PhD Course: Advanced Statistics

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1 Course Contents and Objective

The course provides

1. a profound data analysis using descriptive statistic,

2. a presentation about design of experiments, and

3. an introduction to advanced statistical methods.

The goal of the course is to teach you advanced statistical methods in particular which kind of problems are solvable with them. An advanced statistical approach you will get to know in detail by working through a scientific paper and the data therein, two other statistical methods you will get to know in detail via presentations of your colleagues. More importantly doing this exercise you will learn how to apply and to work through a new method on your own. The aim is to determine what are the questions you should ask and what are the characteristics you should look at.

How do we reach this goal in such a short time?

1. The **first part of the course** are lectures about the methods. Regarding the advanced statistical methods I will give you an overview about a few approaches, show you problems that can be solved with these methods and discuss advantages and disadvantages of the methods. However, I will not be able to go into too much details.

2. In the **second part** of the course you will receive an already published paper or working paper with the corresponding data. The assignment is to replicate the findings therein. After the second lecture you will be assigned to a problem. Till our next class you should try to get familiar with the data used (descriptive

statistics). During the mentoring time I will teach you one of the methods employed in the paper in detail and show you how to use SPSS or R to compute the approaches and interpret the obtained results. For our last meeting you prepare a presentation that

(a) summarizes the problem analyzed in your paper,

(b) discusses the findings of the descriptive analysis,

(c) specifies the advanced statistical methods used in detail,

(d) shows the implementation in SPSS/R, and

(e) discusses the results of the paper.

Note: If you have already a scientific problem for your thesis and corresponding data you are welcome to use these instead of an already published paper.

Note: As few as possible formulae will be used. However, it is also necessary to teach and to learn how to read formulae in order to be able to study further yourself and to understand scientific papers.

2   Course Schedule

The course takes place during the winter semester 2010 at the SoWi, University of Innsbruck*. Lectures, consultation hours, and presentations are blocked on 4 Fridays. The exact time and location is in the following table:

Day	Date	Time	Room
Friday	2010/10/15	8:00-10:00, 10:30-12:30, 13:30-15:00	SR 7 (SoWi)*
Friday	2010/11/19	8:00-10:00, 10:30-12:30, 13:30-15:00	SR 7 (SoWi)*
Friday	2010/12/17	8:00-10:00, 10:30-12:30, 13:30-15:30	SR 7 (SoWi)*
Friday	2011/01/21	8:00-10:00, 10:30-12:30, 13:30-15:30	SR 7 (SoWi)*

*University of Innsbruck (SoWi), 2nd floor, East, Universitaetsstr. 15, A-6020 Innsbruck

Day	Type	Topic
Friday, 2010/10/15	Lecture	Descriptive Statistics, Design of Experiments, Multivariate Linear Regression Analysis
Friday, 2010/11/19	Lecture	Overview of advanced statistical methods
Friday, 2010/12/17	Mentoring	Discussion of the paper and the methods therein in groups
Friday, 2011/01/21	Presentations	

3 Workload and Grading

- After the first lecture you will get small problems to solve and to hand them in at the next lecture. For this exercise **20%** can be achieved.

- At the end of the second lecture each group will be given a paper. The purpose is to replicate the findings of the authors. Therefore, it will be necessary to work more profoundly on an advanced statistical method. You will get help during the monitoring time. At the end of the course you will present the paper and discuss the results obtained. A given report including the commands of the software used must be handed in immediately after the presentation. For this work you can obtain a maximum of **40%**.
  This report as well as other important information can be found on the homepage of our course: PhD course "Advanced Statistics".

- The final exam will be worth **40%** of the grade. The exam will last 90 minutes. The final exam will be held on Friday, 4th February 2011, 9:00 - 10:30 am, SR 7 (SoWi).

Grading is as follows:

Result	Grade
$< 55\%$	fail
$55\% - 65\%$	4
$65\% - 75\%$	3
$75\% - 85\%$	2
$> 85\%$	1

4   Literature

- Hair J.F., Anderson R.E., Tatham R.L., Black W.C. (1998). Multivariate Data Analysis. Prentice Hall, London. pp 730.

- Legendre P., Legendre L. (1998). Numerical Ecology. Elsevier, Amsterdam pp 853.

- Tutz G., Fahrmeir L. (2001). Multivariate Statistical Modelling Based on Generalized Linear Models. Springer Series in Statistics, Berlin pp 548.

- Krebs C.J. (1989). Ecological Methodology. Harper & Row, New York. pp 654.

- Magnusson W.E., Mourão G. (2004). Statistics without math. Sinauer, Sunderland. pp 136.