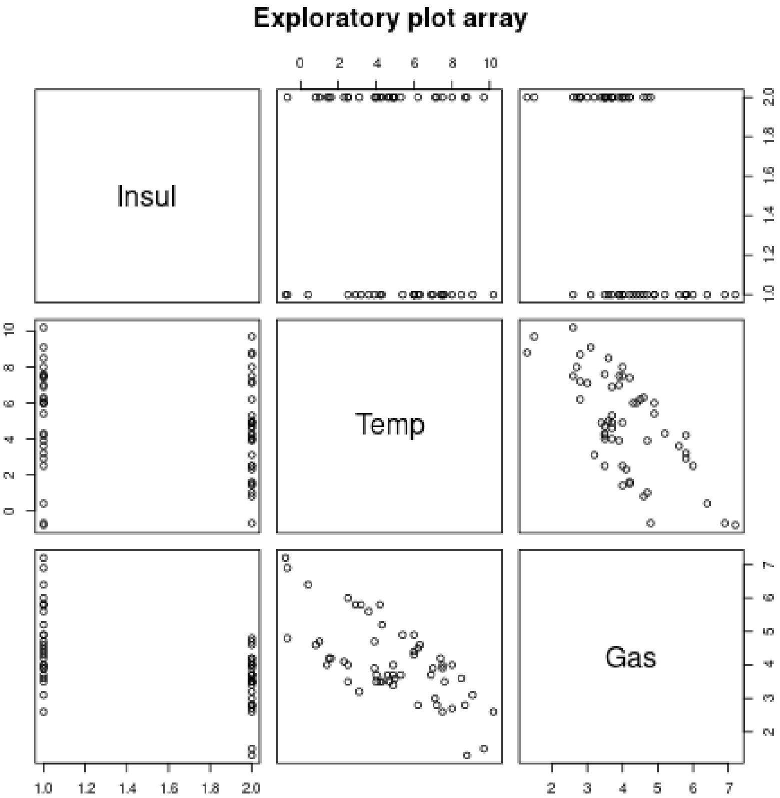
1. Create a code block that prints graphics output to `plot1.png`
2. Make the `whiteside` data set from the `MASS` package available in your R session
3. Display the structure of the `whiteside` data set
4. Apply the `plot` function to the `whiteside` data frame
5. Title the plot "Exploratory plot array"

   —– PUT YOUR CODE BELOW THIS LINE —–

   ```
   library(MASS)
   str(MASS::whiteside)
   ```

   ```
   'data.frame':	56 obs. of  3 variables:
    $ Insul: Factor w/ 2 levels "Before","After": 1 1 1 1 1 1 1 1 1 1 ...
    $ Temp : num  -0.8 -0.7 0.4 2.5 2.9 3.2 3.6 3.9 4.2 4.3 ...
    $ Gas  : num  7.2 6.9 6.4 6 5.8 5.8 5.6 4.7 5.8 5.2 ...
   ```

```
plot(whiteside,
main="Exploratory plot array")
```



## 4 DONE Creating an explanatory scatterplot

1. Use the `plot` function to construct a scatterplot of the heating gas consumption, `Gas`, versus the outside temperature, `Temp`, from the `whiteside` data frame in the `MASS` package.

2. Label the x- and y-axes to indicate the variables in the plot, e.g. "Outside temperature", and "Heating gas consumption", resp.

3. Title the plot "Explanatory scatterplot"

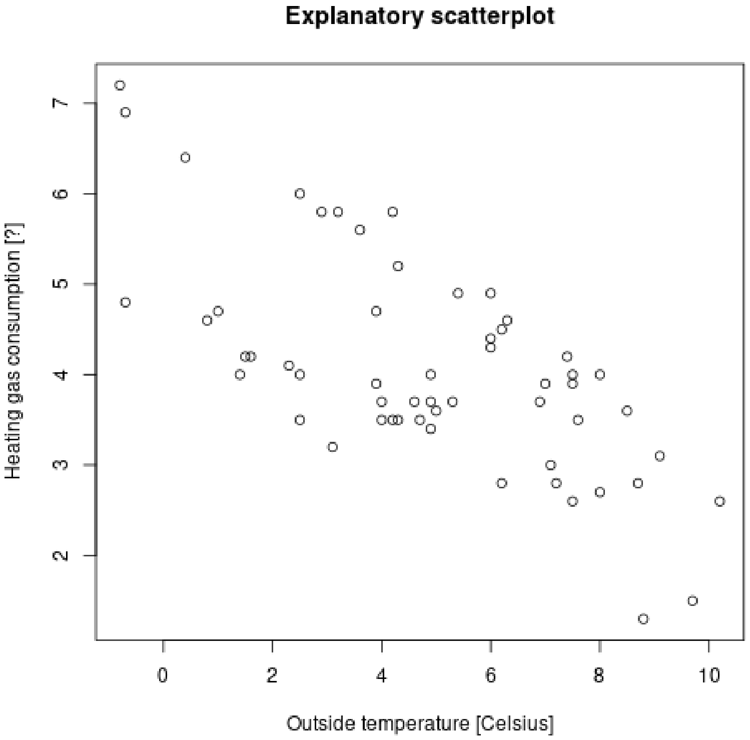
4. Print the plot to a file `plot2.png`

   —– PUT YOUR CODE BELOW THIS LINE —–

```
str(whiteside)
```

```
'data.frame': 56 obs. of  3 variables:
 $ Insul: Factor w/ 2 levels "Before","After": 1 1 1 1 1 1 1 1 1 1 ...
 $ Temp : num  -0.8 -0.7 0.4 2.5 2.9 3.2 3.6 3.9 4.2 4.3 ...
 $ Gas  : num  7.2 6.9 6.4 6 5.8 5.8 5.6 4.7 5.8 5.2 ...
```

```
plot(
  x = whiteside$Temp, # independent variable
  y = whiteside$Gas,   # dependent variable
  xlab = "Outside temperature [Celsius]",
  ylab = "Heating gas consumption [?]",
  main = "Explanatory scatterplot")
```



## 5 DONE The `plot()` function is generic

1. Apply the `plot` function to the `Insul` variable from the `whiteside` data frame in the `MASS` package.

2. Title the plot "Insulation"

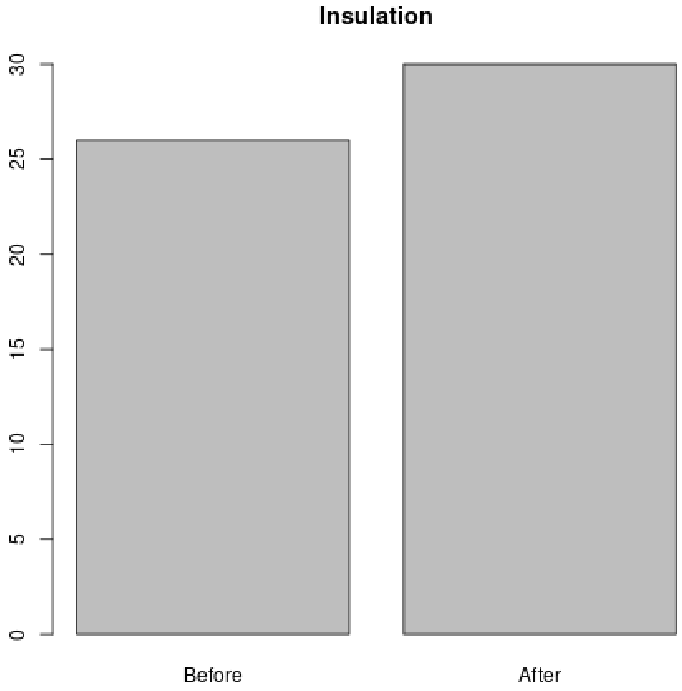
3. Name the resulting plot `plot3.png`

   —– PUT YOUR CODE BELOW THIS LINE —–

```
str(whiteside$Insul)
```

```
Factor w/ 2 levels "Before","After": 1 1 1 1 1 1 1 1 1 1 ...
```

```
plot(whiteside$Insul,
main = "Insulation")
```



## 6 DONE A preview of some more and less useful techniques

Watch the video and/or look at the slides (GDrive) - 4 minutes.

## 7 DONE Adding details to a plot using point shapes, color, and reference lines

1. Create an R code block to check that the data set `Cars93` from the `MASS` package is in your work space, and to look at its structure.
2. Create another R code block that stores output in the file `plot4.png`
3. Use `plot` to create a scatterplot of the `Max.Price` variable vs. the `Price` variable.
4. Specify `pch` and `col` parameters so that the data points are represented as red solid triangles. The `pch` value for solid triangle symbols is 17.
5. Use the `points` function to add a second set of points to your scatterplot, representing `Min.Price` versus `Price`.
6. Specify the new data points as blue solid circles. The `pch` value for solid circles is 16.
7. Use the `abline` function to add a dashed equality reference line (i.e. a line with y-intercept 0 and slope 1). Check `help(abline)` to find out what its arguments refer to. The `lty` value for a dashed line is 2.
8. Give your plot a suitable title, and label the axis appropriately. You can either do this in the `plot` function as a `main` parameter, or use the `title` function.

   —– PUT YOUR CODE BELOW THIS LINE —–

```
data(Cars93)
str(Cars93)
```

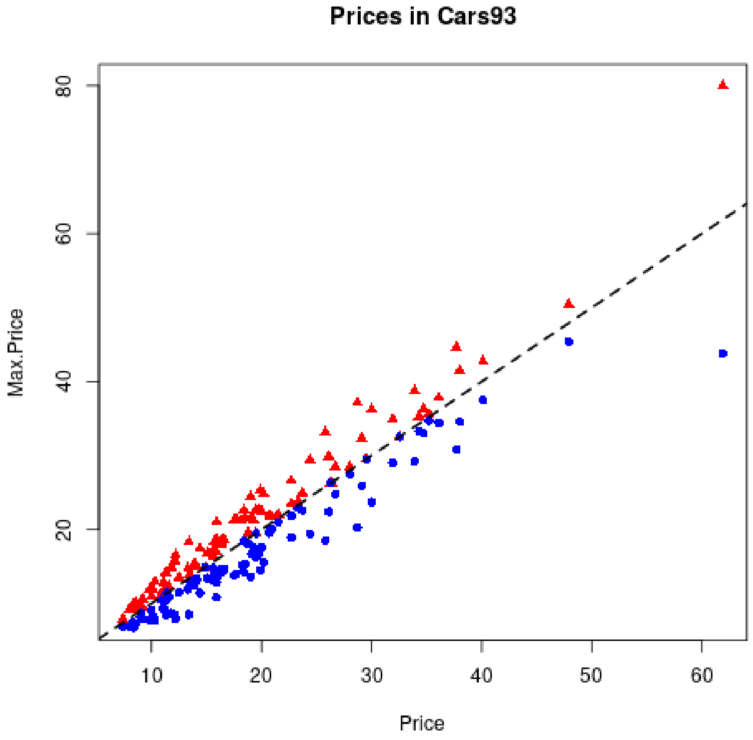
```
'data.frame': 93 obs. of  27 variables:
 $ Manufacturer      : Factor w/ 32 levels "Acura","Audi",..: 1 1 2 2 3 4 4 4 4 5
 $ Model             : Factor w/ 93 levels "100","190E","240",..: 49 56 9 1 6 24 5
 $ Type              : Factor w/ 6 levels "Compact","Large",..: 4 3 1 3 3 3 2 2 3
 $ Min.Price         : num  12.9 29.2 25.9 30.8 23.7 14.2 19.9 22.6 26.3 33 ...
 $ Price             : num  15.9 33.9 29.1 37.7 30 15.7 20.8 23.7 26.3 34.7 ...
 $ Max.Price         : num  18.8 38.7 32.3 44.6 36.2 17.3 21.7 24.9 26.3 36.3 ...
 $ MPG.city          : int  25 18 20 19 22 22 19 16 19 16 ...
 $ MPG.highway       : int  31 25 26 26 30 31 28 25 27 25 ...
 $ AirBags           : Factor w/ 3 levels "Driver & Passenger",..: 3 1 2 1 2 2 2 2
 $ DriveTrain        : Factor w/ 3 levels "4WD","Front",..: 2 2 2 2 3 2 2 3 2 2 .
 $ Cylinders         : Factor w/ 6 levels "3","4","5","6",..: 2 4 4 4 2 2 4 4 4 5
 $ EngineSize        : num  1.8 3.2 2.8 2.8 3.5 2.2 3.8 5.7 3.8 4.9 ...
 $ Horsepower        : int  140 200 172 172 208 110 170 180 170 200 ...
 $ RPM               : int  6300 5500 5500 5500 5700 5200 4800 4000 4800 4100 ...
 $ Rev.per.mile      : int  2890 2335 2280 2535 2545 2565 1570 1320 1690 1510 ...
 $ Man.trans.avail   : Factor w/ 2 levels "No","Yes": 2 2 2 2 2 1 1 1 1 1 ...
 $ Fuel.tank.capacity: num  13.2 18 16.9 21.1 21.1 16.4 18 23 18.8 18 ...
 $ Passengers        : int  5 5 5 6 4 6 6 6 5 6 ...
 $ Length            : int  177 195 180 193 186 189 200 216 198 206 ...
 $ Wheelbase         : int  102 115 102 106 109 105 111 116 108 114 ...
 $ Width             : int  68 71 67 70 69 69 74 78 73 73 ...
 $ Turn.circle       : int  37 38 37 37 39 41 42 45 41 43 ...
 $ Rear.seat.room    : num  26.5 30 28 31 27 28 30.5 30.5 26.5 35 ...
 $ Luggage.room      : int  11 15 14 17 13 16 17 21 14 18 ...
 $ Weight            : int  2705 3560 3375 3405 3640 2880 3470 4105 3495 3620 ...
 $ Origin            : Factor w/ 2 levels "USA","non-USA": 2 2 2 2 2 1 1 1 1 1 ..
 $ Make              : Factor w/ 93 levels "Acura Integra",..: 1 2 4 3 5 6 7 9 8 1
```

```
library(MASS)
plot(
  data=Cars93,
  Max.Price ~ Price,
  pch=17,
  col="red")

points(
  data=Cars93,
  Min.Price ~ Price,
  pch=16,
  col="blue")

abline(
  a=0, # intercept
  b=1, # slope
  lty=2,   # dashed line
  lwd=2)   # wider line

title(main="Prices in Cars93")
```



## 8 DONE Creating multiple plot arrays

1. Create an R code block and look at the structure of the `Animals2` data set in the `robustbase` package.

2. Create another R code block that writes graphics output to a file `plot5.png`.

3. Use the `par` function and set the `mfrow` parameter to create a side-by-side plot array with 1 row and 2 columns.

4. Use the `plot` function to create a scatterplot of the variables `brain` vs. `body` from the `Animals2` data frame, without customization.

5. Add the title "Original representation" to the plot using the `title` function.

6. Add another `plot` command in the same code block, with the same variables, but add the parameter `log="xy"` to the arguments. This creates a plot of both variables in log scale.

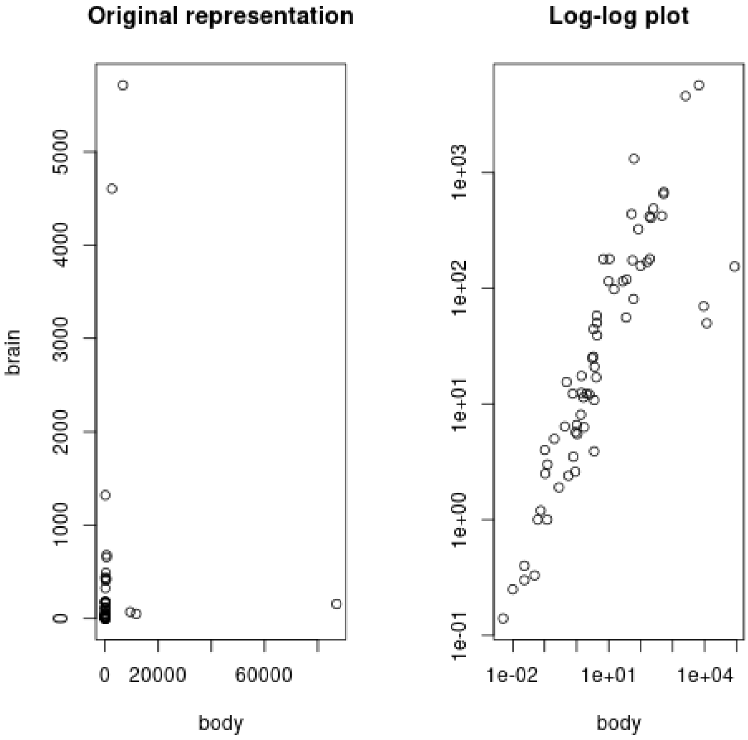
7. Add the title "Log-log plot" to the plot using the `title` function.

   —– PUT YOUR CODE BELOW THIS LINE —–

```
library(robustbase)
str(Animals2)
```

```
’data.frame’: 65 obs. of  2 variables:
 $ body : num  1.35 465 36.33 27.66 1.04 ...
 $ brain: num  8.1 423 119.5 115 5.5 ...
```

```
par(mfrow=c(1,2))
plot(brain ~ body, data=Animals2,
main="Original representation") # hard to read
plot(brain ~ body, data=Animals2, ylab="",
log="xy", # logarithmic transformation of both x and y axis
main="Log-log plot")
```



## 9 DONE Avoid pie charts

1. Create an R code block and look at the structure of the `dataCar` data set in the `insuranceData` package. Remember that you may have to install packages (on the R console, not in the Org-mode file), and that you must load packages (with `library`) and sometimes load data sets, too (with `data`).

2. Create a new R code block that writes graphics output to the file `plot6.png`.

3. Set up a side-by-side plot array with 1 row and 2 columns.

4. Use `table` to create a table `tbl` of counts of the distinct levels of the `veh_body` variable in the `dataCar` data frame.

5. Use `sort` to sort the table `tbl`, and set the parameter `decreasing=TRUE` to sort in descending order. Store the sorted table in `tbl_sorted`.

6. Pass `tbl_sorted` as the argument to the plotting function `pie`. This will create a pie chart.

7. Use `title` to title this plot "Pie chart".

8. Use the plotting function `barplot` and the function `title` to create a barplot titled "Bar chart" from the data of `tbl_sorted`.

9. Inside `barplot`, set the parameters `las=2` to make the sets of x- and y-labels perpendicular to the axes, and `cex.names=0.5` to make the name labels half the default size.

   —– PUT YOUR CODE BELOW THIS LINE —–

```
library(insuranceData)
data(dataCar)
str(dataCar)
```

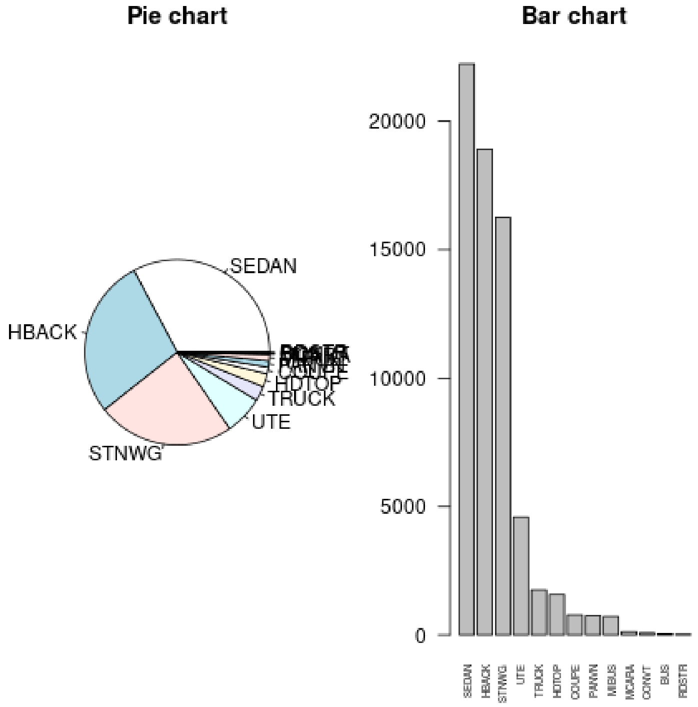
```
'data.frame': 67856 obs. of  11 variables:
 $ veh_value: num  1.06 1.03 3.26 4.14 0.72 2.01 1.6 1.47 0.52 0.38 ...
 $ exposure : num  0.304 0.649 0.569 0.318 0.649 ...
 $ clm      : int  0 0 0 0 0 0 0 0 0 0 ...
 $ numclaims: int  0 0 0 0 0 0 0 0 0 0 ...
 $ claimcst0: num  0 0 0 0 0 0 0 0 0 0 ...
 $ veh_body : Factor w/ 13 levels "BUS","CONVT",..: 4 4 13 11 4 5 8 4 4 4 ...
 $ veh_age  : int  3 2 2 2 4 3 3 2 4 4 ...
 $ gender   : Factor w/ 2 levels "F","M": 1 1 1 1 1 2 2 2 1 1 ...
 $ area     : Factor w/ 6 levels "A","B","C","D",..: 3 1 5 4 3 3 1 2 1 2 ...
 $ agecat   : int  2 4 2 2 2 4 4 6 3 4 ...
 $ X_OBSTAT_: Factor w/ 1 level "01101    0    0    0": 1 1 1 1 1 1 1 1 1 1 ...
```

```
table(dataCar$veh_body) -> tbl
tbl
sort(tbl,decreasing=TRUE) -> tbl_sorted
tbl_sorted
```

```
  BUS CONVT COUPE HBACK HDTOP MCARA MIBUS PANVN RDSTR SEDAN STNWG TRUCK   UTE
   48    81   780 18915  1579   127   717   752    27 22233 16261  1750  4586
```

```
SEDAN HBACK STNWG   UTE TRUCK HDTOP COUPE PANVN MIBUS MCARA CONVT   BUS RDSTR
22233 18915 16261  4586  1750  1579   780   752   717   127    81    48    27

par(mfrow=c(1,2))
pie(tbl_sorted)
title("Pie chart")
barplot(tbl_sorted, las=2, cex.names=0.5)
title("Bar chart")
```


Pie chart
SEDAN
HBACK
STNWG
UTE
TRUCK
HDTOP
COUPE
Bar chart
SEDAN
HBACK
STNWG
UTE
TRUCK
HDTOP
COUPE
PANVN
MIBUS
MCARA
CONVT
BUS
RDSTR