

STA 4702/5701
Multivariate Statistical Methods/Applied Multivariate Methods

Fall, 2022
MWF, 1.55-2.45 pm, TURLINGTON 2319

Catalog description:

Review of matrix theory, univariate normal, t, chi-squared and F distributions and multivariate normal distribution. Inference about multivariate means including Hotelling's T², multivariate analysis of variance, multivariate regression and multivariate repeated measures. Inference about covariance structure including principal components, factor analysis and canonical correlation. Multivariate classification techniques including discriminant and cluster analyses. Additional topics at the discretion of the instructor, time permitting.

Prerequisite: ([STA 3024](#) or [STA 4210](#) or [STA 4322](#) or STA 6127 or [STA 6167](#)) and ([MAS 3114](#) or [MAS 4105](#) or the equivalent).

Prerequisite for STA 5701: [STA 3024](#), STA 6127, [STA 6167](#), or 4211. Intended for graduate students not majoring in statistics.

Instructor: Dr. David Holmes

Email: david.holmes@ufl.edu

Office: FLO 220

Instructor Office Hours for this course: M 3.00-4.00, W 9.30-10.30, and by appointment.

Learning Outcomes: By the end of the course successful students should have achieved the following learning goals:

- (i) A clear understanding of the theoretical development of statistical techniques for analyzing large data sets.
- (ii) The selection of appropriate multivariate techniques in given contexts.
- (iii) The skills to apply multivariate statistical procedures to a wide variety of real-life problems.
- (iv) The practice of assessing the reasonableness of analytic results.
- (v) The ability to provide correct interpretations of results and to recommend appropriate decisions.
- (vi) The possession of strong computing skills and familiarity with statistical software.
- (vii) The possession of skills directed to the communication of statistical results to a variety of audiences

Part I: Course Requirements

Recommended (but not required) Textbooks:

Multivariate Statistical Methods: A Primer (Fourth Edition) by Bryan F. J. Manly and Jorge A. Navarro Alberto (CRC Press)

Essentials of Multivariate Data Analysis by Neil H. Spencer (CRC Press)

An Introduction to Applied Multivariate Analysis with R by Brian Everitt and Torsten Hothorn (Springer)

Fun reading: Flatland by Edwin A. Abbott

Academic Syllabus: The following topics will be covered:

- Matrices, eigenvalues and eigenvectors
- Hotelling's T^2
- Principal components analysis
- Factor analysis
- Cluster analysis, using a variety of metrics and clustering algorithms
- Discriminant analysis (two and three group analyses)
- Multi-dimensional scaling (classical and ordinal)
- Correspondence analysis
- Canonical Correlation analysis

Calculator: A calculator capable of basic arithmetic operations and taking square roots will be needed for in-class exams. (Internet-enabled electronic devices, such as cell phones or tablets, cannot be used as calculators during exams.)

Software: In this course, we will use statistical software to conduct analyses. I will be demonstrating concepts using SAS JMP Pro 16 throughout the semester. JMP Pro is available as a free download or as a UF App. Information on how to download this program is posted on our Canvas course page and is discussed during the first week of class. You are free to use either SAS JMP Pro or R to complete course assignments.

Please feel free to bring a laptop to class.

Course Assignments

Your final course grade will be based on exams and investigative tasks. Due dates are posted on the course schedule in Canvas and announced in class.

Investigative Tasks (IT's):

There will be three sets of investigative tasks and these tasks will be completed using statistical software. Answers must be supported and shown to the proper level of accuracy. Your attractively formatted documents are to be submitted on Canvas. Due dates for all IT's are posted on the Course Schedule on Canvas and you will be reminded of these. There will be a 10% penalty per day for late work and no IT's will be accepted more than two days after the due date.

You have a reasonable time after a graded IT is posted, to question a grade. If you do not notify me of any issues concerning your score within that "reasonable" time, then the posted grade stands.

Exams: There will be seven short (45 minutes) in-class exams during the course. All in-class exams are closed-book, closed-notes. No study guides are allowed since this course rarely involves formulae. Any formulae or statistical tables you might need will be supplied. You may use a calculator but not your computer or tablet. Cell phones must be turned off and put away during an exam (i.e. they cannot be used as clocks or calculators).

The dates for all seven exams are posted on the Course Schedule on Canvas and you will be reminded of these. In case of conflict or illness, if a student is unable to take an exam at the scheduled time, they must get in touch with the instructor prior to the exam time for any arrangements to be made for a makeup. Each case will be reviewed individually. Valid and detailed documentation is a prerequisite under such extenuating circumstances.

The same rule detailed above also stands for Exam scores.

Homework: There will be no graded homework, but at the end of most classes practice problems will be suggested and it is strongly advised that you try these problems. *We will learn by doing.* I will go over solutions in the following class.

There is ***no "extra credit" or forgiven grades*** – you are responsible for all your work done (or left undone). If an exam is scheduled on a religious holiday that you observe, see your instructor to make alternative arrangements.

* Incompletes are only assigned when extraordinary circumstances (such as an accident, or extended hospitalization), arising after the date for dropping the course, prevent the student from completing the course requirements. Having a failing grade in the course is not a valid reason for requesting an Incomplete. Information on Medical Withdrawal can be found at <https://umatter.ufl.edu/> . Information on how to Drop a class can be found in UF's Academic Catalog <https://catalog.ufl.edu/> and <https://catalog.ufl.edu/UGRD/academic-regulations/dropping-courses-withdrawals/>

If you have a disability that requires academic accommodation, contact the Disability Resource Center (DRC), <https://disability.ufl.edu/>. The DRC will provide documentation to the students who must then provide this documentation to the instructor when requesting information. You must submit this documentation prior to submitting any assignments for which you are requesting accommodation

Honor Code on Investigative Tasks

IT's are to be undertaken independently; all graded work is expected to be your original and independent work. It is not appropriate to: (1) give your work on the assignment to someone else to copy, (2) copy directly from someone else's solutions, or (3) use someone else's computer program or output, or a copy of someone else's computer session. ***You are responsible for making sure that there is no reason to doubt that the work you hand in is your own.***

As only your name appears on an assignment, my expectation and assumptions are that you have done the work yourself, fully and independently. Past sanctions that have been given for an Honor Code Violation on Investigative Tasks (for a student's first offense) include zero for the assignment, 10% reduction in the student's final grade, and an Academic Integrity Seminar. Stronger sanctions are given for a second offense. Even stronger sanctions are given for cheating on an exam. It will begin with an E in the course. Please do not cheat. At the end of the story, you are actually cheating yourself and those students working honestly.

I take the UF Honor Code very seriously and will enforce it. Please see the following website for more information. Please review the Student Honor Code and Student Conduct Code at sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code. The Honor Code will be enforced for all investigative tasks and exams.

Communication: The Canvas site for this course will be used to provide you with information relevant to the course. So, please check the Canvas course site regularly for updates. Such information includes announcements, lecture notes, IT Task assignments, reading assignments, non-graded homework and solutions, data sets, dates of exams, and any changes to posted office hours.

Study Approach: You are to read the lecture slides before class to familiarize yourself with the material and its organization. The lecture notes will be posted on Canvas. The best way to learn is to print out the notes before class, annotate them during the class, then study carefully the notes along with your annotations after the lecture to increase understanding.

Email policy: You must use your UF email account for all email correspondence having anything to do with your work at UF. Federal laws protecting your privacy rights require that we only communicate student information directly to students – and use of the university email system is our only way to validate your identity. You may forward your campus email elsewhere, but we can respond only to a UF email account.

Help: Remember to ask for help! In addition to my office hour, I can also answer some questions via email. *I will try to answer any student emails received during the working week within 24 hours, however emails received over the weekend may not be answered until Monday morning.*

Weighted Grading Scheme:

Investigative Tasks (three at 10% each) = 30%

Exams (seven at 10% each) = 70%

Course letter grades are assigned as follows and are not curved:

90 – 100 A

80 – 89 B

70-79 C

60 – 69 D

0 – 59 F

Pluses and minuses will be given but their point values will be determined after the last exam.

Part 2: University Services and Policies

Classroom Behavior: During class students should silence their cellular phones and refrain from eating, drinking, reading newspapers, doing homework, listening to music, excessive talking and all other behaviors that are distracting and disrespectful to the instructor and their fellow students.

Privacy Policy: Student records are confidential. Only information designated “UF directory information” may be released without your written consent. This applies to parents or anyone else who contacts me about your grades.

Faculty Course Evaluations: “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 at <https://gatorevals.aa.ufl.edu/students/>. 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 <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.”

U Matter, We Care: Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A night-time and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

***Sexual Assault Recovery Services (SARS): Student Health Center, 392-1161**

***University Police Department, 392-1111 (or 9-1-1 for emergencies),**

<http://www.police.ufl.edu>

***Student Health Care Center:** Call 352-392-1161 for 24/7 information to help you find the care you need or visit the Student Health Care Center website.

***GatorWell Health Promotion Services:** For prevention services focused on optimal wellbeing, including Wellness Coaching for Academic Success, visit the GatorWell website or call 352-273-4450.

Academic Resources

E-learning technical support: Contact the UF Computing Help Desk at 352-392-4357 or via e-mail at helpdesk@ufl.edu.

Writing Studio: 2215 Turlington Hall, 352-846-1138. Help brainstorming, formatting, and writing papers.

Student Complaints On-Campus: Visit the Student Honor Code and Student Conduct Code webpage for more information.

Covid Policy

In response to COVID-19, the following recommendations are in place to maintain your learning environment, to enhance the safety of our in-classroom interactions, and to further the health and safety of ourselves, our neighbors, and our loved ones.

- If you are not vaccinated, get vaccinated. Vaccines are readily available and have been demonstrated to be safe and effective against the COVID-19 virus. Visit one.ufl.edu for screening/testing and vaccination opportunities.
- If you are sick, stay home. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 to be evaluated.
- Course materials will be provided to you with an excused absence, and you will be given a reasonable amount of time to make up work.