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|  | STA4322.0001: Statistical Theory II *Department of Statistics and Data Science, College of Sciences*  Credit Hours: 3 |

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# Course Syllabus

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| Instructor: | Nathaniel Simone | Term: | Fall 2023 |
| Office Location: | Technology Commons II (TC2) 211B | Class Meeting Days: | Monday/Wednesday |
| Office Hours: | 3:00pm - 4:30pm Monday/Wednesday | Class Meeting Time: | 9:00am-10:20am |
| Phone: | Department Phone Number:  (407) 823-2289 | Class Location: | BA1 147 |
| Email: | [nathaniel.simone@ucf.edu](mailto:nathaniel.simone@ucf.edu) (include STA4322 in subject line) | Course Modality: | Face to Face (P) |
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## Course Description

Undergraduate Catalog Description: Conditional distributions, sums of random variables. Chebyshev's inequality, central limit theorem, method of moments, maximum likelihood, confidence intervals, hypothesis testing, two random variables transformations.

This course provides the theoretical framework for statistical inference. The course will cover topics such as the distribution of functions of random variables, which will lead to the concepts of sampling distributions and the Central Limit Theorem. Different estimation methods will be explored, as well as properties of point estimators. These properties lead to the study of confidence intervals and hypothesis testing. The mathematical background of linear regression and inference in linear regression will also be explored.

Time permitting, two other topics will be explored: categorical data analysis and Bayesian methods for inference. Categorical data is commonly used in many settings, such as clinical trials or epidemiological studies. Bayesian inference is another method of conducting standard inference testing, and this method of hypothesis testing has become increasingly more common.

Overall, this course provides a thorough introduction to mathematical statistics, and will prepare students for knowing the theoretical background of methods used in industry, as well as further studies in graduate school.

## Student Learning Outcomes

By the end of this course, students will be able to demonstrate across homework assignments, quizzes, and exams:

* Evaluate the distribution of functions of random variables using three different methods: method of distribution functions, method of transformations, method of moment-generating functions.
* Explain various sampling distributions, as well as perform calculations using these distributions.
* Explain the Central Limit Theorem (CLT) and perform calculations using the CLT.
* Describe the ways to evaluate point estimators and use formulas to numerically determine these evaluations.
* Calculate and interpret one-sided and two-sided confidence intervals.
* Determine if a statistic is consistent or sufficient.
* Use the method of moments and method of maximum likelihood to derive point estimates.
* Conduct hypothesis tests and interpret their results.
* Perform simple linear regression mathematically to determine the relationship between two variables.
* Conduct hypothesis tests in simple linear regression and multiple linear regression.
* (Time permitting) Conduct hypothesis tests, such as a goodness of fit test, on categorical data.
* (Time permitting) Compare frequentist methods and Bayesian methods for hypothesis testing.

This course relates to the following [Academic Learning Compacts](https://oeas.ucf.edu/about/academiclearningcompacts/) from the department of Statistics and Data Science:

* Students will demonstrate an understanding of probability and distribution theory.
* Students will identify and carry out statistical procedures such as regression analysis and analysis of variance.

## Course Materials and Resources

Required Text: Wackerly, D., Mendenhall, W. and Scheaffer, R.L. (2008). Mathematical Statistics with

Applications, 7th Edition. ISBN-13: 9780495110811. Thomson Learning Inc.

## Enrollment Requirements

Prerequisites: STA4321.

Recommended Prerequisites: MAS3105, for Chapter 11. If MAS3105 has not been taken, Appendix 1 in the textbook provides the necessary information from matrix and linear algebra.

## Course Expectations

Participation/Attendance

* Attendance and participation are expected from every student. Attendance will be measured by quizzes that can potentially be unannounced.
* Each class will contain in-class examples which the student is expected to follow along. Certain practice problems will also be solved, and students are expected to solve the practice problems and potentially share their solution with others or to the class.
* While in class, students should be respectful and turn their cell phones off and pay attention to the lecture. Students may be asked to leave if they are being disruptive to the rest of the class.

Other Expectations

* Each student should have access to Webcourses and check the site regularly for updates and announcements.
* Homework assignments are large are cover a wide span of topics, so students should work on the homework as each topic is discussed in class and not all at once before the assignments are due.
* Standard practice is 2 hours of studying per 1 in class, so for a 3-credit hour class, 6 hours of studying per week is expected. This class may require extra studying and 6-12 hours of work per week may be required.

### Important Dates

* Add/Drop/Swap Deadline – August 25th
* Labor Day (No classes) – September 4th
* Withdrawal Deadline – October 27th
* Thanksgiving Week (No classes) – November 22nd – 24th

### Exam Dates (Tentatively)

* Exam #1 – September 18th
* Exam #2 – October 18th
* Exam #3 – December 6th

### Pacing Schedule

The pacing schedule with tentative classes will be posted as an Excel document in Webcourses.

### Communication

While I usually respond faster, please allow a minimum of 24 business hours (Monday-Friday, 9am-5pm) for a response via email. Communication outside that timeframe is likely, though not guaranteed.

### Assignment Submission

* Homework assignments should be submitted online via Webcourses. The document submitted should be a word document or a pdf file. **Only 1 file should be submitted for the homework** (if you scan your homework, please ensure that it is a single pdf file and not a file for each sheet of paper). Failure to submit a single document may result in a late penalty to condense the files into one single file, or a 0%.
* Exams and quizzes will be on paper in class.

### Final Exam

While there is no “final exam” to the course, the last exam will be taken during the final examination period. The final examination period for this class is: Wednesday, December 6, 2023 7:00 AM – 9:50 AM.

## Assessment and Grading Procedures

### Grading Methods

The following grading scheme will be used to convert the overall course percentage to a letter grade. Final grades are rounded to two decimal places that compared to the scheme below.

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| A | A- | B+ | B | B- | C+ | C | D | F |
| >90% | >88%-90% | >86%-88% | >80%-86% | >78%-80% | >76%-78% | >70%-76% | >60%-70% | <60% |

The overall grade will be made up of the following:

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| --- | --- | --- |
| **Category** | **Description** | **Weight** |
| Homework | * 6 homework assignments, equally weighted | 30% |
| Quizzes | * 7 quizzes total, may be announced or unannounced. * Lowest 1 score dropped. | 10% |
| Exam #1 | * Chapters 6-7 | 20% |
| Exam #2 | * Chapters 8-9 | 20% |
| Exam #3 (Final Exam) | * Chapters 10 & 11, 14 (time dependent), 16 (time dependent) * The final exam will be taken during the final examination period, but it is not a cumulative exam. Content in this course is naturally cumulative. | 20% |

Additional Details:

* Homework
  + Collaboration is allowed and encouraged. However, you are expected to turn in your own work.
  + You may use the internet to access resources for finding information about a topic, but you may not use internet resources to find solutions to specific problems (i.e. Chegg, Quizlet, etc.).
  + Graded 50% for accuracy and 50% for effort.
* Quizzes
  + May be announced or unannounced.
  + Graded 50% for accuracy and 50% for effort.
  + Open-note, but not open-book.
  + Given at the end of the class, will take no longer than 10-15 minutes.
  + Unless otherwise noted, all quizzes are individual work. No internet access is allowed, no access to the textbook is allowed. If notes are on one’s personal laptop, the laptop must be in view of the instructor so ensure that no internet access is being used.
    - Please try and bring up all the notes you plan on using during the quiz if you are on a laptop. This will stop confusion if the internet is being accessed or not.
  + No calculators are allowed.
* Exams
  + Graded 100% for accuracy.
  + One single sheet of paper (standard sized printer paper, 8.5” x 11” or smaller), front and back, may be brought to each exam. Each student should create their own note sheet.
  + No access to the internet, the textbook, or other notes are allowed. No collaboration with others is permitted.
  + If statistical tables are needed, the instructor will provide them.
  + In general, please arrive at least 5 minutes early so that everyone can receive the full time allotted for the exam.
  + Cell phones should be turned off and out of sight (in a backpack, purse, bag, etc.). Nothing should be on the desk other than the exam, note sheet, writing utensil, and a calculator.
  + A TI-84 calculator or below is allowed. All other calculators are subject to approval by the instructor.

Academic Integrity/Breaking of Rules

* Homework
  + If you are caught breaking any of the rules above, some potential consequences (depending on the severity of the situation) could be:
    - Receiving a 0 for the homework assignment.
    - Receiving a 0 for the homework grade weight.
    - Receiving an F in the course.
    - Being reported to the Office of Student Conduct and Academic Integrity.
* Quizzes
  + If you are caught breaking any of the rules above, some potential consequences (depending on the severity of the situation) could be:
    - Receiving an un-droppable 0 for the quiz.
    - Receiving a 0% for the entire quiz weight.
    - Getting reported to the Office of Student Conduct and Academic Integrity.
* Exams
  + If you are caught breaking any of the rules above, some potential consequences (depending on the severity of the situation) could be:
    - Receiving a 0 for the exam.
    - Receiving an F for the class.
    - Getting reported to the Office of Student Conduct and Academic Integrity.

### Missing an Assignment

Unless the student and instructor previously worked something out, only documented excuses may be used for an extension on a homework assignment. An extension must be requested 24 hours prior to the deadline. The following is a non-exhaustive list of what constitutes a documented excuse:

* University-Sponsored Events
* Religious Observations (see below)
* Illness (doctor’s note must be provided)
* Serious family emergencies (death or extreme illness of an immediate family member).
* Jury Duty

If a homework assignment is missed for an unexcused reason, a penalty of 10% will be applied per day, up to five days. After two weeks, the homework assignment will be closed, and the student may earn no credit for that assignment.

### Missing a Quiz/Exam

If you are expected to miss a class, please let me know as soon as possible. Since quizzes may be unannounced, please indicate to me via email (or Webcourses) if you plan on missing a class at least 24 hours in advance, unless the emergency happens within 24 hours of the class.

* A documented excuse allows the student to make-up a quiz/exam, provided the documentation is provided in a timely manner.
* It is up to the discretion of the instructor whether an unexcused absence can be used to make up a quiz or exam.

The following constitutes an excused absence:

* Illness
* Family Emergency (death of an immediate family member)
* Personal Emergency (such as a car accident)
* Religious Observance (see below)
* Military Obligations
* University Activities (see below)
* Severe Weather Conditions

If a student has an excused absence or an accepted unexcused absence, the quiz or exam may be made-up.

### AI Tools

* This class will make use of Artificial Intelligence (AI) in various ways. You are permitted to use AI only in the manner and means described in the assignments. Any attempt to represent AI output inappropriately as your own work will be treated as plagiarism.
* AI should be used as a tool to assist you in learning – not doing the work for you. If you decide to use AI for any part of any assignment, please *cite which parts you received assistance from AI, and how you used it (i.e., list the prompt and output).* AI should not solve questions for you, but looking up concepts from AI is allowed.

### Extra Credit

* Extra credit may be available on certain exams. If bonus questions are available, a student may get more than a 100% on an exam, meaning that a student may achieve higher than a 100% in the course overall.
* Other than the extra credit listed above, *no other extra credit opportunities will be offered*.

### Regrades

* Any regrades or grade complaints must be made within 48 hours of receiving the feedback. Quiz and exam feedback will be handed out in-class. Homework feedback will be posted online. If this request is not made within 48 hours, then that grade will be treated as final and cannot be changed.

### Grade Dissemination

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To comply with the Family Educational Rights and Privacy Act (FERPA), grades must not be released to third parties, which includes posting grades by name, SSN, or UCFID. This section can indicate how you will return graded assignments to the individual student. To ensure students have prompt feedback, and knowledge of their progress, faculty members must record all grades in Webcourses@UCF and follow student data classification and security standards.

## Policy Statements

**Academic Integrity**

Students should familiarize themselves with UCF’s Rules of Conduct at <https://scai.sdes.ucf.edu/student-rules-of-conduct/>. According to Section 1, “Academic Misconduct,” students are prohibited from engaging in

1. Unauthorized assistance: Using or attempting to use unauthorized materials, information or study aids in any academic exercise unless specifically authorized by the instructor of record. The unauthorized possession of examination or course-related material also constitutes cheating.
2. Communication to another through written, visual, electronic, or oral means: The presentation of material which has not been studied or learned, but rather was obtained through someone else’s efforts and used as part of an examination, course assignment, or project.
3. Commercial Use of Academic Material: Selling of course material to another person, student, and/or uploading course material to a third-party vendor without authorization or without the express written permission of the university and the instructor. Course materials include but are not limited to class notes, Instructor’s PowerPoints, course syllabi, tests, quizzes, labs, instruction sheets, homework, study guides, handouts, etc.
4. Falsifying or misrepresenting the student’s own academic work.
5. Plagiarism: Using or appropriating another’s work without any indication of the source, thereby attempting to convey the impression that such work is the student’s own.
6. Multiple Submissions: Submitting the same academic work for credit more than once without the express written permission of the instructor.
7. Helping another violate academic behavior standards.
8. Soliciting assistance with academic coursework and/or degree requirements.

**Responses to Academic Dishonesty, Plagiarism, or Cheating**

Students should also familiarize themselves with the procedures for academic misconduct in UCF’s student handbook, The Golden Rule <https://goldenrule.sdes.ucf.edu/>. UCF faculty members have a responsibility for students’ education and the value of a UCF degree, and so seek to prevent unethical behavior and respond to academic misconduct when necessary. Penalties for violating rules, policies, and instructions within this course can range from a zero on the exercise to an “F” letter grade in the course. In addition, an Academic Misconduct report could be filed with the Office of Student Conduct, which could lead to disciplinary warning, disciplinary probation, or deferred suspension or separation from the University through suspension, dismissal, or expulsion with the addition of a “Z” designation on one’s transcript.

Being found in violation of academic conduct standards could result in a student having to disclose such behavior on a graduate school application, being removed from a leadership position within a student organization, the recipient of scholarships, participation in University activities such as study abroad, internships, etc.

Let’s avoid all of this by demonstrating values of honesty, trust, and integrity. No grade is worth compromising your integrity and moving your moral compass. Stay true to doing the right thing: take the zero, not a shortcut.

**Course Accessibility Statement**

The University of Central Florida is committed to providing access and inclusion for all persons with disabilities. Students with disabilities who need access to course content due to course design limitations should contact the professor as soon as possible. Students should also connect with Student Accessibility Services (SAS) <http://sas.sdes.ucf.edu/> (Ferrell Commons 185, sas@ucf.edu, phone 407-823-2371). For students connected with SAS, a Course Accessibility Letter may be created and sent to professors, which informs faculty of potential course access and accommodations that might be necessary and reasonable. Determining reasonable access and accommodations requires consideration of the course design, course learning objectives and the individual academic and course barriers experienced by the student. Further conversation with SAS, faculty and the student may be warranted to ensure an accessible course experience.

**Campus Safety Statement**

Emergencies on campus are rare, but if one should arise during class, everyone needs to work together. Students should be aware of their surroundings and familiar with some basic safety and security concepts.

* In case of an emergency, dial 911 for assistance.
* Every UCF classroom contains an emergency procedure guide posted on a wall near the door. Students should make a note of the guide’s physical location and review the online version at <https://centralflorida-prod.modolabs.net/student/safety/index>.
* Students should know the evacuation routes from each of their classrooms and have a plan for finding safety in case of an emergency.
* If there is a medical emergency during class, students may need to access a first-aid kit or AED (Automated External Defibrillator). To learn where those are located, see <https://ehs.ucf.edu/automated-external-defibrillator-aed-locations>.
* To stay informed about emergency situations, students can sign up to receive UCF text alerts by going to [www.getrave.com/login/ucf](http://www.getrave.com/login/ucf) and logging in. On the “My Account” tab, fill out the information, including e-mail address and cell phone number.
* Students with special needs related to emergency situations should speak with their instructors outside of class.
* To learn about how to manage an active-shooter situation on campus or elsewhere, consider viewing this video (<https://youtu.be/NIKYajEx4pk>).

**Campus Safety Statement for Students in Online-Only Courses (In case we need to pivot to online)**

Though most emergency situations are primarily relevant to courses that meet in person, such incidents can also impact online students, either when they are on or near campus to participate in other courses or activities or when their course work is affected by off-campus emergencies. The following policies apply to courses in online modalities.

* To stay informed about emergency situations, students can sign up to receive UCF text alerts by going to [www.getrave.com/login/ucf](http://www.getrave.com/login/ucf) and logging in. On the “My Account” tab, fill out the information, including e-mail address and cell phone number.
* Students with special needs related to emergency situations should speak with their instructors outside of class.

**Deployed Active Duty Military Students**

Students who are deployed active duty military and/or National Guard personnel and require accommodation should contact their instructors as soon as possible after the semester begins and/or after they receive notification of deployment to make related arrangements.

**Make-up Assignments for authorized university events or co-curricular activities**

Students who represent the university in an authorized event or activity (for example, student-athletes) and who are unable to meet a course deadline due to a conflict with that event must provide the instructor with documentation in advance to arrange a make-up. No penalty will be applied. For more information, see the UCF policy at <https://policies.ucf.edu/documents/4-401.pdf>

**Religious Observances**

Students must notify their instructor in advance if they intend to miss class for a religious observance. For more information, see the UCF policy at <http://regulations.ucf.edu/chapter5/documents/5.020ReligiousObservancesFINALJan19.pdf>.

**Title IX policy**

Title IX prohibits sex discrimination, including sexual misconduct, sexual violence, sexual harassment, and retaliation. If you or someone you know has been harassed or assaulted, you can find resources available to support the victim, including confidential resources and information concerning reporting options at <https://letsbeclear.ucf.edu> and <http://cares.sdes.ucf.edu/>.

**This syllabus is subject to change and all changes will be announced in class or through Webcourses.**