Friday: Periods 2-4
Instructor: Prof. Badredine Arfi
Office: Zoom
Phone: (352) 273 2357.
email: barfi@ufl.edu
Wednesday 2:00-4:00pm.

Course Description and Objectives

This course is designed to cover advanced statistical topics for graduate students in social sciences as well as other disciplines. The course specifically deals with various topics in what is broadly known as multilevel models covering multilevel generalized linear models, structural equation models, Latent variable models, and Bayesian hierarchical models as well as time-series analysis.

The main goal of the course is to lead the students in acquiring a good and working knowledge of how the statistical analysis of data is conducted using multilevel statistical models. The course specifically offers an understanding of how such models work under various conditions. The course also concentrates on studying some of the potential drawbacks and limitations and how we can overcome them. However, due to time constraints, the course must selectively dwell on a limited number of specific models and modifications thereof.

The expectation is that by the end of the semester, three goals should have been achieved:

(1) students should have improved their already acquired statistical skills in analysing and critically evaluating the quantitative professional literature using multilevel models.
(2) students should be able to design and carry out statistical projects that employ multilevel modelling techniques for testing substantive theories.
(3) students should become better equipped to explore and study more advanced statistical models and techniques in future projects.

Therefore, the course is a hands-on learning experience, organized every week in two parts. The first part will consist of a presentation and discussion of the major theoretical notions and approaches of the course. The second part will consist of a **collective** learning through direct group discussion and practice of the ways on how to use the python language to analyse multilevel data. Students are required to attend classes and are required to come prepared to pro-actively participate in the discussion and practice.

Requirements and Assessments

The requirement for this course is simple: work diligently and persistently. This includes attending classes, being actively involved in the class discussions, and working

regularly on homework sets and a research paper. Each student should expect to be spending many hours learning how to excel in using the python language techniques and packages to estimate the models discussed in class.

There will be a number of homework assignments that the students must complete and turn in canvas. The homework assignments are weekly assigned by the instructor when appropriate to the flow of the discussion in the lectures and are due on specified dates. Not submitting the homeworks on time defeats their training purpose.

There will also be a final take-home exam, the specifics of which will be discussed in class. Roughly speaking, it will consist in answering a number of questions by analyzing an original dataset that will be provided to you with the questions.

A major component of the course assessment will be a research paper. Each student is expected to produce a manuscript of high quality using an appropriate modelling strategy. I will work closely with the students on their projects.

Distribution of grades

10%: **Weekly homework exercises**. All assignments are to be uploaded to canvas before the beginning of class on their respective due dates. The problem sets will be assigned at the end of the lectures depending on what we cover in the lecture sessions. Every homework is to be submitted as a working python jupyter notebook as will be explained in the first day of classes.

35%: **Take-Home Final Examination**
The final exam is a 24-hour take-home - it is a closed-book, closed-computer (except for seeking help with python), closed-anything-including-human-beings (physical or virtual) exam.

45%: **A Research Paper**
Each student is required to choose in consultation with the instructor (see down below) a topic to be analyzed using an MLM methodology. The goal is to produce a high-quality, potentially publishable manuscript, using a model (or models) discussed in the course.

10%: **Paper Presentation**.
Each student will present his/her paper at the end of the semester. The presentation will consist of a ppt presentation for about 10 minutes followed by 5 minutes of Q & A.

Note: Information on UF's grading policies is posted at
   http://www.registrar.ufl.edu/catalog/policies/regulationgrades.html

Recommended Statistical Texts

1. Edward W. Frees. 2004. Longitudinal and Panel Data Analysis and Applications in the Social Sciences. Cambridge University Press.
2. Harvey Goldstein. 2011. Multilevel Statistical Models. 4th Edition. Wiley.
3. Randall E. Schumacker and Richard G. Lomax. 2016. A Beginner's Guide to Structural Equation Modeling. 4th Edition. Routledge.
4. J. Christopher Westland. 2019. Structural Equation Models: From Paths to Networks. 2nd Edition. Springer

Software Requirement

All models covered in this class will be estimated using the python language, using several relevant packages.

Specifics on the Research Paper

In order for the instructor to provide adequate and timely feedback in the preparation of this paper, you will be required to turn in various brief intermediate papers throughout the semester. The students have one of two options:

1. **For students who are ALREADY writing their dissertations**:
   A student can opt to fulfill this requirement by carrying out a statistical analysis that falls within his/her dissertation using a multilevel-models approach. This will be done in close consultation with the instructor. The completed paper will ultimately consist in writing one paper/chapter of the dissertation. The same deadlines as stipulated in the following apply to this option for fulfilling the research paper requirement.

2. **For students who are not yet in the stage of writing their dissertations**:
   Each student must:

   - Find a topic from your discipline/field. Having done that the next task is to find a dataset (your own, online, or from an already published book/paper). You must therefore choose a topic from which you can obtain a dataset. \
   Due Date: January 27th – one-page summary of the chosen paper/topic and about the location of the dataset as well as description of why the dataset is appropriate to the research question.

3. Clean the data and prepare it for the multilevel analysis.
   Due Date: February 17th – one-page report and a jupyter notebook showing all the steps.

4. Begin the analysis.
   Due Date: March 24th – submit a multiple-page report and a jupyter notebook showing the analyses done so far.

5. The final product should be about **15-20 pages long**, including the bibliography.
   Due Date: April 21st. Plus a working complete jupyter notebook covering all the work from beginning to end.

6. **Prepare a ppt presentation** at the date and time TBD.

Topic	Theme
1	Introduction to the Multilevel Models and Data Structures
2	The Basic Two-Level Regression Model
3	Three-Level Models and More Complex Hierarchical Structures
4	Multilevel Generalized Linear Models for Dichotomous Data and Proportions
5	Multilevel Generalized Linear Models for Categorical and Count Data
6	Longitudinal Panel Data Analysis using Multilevel Models
7	Time-Series Analysis
8	SEM (Structural Equation Models) Basics
9	Latent Models and Factor Analysis — Basics and Second-Order
10	Latent Growth Models
11	Multilevel Survival Models
12	Bayesian Multilevel Models

Note: This is not written in stones as we might need to shuffle topics around if need be.

- Incomplete grades may be granted under very special circumstances as supported by valid official documentation (in accordance with the university regulations). Any student seeking such accommodation must request it prior to the deadline for the specific assignment.

- Retroactive extensions/incompletes will not be granted under any circumstances.

- The instructor reserves the right to change any part or aspect of this document should a need for doing so emerge at any point in time during the semester.

- Online course evaluation process: Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available from the Gatorevals website. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via the evaluation system. Summaries of course evaluation results are available to students at the public results website.

- Per university rules there is a zero-percent tolerance on cheating, plagiarism, bribery, misrepresentation, conspiracy, fabrication (see university definitions down below).

- The Writing Studio (352-846-1138) can assist UF students with academic writing through one-on-one consultations either in person or online. Consultations can be scheduled through their website. English language learners   can request general writing help or can get help with a specific assignment. are available for students who cannot visit the Writing Studio in person.

UF Policies:

- **University Policy on Accommodating Students with Disabilities**: Students with disabilities requesting accommodations should first register with the UF Disability Resource Center (352.392.8565) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodations. Students with disabilities should follow this procedure as early as possible in the semester.

- **Workload**: As a Carnegie I, research-intensive university, UF is required by federal law to assign at least 2 hours of work outside of class for every contact hour. Work done in these hours may include reading/viewing assigned material and doing explicitly assigned individual or group work, as well as reviewing notes from class, synthesizing information in advance of exams or papers, and other self-determined study tasks.

- **Statement Regarding Course Recording**: As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

- **UF policy on the student computer requirement**: Access to and on-going use of a computer is required for all students. The University of Florida expects each student

entering a UF Online program, to acquire computer hardware and software appropriate to his or her degree program. Competency in the basic use of a computer is required. Course work will require use of a computer and a broadband connection to the internet, academic advising and registration can be done by computer, official university correspondence is often sent via e-mail and other services are provided that require access through the Internet. While the university offers limited access to computer software through its virtual computer lab and software licensing office, most students will be expected to purchase or lease a computer. The cost of meeting this requirement may be included in financial aid considerations.

- **University Policy on Academic Misconduct**: Academic honesty and integrity are fundamental values of the University community. Students should be sure that they understand the UF Student Honor Code at http://www.dso.ufl.edu/students.php.

Legal Definitions

(a) **Cheating** – The improper taking or tendering of any information or material which shall be used to determine academic credit. Taking of information includes, but is not limited to, copying graded homework assignments from another student; working together with another individual(s) on a take-home test or homework when not specifically permitted by the teacher; looking or attempting to look at another student's paper during an examination; looking or attempting to look at text or notes during an examination when not permitted. Tendering of information includes, but is not limited to, giving your work to another student to be used or copied; giving someone answers to exam questions either when the exam is being given or after having taken an exam; giving or selling a term paper or other written materials to another student; sharing information on a graded assignment.

(b) **Plagiarism** – The attempt to and/or act of representing the work of another as the product of one's own thought, whether the other's work is published or unpublished, or simply the work of a fellow student. Plagiarism includes, but is not limited to, quoting oral or written materials without citation on an exam, term paper, homework, or other written materials or oral presentations for an academic requirement; submitting a paper which was purchased from a term paper service as your own work; submitting anyone else's paper as your own work.

(c) **Bribery** – The offering, giving, receiving or soliciting of any materials, items or services of value to gain academic advantage for yourself or another.

(d) **Misrepresentation** – Any act or omission of information to deceive a teacher for academic advantage. Misrepresentation includes using computer programs generated by another and handing it in as your own work unless expressly allowed by the teacher; lying to a teacher to increase your grade; lying or misrepresenting facts when confronted with an allegation of academic dishonesty.

(e) **Conspiracy** – The planning or acting with one or more persons to commit any form of academic dishonesty to gain academic advantage for yourself or another.

(f) **Fabrication** – The use of invented or fabricated information, or the falsification of research or other findings with the intent to deceive for academic or professional advantage.

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University Police
The UF police are together for a safe campus. 392-1111 (or 9-1-1 for emergencies) http://www.police.ufl.edu/.

Career Connections Center
Career Connections Center (352-392-1601 | CareerCenterMarketing@ufsa.ufl.edu) connects job seekers with employers and offers guidance to enrich your collegiate experience and prepare you for life after graduation.

Counseling and Wellness Center
Counseling and Wellness Center (352-392-1575) provides counseling and support as well as crisis and wellness services including a variety of workshops throughout the semester (e.g., Yappy Hour, Relaxation and Resilience).

Dean of Students Office
Dean of Students Office (352-392-1261) provides a variety of services to students and families, including Field and Fork (UF's food pantry) and New Student and Family programs

Multicultural and Diversity Affairs
Multicultural and Diversity Affairs (352-294-7850) celebrates and empowers diverse communities and advocates for an inclusive campus.

Office of Student Veteran Services
Office of Student Veteran Services (352-294-2948 | vacounselor@ufl.edu) assists student military veterans with access to benefits.

ONE.UF
ONE.UF is the home of all the student self-service applications, including access to:
- Advising
- Bursar (352-392-0181)
- Financial Aid (352-392-1275)
- Registrar (352-392-1374)

Official Sources of Rules and Regulations
The official source of rules and regulations for UF students is the Undergraduate Catalog and Graduate Catalog. Quick links to other information have also been provided below.
- Student Handbook
- Student Responsibilities, including academic honesty and student conduct code
- e-Learning Supported Services Policies includes links to relevant policies including Acceptable Use, Privacy, and many more
- Accessibility, including the Electronic Information Technology Accessibility Policy and ADA Compliance
- Student Computing Requirements, including minimum and recommended technology requirements and competencies