***Preliminaries***

The solutions to the assignments involving R coding should be reported in details, all R code that you write should be **included** into the report. Also, all appropriate pictures or diagrams should be included.

***Assignment 1: Multivariate normal***

1. Write a code generating mulitivariate random normal variables with mean and covariance matrix (use *chol()*)
2. Run your code to generate 1000 random samples and make a scatter plot of your data. Does it look as it should?
3. Compute sample variances and sample covariance in your data and make necessary conclusions.

***Assignment 2: Linear regression***

The Excel file “**tecator.xls**” contains the results of a study aimed to investigate whether a near-infrared absorbance spectrum can be used to predict the protein content of samples of meat. For each meat sample the data consists of a 100 channel spectrum of absorbance records and the levels of moisture (water), fat and protein. The absorbance is -log10 of the transmittance measured by the spectrometer. The moisture, fat and protein are determined by analytic chemistry. The worksheet you need to use is “data”. It contains data from 215 samples of finely chopped meat. The aim is to fit a linear regression model that could predict protein content

1. Import the data set to R
2. The generally used method for fitting linear models in R is *lm()*. Suggest why using this method may be inconvenient? (If you can not guess, just try to do that!)
3. Compose the system of linear equations of the type **Aβ=b** that gives regression coefficients as solutions
4. Try to solve it with default solver *solve()*. What result did you get? Why do you think this might happen?
5. Apply QR-factorization to solve this system in the optimal way. (Use *qr(), backsolve()*) . For the linear system **Aβ=b** at step 3, examine **Aβ-b** using the computed **β** and make conclusions.
6. Try to find a solution by using Conjugate gradient method. Make comments about the output obtained.(Use *optim*() with parameter *method=”CG”*)
7. Compare the results obtained by the different methods.

## Submission procedure

If you are neither speaker or opponent, you should just send-in the solutions via It’s learning. **Note that there is a deadline for submission!** If you are *speaker*, you must also do the following:

* Put your report and PowerPoint presentation to the folder *Lab 5* which is in the folder *Seminars*. Specify Active : “Set time span”. Specify activation time as 7 **maj 15:00. Make sure that the time settings are specified!**

If you are *opponent*, you may find the report and PPT-file for revision available immediately after **7 maj 15:00** in the folder*Seminars->Lab 5*