

Exercise 1

04. April 2011

1. Download and install the R-Software. <http://www.r-project.org/> → Download CRAN → search a city near you Choose your system (Windows / Mac / Linux) Follow the instructions.
2. Create a vector t `"t<-seq(-2*pi,2*pi,by=0.01)"` plot several functions in one window $(\sin(t), \cos(t), \exp(\frac{t}{5}), (\frac{t}{5})^2, (\frac{t}{5})^3)$. Try some of the plot arguments: Set ylim, label the axes, set a different colour for each function, vary the line width. Save the plot as a figure.
For help try `"?plot"` or `"?plot.default"`
3 points
3. Set up a vector of length 20 and create a vector b with a linear relationship to a (e.g. $a = 3b + 7$). Calculate the correlation(`"cor(a,b)"`).
1 point
4. Set up two random vectors a,b of length 20 and calculate the correlation. Repeat this procedure several times to get a feeling for the correlation coefficient. Than vary the length of vector a and b (vary the sample number) and discuss how the correlation coefficient changes (e.g. 10,50,100,1000).
2 points
5. Repeat the experiment from task 4 100 times by using a loop. Create before the loop an empty vector (`"cor.val<-vector()"`) and save the correlation of a and b in this vector (e.g. `"cor.val[i]<-cor(a,b)"`) for each realisation. Compute the mean value and plot the histogram of cor.val. What happens with the histogram when the length of a and b is varied (e.g. 10,50,100)? Save two different histograms as a figure and explain the difference between them.
2 points

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6. Repeat the procedure of task 5. with partly linear dependent vectors: ("a<-rnorm(100); b<-r*a+rnorm(100)") Choose one value for r and shortly discuss the mean value and the histogram of cor.val compared to task 5. Save the histogram as a figure.

2 points

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# Important R-commands
rnorm(N) # create vector with N normal distribution random numbers
cor(a,b) # calculates the correlation coefficient
hist(a)  # histogram of vector a
mean(a)  # mean value of vector a
```

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# Helpful introductions to R can be found in e.g.
http://www.stat.cmu.edu/~larry/all-of-statistics/=R/Rintro.pdf
http://cran.r-project.org/doc/manuals/R-intro.pdf
```

Notes on submission form of the exercises: *Working in study groups of two persons is encouraged, but each student should programme his/her own code. The programme code and the answers to the questions including the figures shall be send as one document to **kriegerm@uni-bremen.de** (until Sunday!).*