האוניברסיטה העברית בירושלים
THE HEBREW UNIVERSITY OF JERUSALEM

The Hebrew University of Jerusalem

Syllabus

Statistics for Graduate Students: From t Tests to Mixed-Effect Models - 51735

Last update 28-08-2022

HU Credits: *4*

Degree/Cycle: *2nd degree (Master)*

Responsible Department: *Psychology*

Academic year: *0*

Semester: *1st Semester*

Teaching Languages: *English*

Campus: *Mt. Scopus*

Course/Module Coordinator: *Noam Siegelman*

Coordinator Email: *noam.siegelman@mail.huji.ac.il*

Coordinator Office Hours: *Thursday 4-5pm (by appointment)*

Teaching Staff:
Dr. Noam Siegelman,
Mr. Gal Chen

Course/Module description:
This is the basic statistics course for research graduate students (M.A. and PhD). The course will review the principles behind frequentist statistics and tools that are derived from this paradigm. We will learn in depth the rationale (as well as the limitations) of both basic (e.g., t-tests, ANOVAs) and more advanced (e.g., multiple regression, mixed-effect models) statistical tests. In all cases we will focus on understanding general principles for appropriate use of tools based on frequentist statistics, the limitations of this paradigm, and additional tools that can complement some of these shortcomings.

In parallel, we will learn how to implement the statistical tests in R, and how to use R to understand more deeply the principles behind the methods learned in class (e.g., by running simulations). R programming will be learned gradually and in a hands-on format, to allow students from various background to successfully acquire necessary skills.

Please note: There will be an extra meeting two weeks after the end of the semester at the time of the lecture, on February 7th, 2023.

Course/Module aims:
The methods learned in class will be a toolbox for students in their future research. Students will understand the principles underlying the learned methods and frequentist statistics more broadly. This understanding will enable them to further acquire statistical tools based on the frequentist paradigm as well as tools based on other approaches (including Bayesian statistics).

Learning outcomes - On successful completion of this module, students should be able to:
Understand the principles behind tests based on frequentist statistics.

Implement a variety of basic and advanced statistical tests, to be used in their future research work.

Use R for data analysis in their future research.

Understand the general linear model and how different statistical tests are derived from it.

Follow contemporary discussions regarding common failures in data analysis (and how to avoid them).

Further acquire advanced methods by themselves and in future courses.

Attendance requirements(%):

Teaching arrangement and method of instruction:

Course/Module Content:

1. Basic statistical tests:
1.1 Z and t-tests.
1.2 Analysis of Variance (ANOVA; between- and within-subject; one- and multiple-way).
1.3 Correlation and simple regression.

2. Advanced statistical tests:
2.1 Multiple regression (including: control variables; coding of categorical variables; centering and interactions; collinearity; transformations of independent variables; logistic models).
2.2 Mixed-effect models (including: fixed vs. random effects; significance and model comparison; categorical dependent variables; determining random effect structure).

3. General topics:
3.1 Using R for data analysis.
3.2 Common failures in data analysis (and how to avoid them).
3.3 Appropriate determination of sample size.
3.4 Confidence intervals and effect size estimates for learned statistical tests.
3.5 Simulations.

Required Reading:

In preparation for some meetings, students will be asked to read papers. Partial list below.

Open Science Collaboration. (2015). Estimating the reproducibility of psychological science. Science.
Cumming, G. (2014). The new statistics: Why and how. Psychological science, 25(1), 7-29.

Ioannidis, J. P. (2005). Why most published research findings are false. PLoS medicine, 2(8), e124.
Simmons, J. P., Nelson, L. D., & Simonsohn, U. (2011). False-positive psychology: undisclosed flexibility in data collection and analysis allows presenting anything as significant. Psychological Science.
Jaeger, T. F. (2008). Categorical data analysis: Away from ANOVAs (transformation or not) and towards logit mixed models. Journal of memory and language, 59(4), 434-446.
Barr, D. J., Levy, R., Scheepers, C., & Tily, H. J. (2013). Random effects structure for confirmatory hypothesis testing: Keep it maximal. Journal of memory and language, 68(3), 255-278.
Matuschek, H., Kliegl, R., Vasishth, S., Baayen, H., & Bates, D. (2017). Balancing Type I error and power in linear mixed models. Journal of memory and language, 94, 305-315.

Additional Reading Material:

Course/Module evaluation:
End of year written/oral examination 0 %
Presentation 10 %
Participation in Tutorials 0 %
Project work 0 %
Assignments 30 %
Reports 0 %
Research project 0 %
Quizzes 0 %
Other 60 %
Final assignment

Additional information: