HUDM 6122 – **Multivariate Analysis I**
Spring 2023
Mondays & Wednesdays 1:00-2:40pm

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Course Description
An introduction to some of the most common methods for the analysis of multivariate data. The course begins with a review/introduction to basic concepts from matrix algebra and a discussion of the properties of the multivariate normal distribution. The class then discusses methods for comparing groups on several variables; methods for testing for differences of means and covariances will be introduced. Discriminant analysis and classification analysis methods are then introduced. The course then moves on to a discussion of principal components analysis and factor analysis. Multiple regression is briefly reviewed and multivariate regression and canonical correlation are briefly introduced. The course concludes with a brief introduction to the ideas of structural equation modeling.

Prerequisites: HUDM 5122–Applied Regression Analysis. Basically any course of applied regression analysis is sufficient. Understanding of linear algebra, dummy variables, F-tests, and the logic of hypothesis testing are all important.

Required Textbook:
An Introduction to Applied Multivariate Analysis with R (2011), by Brian Everitt & Torsten Hothorn, Springer. The book is available online through the Columbia Libraries Website.

Other Good Textbooks:
Methods of Multivariate Analysis (2012), Third Edition, by Alvin C. Rencher & Wiliam F. Christensen, Wiley. Book available online through the Columbia Libraries Website.

Applied Multivariate Statistical Analysis. by Johnson and Wichern. Prentice-Hall.

Multivariate Analysis, by Mardia, Kent, and Bibby. Academic Press.

Course Outline

I. Introduction to the course
II. Review/introduction to matrix notation
III. Summaries of multivariate populations and samples
IV. The Multivariate Normal Distributions
V. Principal components analysis
VI. Exploratory factor analysis
VII. Confirmatory factor analysis
VIII. MIDTERM: Review on 3/6, Exam on 3/8
IX. Spring Break; 3/12-3/19.
X. Discriminant Analysis
XI. Multivariate Regression & Canonical correlation
XII. Multidimensional scaling
XIII. Intro to structural equation models
XIV. The Analysis of Repeated Measures Data
XV. FINAL PROJECT: Due 5/12.

Course Grading:

Your final grade is composed of the following:
• **Homeworks**: 40%
– We will go through a lab that helps you learn the method using R on an applied problem. Labs will be held almost every week during our Wednesday class meeting time.
– Weekly assignments will be handed out in class and posted on CANVAS. Students are expected to work independently on the homework assignments. No late assignments are allowed.

• **Midterm Exam**: 30% There will be one in-class exam given on March 8th.

• **Final Project**: 30%
There will be an applied final project that will be completed by teams of up to three students (you are also allowed to work alone or in pairs, if you prefer). Each team will select one applied multivariate data analysis problem to work on. Upon completion of the analysis, each team will write a brief 5-10 pages report on the findings. Think of the project as a "big" homework problem. The final project is due May 12th by 5:00pm.

Services for Students with Disabilities
The College will make reasonable accommodations for persons with documented disabilities. Students are encouraged to contact the Office of Access and Services for Individuals with Disabilities for information about registration (166 Thorndike Hall). Services are available only to students who are registered and submit appropriate documentation." As your instructor, I am happy to discuss specific needs with you as well.

IN Incomplete
The grade of Incomplete is to be assigned only when the course attendance requirement has been met but, for reasons satisfactory to the instructor, the granting of a final grade has been postponed because certain course assignments are outstanding. If the outstanding assignments are completed within one calendar year from the date of the close of term in which the grade of Incomplete was received and a final grade submitted, the final grade will be recorded on the permanent transcript, replacing the grade of Incomplete, with a transcript notation indicating the date that the grade of Incomplete was replaced by a final grade.

If the outstanding work is not completed within one calendar year from the date of the close of term in which the grade of Incomplete was received, the grade will remain as a permanent Incomplete on the transcript. In such instances, if the course is a required course or part of an approved program of study, students will be required to re-enroll in the course including repayment of all tuition and fee charges for the new registration and satisfactorily complete all course requirements. If the required course is not offered in subsequent terms, the student should speak with the faculty advisor or Program Coordinator about their options for fulfilling the degree requirement. Doctoral students with six or more credits with grades of Incomplete included on their program of study will not be allowed to sit for the certification exam.

Email
Teachers College students have the responsibility for activating the Columbia University Network ID (UNI) and a free TC Gmail account. As official communications from the College – e.g., information on graduation, announcements of closing due to severe storm, flu epidemic, transportation disruption, etc. – will be sent to the student's TC Gmail account, students are responsible for either reading email there, or, for utilizing the mail forwarding option to forward mail from their account to an email address which they will monitor.

Religious Holidays
It is the policy of Teachers College to respect its members' observance of their major religious holidays. Students should notify instructors at the beginning of the semester about their wishes to observe holidays on days when class sessions are scheduled.

Where academic scheduling conflicts prove unavoidable, no student will be penalized for absence due to religious reasons, and alternative means will be sought for satisfying the academic requirements involved. If a suitable arrangement cannot be worked out between the student and the instructor, students and instructors should consult the appropriate department chair or director. If an additional appeal is needed, it may be taken to the Provost.

Academic Integrity

Students who intentionally submit work either not their own or without clear attribution to the original source, fabricate data or other information, engage in cheating, or misrepresentation of academic records may be subject to charges. Sanctions may include dismissal from the college for violation of the TC principles of academic and professional integrity fundamental to the purpose of the College.

Sexual Harassment and Violence Reporting

Teachers College is committed to maintaining a safe environment for students. Because of this commitment and because of federal and state regulations, we must advise you that if you tell any of your instructors about sexual harassment or gender-based misconduct involving a member of the campus community, your instructor is required to report this information to the Title IX Coordinator, Janice Robinson. She will treat this information as private, but will need to follow up with you and possibly look into the matter. The Ombuds officer for Gender-Based Misconduct is a confidential resource available for students, staff and faculty. "Gender-based misconduct" includes sexual assault, stalking, sexual harassment, dating violence, domestic violence, sexual exploitation, and gender-based harassment. For more information, see http://sexualrespect.columbia.edu/gender-based-misconduct-policy-students

Emergency Plan

TC is prepared for a wide range of emergencies. After declaring an emergency situation, the President/Provost will provide the community with critical information on procedures and available assistance. If travel to campus is not feasible, instructors will facilitate academic continuity through Canvas and other technologies, if possible.

1. It is the student's responsibility to ensure that they are set to receive email notifications from TC and communications from their instructor at their TC email address.
2. Within the first two sessions for the course, students are expected to review and be prepared to follow the instructions stated in the emergency plan.
3. The plan may consist of downloading or obtaining all available readings for the course or the instructor may provide other instructions.