Teaching R
Business Statistics and Statistical Computing
Kurt Hornik
- R Core Developer, ISI Highly Cited Researcher

Ronald Hochreiter
- Business Informatics
- Teaching: Statistics and Finance (Bachelor), Finance (Master)

Christoph Waldhauser
- Political Science
- Teaching: Statistics (Bachelor, Post Graduate (Social Science))
International Business Administration program

- Overall rank: 24th out of 65 programs.
- 4th in the German-speaking world.

CEMS Master in International Management program

- Overall rank: 2nd out of 65 programs.

European Business School Ranking 2009

- 34th place out of 70.
Students (Spring 2010)

- Total students 26,065 (49% women).
- International students 6,272 (24% of total).
- Incoming exchange students: approx. 1000 per year.
- Outgoing exchange students: approx. 900 per year.

Faculty and Staff (2009 in full-time equivalents)

- Total faculty 620 (39% women).
- Administrative staff 413 (70% women).
Resources

- Budget (2009) EUR 110 million, Premises 137,000 $m^2$
- Library stock 819,000 books
- 221 Partner universities, 10 International Summer Universities
- 130 Courses in English per semester

Certifications

- PIM member since 1989
- CEMS member since 1990
- EQUIS 2007, renewed 2010
Business Statistics

Contents at WU (undergraduate level)

- Descriptive Statistics
- Hypothesis Testing (including Permutation Test)
- Regression, ANOVA (uni- and multi-variate)
- Model Selection
- Time Series Analysis, Stochastic Processes

Problems

- Only one lecture, 2 hours, just 4 ECTS points!
- Prepare students for finance, economics, marketing, . . .
R Examination Package

A quick glance at the package

- Package exams on CRAN (free, open-source).
- Automatic exam generation.
- Integrated facilities for correction.
- Minimization of time from design of exam to execution, correction, and publishing results.

Implementation at WU

- Individual exams for each and every student.
- Results are published online (web interface) within 4-24 hours after the exam.
Main rule
Do not invent real world examples if you do not have a clue about the area and do not mix (and mess) application areas.

Example from current WU lecture
Hypothesis test, proportion test (second lecture) examples created by a mathematician: cheque reader and credit card.

Problem
Overestimation of familiarity with real world applications.
Why Statistical Computing?

Tim Burners-Lee

“Journalists need to be data-savvy”

New world statistics

- data-driven
- computationally expensive
- visualization and immersion
- (online) data harvesting
Why R?

Advantages of R

- Free Software
- State of the art
- low cost
- no license hassle
- rather low level
- very transparent
- excellent community for support
Lasswell’s formula

Who teaches what in which channel to whom with what effect?
General Considerations

Lasswell’s formula

*Who* teaches *what* in *which channel* to *whom* with *what effect*?
General Considerations

Lasswell’s formula

**Who** teaches what in which channel to whom with what effect?

Who? Qualified faculty

- Industry experience with R
- Experience in teaching software
- Qualification programmes
Lasswell’s formula

Who teaches what in which channel to whom with what effect?

What? Syllabus

- Computer driven statistical analysis
- Statistical programming
- Data visualization
Lasswell’s formula

Who teaches what in **which channel** to whom with what effect?

**Which channel? Infrastructure**

- FLOSS comes at no cost
- Hardware needs to be provided
- Computer labs at WU available 24/7 to students
General Considerations

Lasswell’s formula

Who teaches what in which channel to **whom** with what effect?

Whom? Audience

Master program attracts different backgrounds. Differences in

- computer literacy
- statistical literacy
- analytical experience
General Considerations

Lasswell’s formula
Who teaches what in which channel to whom with **what effect?**

What effect? Teaching outcomes

- Statistical Analysis
- Statistical Programming
- Deployment of stat methods
- Autonomous extension of knowledge (i.e. learn how to use new R packages)
Smoothening Out Differences

Starting point

heterogenous group of students

On the way

- online & self-study materials
- small group tutorials
- peer tutoring

End point

homogeneous performances of entire group
Smoothening Out Differences

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Partial Immersion

Learning statistics is like learning a language

Language learning

- steep learning curve
- mixes theory & application
- exposure maximizes results
Partial Immersion

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Solution: Partial immersion

is a technique in which students are early on and repeatedly exposed to a new language. Content is provided in both the old and the new language.
Quality Control

Quality indicators
- drop-out rate
- PhD scholarships awarded
- ...

Student feedback
- qualitative focus group discussions
- quantitative survey