Lecture plan for "Statistics"

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Content and objectives

Research methods are our essential tools as social scientists. Our methodological capabilities help us address real world questions in a systematical and valid way.

This course focuses on the quantitative part of the universe of research methods for social scientists. The course aims to prepare students to conduct quantitative data analysis and to critically approach phenomena as researchers. The focus is on the capacity to conduct independent analyses using different types of data material, to interpret their results, and to understand and evaluate the assumptions on which the analyses rest.

The course consists of lectures, workshops, and exercises. The lectures will have a teacher driven review of a focused part of the theoretical course contents.

The workshops and exercises will focus on applying the methods from the curriculum and the contents from the lectures to solve data analytical problems. In addition to a focus on understanding and interpreting statistical methods, a key element will be the introduction to the statistical softwares R and RStudio.

Since the purpose of the exercises is to facilitate that the students apply the methods to real data problems, a high degree of student involvement is expected. The exercise teachers will assist students in applying the methods and direct discussions and interpretations of results.

Students are required to hand in two mandatory homework assignments. These can be up to five pages and answered in groups of up to five students. There will be no supervision on the homework assignments and feedback will be provided on a general basis to all students.

Fulfillment of the learning objectives of the course will make the students able to evaluate an appropriately formulated research questions in for example a Bachelor's thesis; to design research strategies to address them and to appropriate statistical methods.

Learning objectives

To achieve the grade 12, students should meet the following learning objectives with no or only minor mistakes or shortcomings:

- Formulate appropriate research questions to be investigated with statistical methods from the social sciences

•Identify and delimit a given statistical problem including identification of necessary and sufficient information to perform a relevant statistical analysis.

• Perform basic data manipulations with a given data material using statistical software and use graphical and numerical methods to summarize the most important results using statistical software.

• Justify with theory the use of a given statistical method and evaluate the strengths and weaknesses of this compared to other methods.

• Demonstrate an understanding of the basics of probability and use these to quantify the uncertainty that exist in a given data analysis.

• Independently conclude based on a given statistical analysis, critically reflect on the validity and reliability of the results, and communicate these in a clear, correct, and non-technical language.

Description of the teaching methods

The course has a mix of lectures, class based teaching, and workshops. Students are expected to take active part in both lectures, exercises, and workshops. Especially the exercises and workshops will be centered around student involvement.

Students are expected to bring a laptop to the exercises. The students should download and install the free softwares R and RStudio.

Students will be introduced to the open source softwares R and RStudio mainly in workshops and exercises. These softwares will also be available for the exam. If students prefer, they are free to rely on other softwares, but there will be no course based support or resources for any alternative softwares, and it will also be the students individual responsibility that the software they choose will be available for the exam.

Feedback during the teaching period

There will be class-based teacher-facilitated feedback on selected exercise problems in exercise classes and workshop and general lecture-based feedback on the mandatory homework assignments.

Mandatory homework assignments

In addition to the weekly exercises there will be two mandatory homework assignments. The problem sets will be published approximately 20 days prior to their deadlines. For students who fail to hand in or pass one of the first two pieces of homework, there will be a third homework assignment.

Student workload

Lectures 26 hours

Exercises 26 hours

Exam 4 hours

Preparation and homework 150 hours

Teaching team

The teaching team consist of Francesco Gerli (FG), who will conduct 60% of the lectures and who is the course coordinator together with Clement Brebion (CB) Clement will conduct the remaining lectures and the exercises classes.

Workshops will be shared among Clement and Alexander Gamerdinger (AG) who will also conduct the lecture on Forecasting.

Further Information

The course runs in Autumn 2022. For the official course description visit:
https://kursuskatalog.cbs.dk/admin/2022/2023/courseview/BA-BEBUO1010U

Lecture Plan

Week	Title	Content	Readings
36	Introduction	Lecture (FG): Introduction to the course, R and the tools	*Imai Chap.1*
		Classes (CB): Exercise Set 1. No Workshop	
37	Causality	Lecture (FG): Causal effects, counter-factuals, experiments and quasi experiments, RCTs	Imai: 2.1 -2.5; Wantchekon (2003)
		Classes and workshop (CB/AG): Exercise Set 2	
38	The Descriptive Statistics	Lecture(FG): Mean, median, mode, IQR, variance, standard deviation	Imai 2.6-2.7; Oakshott 88-108; 114,115
		Classes and workshop (CB/AG): Exercise Set 3	
39	Measurement 1	Lecture (FG): Surveys, sampling, variable types, visualizations of univariate distributions	Imai 3.1-3.4; Agresti & Finlay ch. 2&3
		Classes and workshop (CB/AG): Exercise Set 4	
40	Measurement 2	Lecture(FG): Bivariate relationships and clustering	Imai 3.6-3.8
		Classes and workshops (CB/AG): Exercise Set 5	
41	Prediction 1	Prediction and linear regression	Imai 4.1, 4.2.
		Classes and workshop (CB/AG): Work on Homework 1	

42	AUTUMN BREAK 😊		
43	Prediction 2	Lecture (FG): Regression and Causation	Imai 4.3; Wantchekon (2003)
		Classes and workshop (CB/AG): Exercise Set 6	
44	Prediction 3	Lecture (FG): Heterogeneous effects and non-linear relationships	Imai 6.1, 6.2. Suggested: Angrist and Pischke:3.3.
		Classes and Workshop (CB/AG): Exercise Set 7	
45	Probability	Lecture (CB): Basic probability, random variables, probability distributions,large sample theorems.	Imai 6.1-6-5.
		Classes and workshop (CB/AG): Work on Homework 2	
46	Uncertainty 1	Lecture (CB): Estimation, standard errors, confidence intervals, hypothesis testing, one-sample-t-test	Imai 7.1-7.2.
		Classes and workshop (CB/AG): Exercise set 8.	
47	Uncertainty 2	Lecture (CB): Two-sample test, linear regression with uncertainty, pitfalls of significance testing	Imai 7.3; 7.4.
		Classes and workshop (CB/AG): Exercise Set 9	
48	Forecasting	Lecture (AG): Introduction to forecasting models, homework 2 feedback	Oakshott 321-338, 342-343.
		Classes and workshop (CB/AG): Exercise set 10	
49	Exam prep	Lecture (CB): Course Recap and Q&A.	-
		Classes and workshop (CB/AG): 2020/2021 Exam Set	Hand in of homework 3

Curriculum

• Core reading (students should acquire this from Academic Books or elsewhere):

– Imai, Kosuke 2017. Quantitative social science: an introduction. Princeton University Press.

• Book excerpt (will be made available on Learn):

– Oakshott, Les, 2016. Essential quantitative methods for business, management and finance. Palgrave Macmillan International Higher Education. pp. 88-108, 114-115, 321-338, 342-343.

– Agresti, Alan and Barbara Finlay, 2015. Statistical Methods for the Social Sciences. PearsonEducation Limited, Fourth Edition. pp. 31-72.

Journal articles:

Wantchekon, L. (2003). Clientelism and voting behavior: Evidence from a field experiment in Benin. World politics, 55(3), 399-422.

Suggested readings

• Books:

– Oakshott, Les, 2016. Essential quantitative methods for business, management and finance.Palgrave Macmillan International Higher Education.

– Wooldridge, Jeffrey M., 2015 Introductory econometrics: A modern approach. Nelson Education.

– Alan Gerber and Donald Green, 2012. Field Experiments. W. W. Norton & Company.

– **Joshua Angrist & Jorn-Steffen Pischke, 2008. Mostly harmless econometrics: An empiricist's companion. Princeton University Press.**

• Journal articles:

– Bertrand, Marianne, and Sendhil Mullainathan. "Are Emily and Brendan more employable than Latoya and Tyrone? Evidence on racial discrimination in the labor market from a large randomized experiment."American Economic Review 94.4 (2004): 991-1013

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