American University of Beirut
Faculty of Health Sciences
EPHD 410
Applied Multivariate and Longitudinal Methods in Health Sciences
3 credits
Spring 2022
Course Syllabus

This course is offered for PhD Epidemiology and PhD Nursing.

Course Director

Name : Dr. Miran A. Jaffa, Ph.D.
Office : 214 Van Dyck
Office Hours : Wednesdays and Friday after class or by appointment
Email : ms148@aub.edu.lb
Extension : 4603

Meetings Times

Lecture: -- 2 Hrs
Lab: -- 2 Hrs

Wednesdays and **Fridays** from **1:30pm-3:30am** starting **Wednesday January 26th**. The course will **end on Friday April 29th**.

The **lectures will take place Van-Dyck room 224** while the **lab sessions will take place in Van-Dyck Computer lab room 105**

Course Material

Lecture notes : Will be provided by the instructors via AUB Moodle
Reference : Applied Multivariate Statistical Analysis, fifth edition, Richard A. Johnson, and Dean W. Wichern

Course Format

Weekly lectures and training sessions whereby concepts covered in each lecture are repeated and reinforced through Lab sessions carried out in the computer lab on STATA. Material retention and mastering of the course LOs are assessed through the 3 midterm tests.

Course Description: (3 credits)

Data are often complicated by high dimensionality and inter-observation correlations. This course aims at providing a solid grounding in the analysis of multivariate data, and longitudinal data. Specifically students will learn to (1) identify correlated data in specific multivariate, longitudinal and repeated measures data, (2) distinguish between univariate and multivariate outcomes, (3) carry out group comparison for multivariate outcomes using paired and independent multivariate analysis, and One-Way MANOVA tests, (4) conduct Profile analysis and repeated measures ANOVA, (5) carry out Multivariate regression, (6) Handle missing data in multivariate normal, (7) conduct analysis of longitudinal normally distributed outcomes using Mixed models and Generalized estimating equations, (8) conduct analysis for binary longitudinal data, 9) analyze repeated measured. STATA will be used in this course as statistical packages.

Course requirements and student evaluation:

Prerequisites: This is an advanced data analysis course that requires as prerequisites the Basic Biostatistics course (EPH310), and knowledge of Analysis of Categorical and Continuous Data. Prior knowledge of matrix and variance-covariance matrix is a bonus. Otherwise, approval from the course director is needed.

Attendance:
Attendance is mandatory.

Student Evaluation:
Assessment of the Course LOs: Each LO is assessed through 2 individual graded midterm tests that include, in addition to the 2 midterm exams, presentations of a published article in the week of midterm 1 and the week of midterm 2.

Topics:

Main topics to be highlighted in this course:

- Introduction to Multivariate and longitudinal data
- Two sample multivariate test using multivariate Hotelling's test and simultaneous confidence intervals.
- One-Way MANOVA using Wilks' Lambda and Hotelling-Lawley Trace Test.
- Profile analysis and repeated one way ANOVA with distinction between the different variance-covariance matrices.
- Missing data using mixed models
- Multivariate multiple regression and Wilks' Lambda test and other multivariate tests, and MANOVA for multivariate testing of the covariate effect.

- Longitudinal Analysis for Continuous Normally distributed Outcome and different specifications for the variance-covariance matrix using both Mixed models and Generalized Estimating Equations (GEE).
- Longitudinal Analysis for Binary Outcome and different specifications for the variance-covariance matrix.
- Analysis of Repeated Measures for Continuous and Binary data.

Course Learning Objectives:

At the end of this course students are expected to be able to:

LO1. Distinguish between univariate and multivariate outcomes.
LO2. Distinguish between correlated and independent observations.
LO3. Apply the appropriate test for the difference in means between different groups for multivariate outcomes.
LO4. Conduct the appropriate analysis for multivariate data.
LO5. Carry out the appropriate analysis for longitudinal and repeated measure data.
LO6. Report and interpret statistical results.
LO7. Utilize STATA package to conduct relevant statistical analysis.
LO8. Critically appraise the statistical aspects of published health related literature entailing multivariate, repeated measures and longitudinal data.
LO9. Generate estimates under missing data.

PhD Epidemiology Competencies addressed in this course
Program Competency 9 (PC9): Use advanced statistical methods to analyze data generated from different epidemiological study designs. (LO1-LO7)
Program Competency 11 (PC11): Interpret and evaluate original or published results. (LO8)

Academic Integrity/Dishonesty:

Cheating and plagiarism will not be tolerated. Review the Student Code of Conduct in your handbook and familiarize yourself with definitions and penalties. If you're in doubt about what constitutes plagiarism, ask your instructor because it is your responsibility to know. The American University of Beirut has a strict anti-cheating policy. Penalties include failing marks on the assignment in question, suspension or expulsion from University and a permanent mention of the disciplinary action in the student's records.

Class Rules and Regulations:

- In class participation and attendance are recommended.
- Every student is expected to be on time before the class starts.
- Questions and clarifications are always welcomed.
- Side conversation and class disruption are intolerable.
- Positive and professional attitude is expected and is a must.
- Course material (slides, datasets, STATA handouts, exams questions, and exams datasets) cannot be circulated and shared with any other student or any other person.

Tentative Grading Subject to change:

Attendance, participation and attitude: 5%

Midterm 1: 45% (Lectures 1-5 and individual presentation of a published article of student's choice relevant to the topics covered in midterm 1).
Midterm 1 covers LOs 1-4, and LOs 6-9.

Midterm 2: 50% (Lectures 6-10 and individual presentation of a published article of student's choice relevant to the topics covered in midterm 2).
Midterm 2 covers LOs 5-8.

Lectures and tentative schedule subject to change due to unaccounted for holidays:

Wed Jan 26, and Friday Jan 28: Syllabus and Lecture 1 Analysis of Multivariate Paired Two Samples. Covering LOs 1, 3, 6, 7, and 8.

Wed Feb 2 and Friday Feb 4: Lecture 2 Analysis of Multivariate Independent Two Samples. Covering LOs 3, 6, 7, and 8.

Wed Feb 9 official holiday no class will be held

Friday Feb 11 and Wed Feb 16: Lecture 3 Hypothesis Testing for G Independent Groups with Multivariate outcomes MANOVA. Covering LOs 3, 6, 7, and 8.

Friday Feb 18 and Wed Feb 23: Lecture 4 Multivariate Regression. Covering LOs 4, 6, 7, and 8.

Friday Feb 25 and Wed Mar 2: Lecture 5 Missing Data in Multivariate Normal. Covering LOs 7 and 9.

Friday Mar 4 no class will be held to give you time to study and prepare for Midterm 1.

Wed Mar 9 and Friday Mar 1: Midterm 1 (lectures 1 to 5 + Presentations) LOs 1-4, and LOs 6-9.

Wed Mar 16 and Friday Mar 18: Lecture 6 Profile Analysis and Repeated Measures ANOVA for the Analysis of Longitudinal Data. LO2, LOs 5, 6, 7 and 8.

Wed Mar 23 and Wed Mar 30: Lecture 7 Longitudinal Data Analysis for continuous and normally distributed outcome using mixed models and discussion of the different Correlation Matrix Structures. Covering LO2, and LOs 5, 6, 7, and 8.

Wed March 25: Official Holiday no class

Friday April 1and Wed April 6: Lecture 8 Longitudinal Data Analysis for continuous and normally distributed outcome using GEE (and revision of Correlation Matrix Structures). Covering LO2, and LOs 5, 6, 7, and 8.

Friday April 8 and Wed April 13: Lecture 9 Longitudinal Data Analysis for Binary Outcome using GEE. Covering LO2, and LOs 5, 6, 7, and 8.

Friday April 15: Official Holiday no class will be held.

Wed April 20: Lecture 10 Analysis of Repeated Measures Continuous and Binary. Covering LO2, and LOs 5, 6, 7, and 8.

Friday April 22: Official Holiday no class will be held.

Wed April 27 and April 29: Midterm 2 (lectures 6 to 10 + Presentations) LOs 5-8, and LOs 6-9.

Students with Disabilities:
AUB strives to make learning experiences as accessible as possible. If you anticipate or experience academic barriers due to a disability (including mental health, chronic or temporary medical conditions), please inform me immediately so that we can privately discuss options. In order to help establish reasonable accommodations and facilitate a smooth accommodations process, you are encouraged to contact the Accessible Education Office: accessibility@aub.edu.lb; +961-1-350000, x3246; West Hall, 314

Non-Discrimination – Title IX – AUB
AUB is committed to facilitating a campus free of all forms of discrimination including sex/gender-based harassment prohibited by Title IX. The University's non-discrimination policy applies to, and protects, all students, faculty, and staff. If you think you have experienced discrimination or harassment, including sexual misconduct, we encourage you to tell someone promptly. If you speak to a faculty or staff member about an issue such as harassment, sexual violence, or discrimination, the information will be kept as private as possible, however, faculty and designated staff are required to bring it to the attention of the University's Title IX Coordinator. Faculty can refer you to fully confidential resources, and you can find information and contacts at www.aub.edu.lb/titleix. **To report an incident**, contact the University's Title IX Coordinator Trudi Hodges at 01-350000 ext. 2514, or titleix@aub.edu.lb. An anonymous report may be submitted online via EthicsPoint at www.aub.ethicspoint.com