Statistics for empirical sciences (3 ECTS)

Target group: PhD students with a limited knowledge in statistics.
Course instructor: Patrik Rydén (patrik.ryden@math.umu.se)
Language: English
No. of participants: up to 20.

Course content and aim:
New technologies make it easy and cheap to produce big and complex data, but data are not equivalent to information. In order to extract information we need statistics. Today a number of statistical methods and algorithms are freely available and easy accessed (*e.g.* in the computer language R). The big challenge is not to use the statistical methods (user-friendly software are commonly available) but to know when to use them and to interpret the results.
The aim of this course is to give the participants knowledge about some of the central concepts in statistics and highlight the advantages and disadvantages with different statistical approaches.

Outline of the course:
The course consists of lectures where the following statistical topics are covered:

- Formulating statistical hypotheses.
- Experimental design.
- Central tendency measures, measures of variability and descriptive statistics.
- An overview of hypothesis testing –the different steps in hypothesis testing, model assumptions, test-statistics, confidence intervals and p-values.
- Test on frequencies – Chi-square tests and Fishers exact test
- Test when we have two populations –t-tests for related and unrelated samples (and corresponding confidence intervals), Wilcoxon signed rank test, Mann-Whitney U tests. Test and confidence intervals for proportions.
- Bootstrap – test and confidence intervals using bootstrap.
- One way ANOVA
- Correlation and linear regression – Pearsons correlation, Spearmans correlation, linear regression, multiple linear regression, model assumptions, model selection and R-square.

The examination consists of a short (1 hour) written exam, where the understanding of the basic statistical concepts are being examined.

Course literature: **Biomeasurement: a student's guide to biological statistics**, Dawn Hawkins, Oxford University Press**.** There are three availably editions of this book, all of them will work for the course).

Expected learning:
At the end of the course, the participants will have increased their knowledge about some of the central statistical concepts and have a better knowledge about when and how to use the different statistical methods.