CS/CE 3341.HON – Probability and Statistics in CS and SE – Fall 2023

Prof. Zygmunt J. Haas

Course Description:

Axiomatic probability theory, independence, conditional probability. Discrete and continuous random variables, special distributions of importance to CS/SE, vector of random variables, and functions of random variables. Simulation of random variables and Monte Carlo methods. Central limit theorem. Basic statistical inference, parameter estimation, hypothesis testing, and linear regression. Introduction to stochastic processes. Illustrative examples from queuing, reliability, and other CS/SE applications.

The course is a theoretical course with engineering/scientific applications.

Course Instructor: Prof. Zygmunt J. Haas, **haas@utdallas.edu**

Office Hours: Tuesdays, 2:00pm-3:00pm or by appointment; Location: **MS Teams**

Course Modality and Expectations:

- **Instructional Mode:** In-person (Please see "Course Schedule" below for additional information.)
- **Course Platform:** Instruction will be in-person; however, the eLearning platform will be used for communications and some teaching functions (e.g., exams, assignments, material postings, etc). Office hours will be conducted through MS Teams. Students are welcome to email the instructor and/or connect through MS Teams with **any** questions **at any time**.
- **Expectations:** Students should be familiar with the MS Teams and eLearing platforms. Students should attend all classes in person. By participating in any on-line course activity, the student agrees and gives permission for the activity to be recorded. It is a requirement for each student to have a web cam, as well as means to scan or take photo of a document (a smart phone is fine).
- **Asynchronous Learning Guidelines:** No asynchronous instructions will be used.

Class Participation: Regular lecture attendance is mandatory. Attendance will be taken at each lecture. Students who fail to follow the class material regularly are inviting scholastic difficulty. The course's material gets much more complex as the course progresses, and it is typically very difficult to catch up with missed classes.

Class Material Access: Students are expected to follow appropriate University policies and maintain the security of passwords used to access all course material. Unless the Office of Student AccessAbility has approved the student to record the instruction, students are expressly prohibited from recording any part of this course. Failure to comply with these University requirements is a violation of the Student Code of Conduct.

Class Materials: The instructor may provide class materials that will be made available to all students registered for this class. If approved, these materials may be downloaded, however, these materials are for registered students' use only. Classroom materials may not be reproduced or shared with those not in the class or uploaded to other online environments, except to implement an approved Office of

Student AccessAbility accommodation. Failure to comply with these University requirements is a violation of the Student Code of Conduct.

Pre-/co-requisites: (1) MATH 1326 or MATH 2414 or MATH 2419, and (2) CE 2305 or CS 2305 or TE 2305, with a grade of C or better. Credit cannot be received for both courses, (CS 3341 or SE 3341 or STAT 3341) and ENGR 3341.

Student Learning Objectives/Outcomes:

- Ability to understand basic properties of probability theory, conditional probability, Bayes Theorem, independence
- Ability to understand basic concepts, properties, expectation, functions of discrete and continuous random variables
- Ability to understand applications of the Central Limit Theorem (CLT)
- Ability to understand and perform estimation of model parameters
- Ability to understand and use hypothesis testing
- Ability to understand and apply regression
- Ability to understand Binomial and Poisson counting processes
- Ability to understand and use Markov Chains

Course TA: TBA

Course Website: The material and announcements of this course can be accessed using your UT Dallas NetID on the **eLearning** website.

Course Times: Mondays/Wednesdays, 2:30pm-3:45pm in room FN 2.302.

Required Course Textbook:

Michael Baron, "Probability and Statistics for Computer Scientists," **3rd edition**, Chapman and Hall/CRC, 2019, ISBN-13: 978-1138044487

Retail book prices - Buy New♦: $151.25; Buy Used♦: $113.50; Rent New♦: $98.31; Rent Used♦: $60.50

(♦Campus Bookstore prices and availability are subject to change at any time without notice.)

The textbook can be purchased online or at the **UT Dallas Bookstore**.

Suggested Course Materials: Notes/Slides, to be posted on the course web site.

Homework Assignments:

There will be approximately 10 homework sets, which will be typically posted on Tuesdays. Each assignment will be due typically a week after its distribution, with some exceptions. Some assignments may require limited computer use. It is expected that every student in the class possesses a web camera, and a smart phone or a scanner, so that the student can scan/take a photo of their assignments, which will then be submitted through eLearning as PDF files. **Note: No late homeworks, or homeworks not submitted through eLearning, will be accepted – no exception.**

Grading Policy:

Component	Weight of final grade
Homework sets	20%
Midterm #1	20%
Midterm #2	20%
Final exam	30%
Discretionary credit (attendance, participation, etc.)	10%
Total	**100%**

Grading Rules:

- All the components are essential for the final grade.
- No one is exempt from the exams. If you have missed an exam due to a legitimate reason, you need to reschedule a makeup exam as soon as possible.
- If you did not turn in up to 2 homework sets due to a legitimate reason, the turned-in assignments will carry the total of the 20% of the final score.
- Any final score component missed not due to a legitimate reason will count as no credits in the final score calculation.
- See the course web site for what constitutes a legitimate reason.
- Note: Individual work is assumed in **all grading components**. In solving the homeworks, use of any means other than the course material is strictly prohibited. In particular, searching the Internet for solutions of grading components is prohibited.
- Use of AI tools in this class, including Generative AI, is prohibited at any time.
- Note that academic honesty and integrity is expected in all the graded elements of the course and will be strictly enforced without any exceptions.

Comet Creed:

This creed was voted on by the UT Dallas student body in 2014. It is a standard that Comets choose to live by and encourage others to do the same:

"As a Comet, I pledge honesty, integrity, and service in all that I do."

Reading Assignments:

Reading assignments will be posted weekly. It is very important to go over the reading material before the classes. Unless specified otherwise, reading assignments are from the textbook.

Class and Office Hours Rules:

- For any questions or concerns about the course, including the requirements, the topics, the HW problems, and so on, please contact the instructor. I am happy to answer **all** of your questions.
- Ask questions, participate, and make comments.
- During class, silence communication devices and do not have side conversations.
- In general, be polite and courteous to everyone.

Communication:

This course utilizes online tools for interaction and communication. Some external communication tools, such as regular email and a web conferencing tool (e.g., office hours), will also be used during the semester. For more details, please visit the **Student eLearning Tutorials** webpage for video demonstrations of eLearning tools. Student emails to the instructor will be answered within 3 working days under normal circumstances.

Learning Student Resources:

Students have access to resources including the McDermott Library, Academic Advising, The Office of Student AccessAbility, and many others. Please see the **eLearning Current Students** webpage for more information.

Exams and Other Tests:

This course **may** use **Honorlock** – an online exam proctoring tool. To successfully take an exam, you must have a web camera with microphone, a laptop or a desktop computer (no tablets/phones), Chrome browser, a reliable internet connection and your photo ID. You will be prompted to install the Honorlock Chrome Extension (which you can remove after you finish the test). You will then access the exam within your eLearning course and go through the authentication process. The web camera will monitor you throughout test. Please see the **Testing Guidelines** and **Support Information** for additional information.

Server Unavailability or Other Technical Difficulties:

The University is committed to providing a reliable learning management system to all users. However, in the event of any unexpected server outage or any unusual technical difficulty which prevents students from completing a time sensitive assessment activity, the instructor will provide appropriate accommodation based on the situation. Students should immediately report any problems to the instructor and also contact the online **eLearning Help Desk**. The instructor and the eLearning Help Desk will work with the student to resolve any issues at the earliest possible time.

Tentative Syllabus (please note that not all course topics are listed in the syllabus):

Lesson Title and Number	Textbook Section(s)
01. Probability Basics and Related Material	2.1, 2.2, 2.3
02. Bayes' Rule and Friends	2.4
03. Discrete Random Variables and Distributions	3.1, 3.2, 3.3
04. Families of Discrete Distributions	3.4
05. Probability Density	4.1
06. Continuous Distributions	4.2
07. Stochastic Processes that Count	6.1, 6.3
08. Stochastic Processes that are Markov	6.2
09. Normal Approximation (The Central Limit Theorem)	4.3
10. Estimating Error with Confidence! (Confidence Intervals)	9.2, 9.3
11. To Reject or Not to Reject (Hypothesis Testing)	9.4
12. Calculus-based Parameter Estimation Methods	9.1
13. Correlation and Regression	11.1

Academic Support Resources:

The information contained in the following link lists the University's academic support resources for all students. Please go to **Academic Support Resources** webpage for these policies.

UT Dallas Syllabus Policies and Procedures:

The information contained in the following link constitutes the University's policies and procedures segment of the course syllabus. Please go to **UT Dallas Syllabus Policies** webpage for these policies. (See also the following pages of this document.)

The descriptions, timelines, and other information contained in this syllabus are subject to change at the discretion of the Professor.

Student Conduct and Discipline:

The University of Texas System and The University of Texas at Dallas have rules and regulations for the orderly and efficient conduct of their business. It is the responsibility of each student and each student organization to be knowledgeable about the rules and regulations which govern student conduct and activities. General information on student conduct and discipline is contained in the UTD publication, *A to Z Guide*, which is provided to all registered students each academic year.

The University of Texas at Dallas administers student discipline within the procedures of recognized and established due process. Procedures are defined and described in the *Rules and Regulations, Board of Regents, The University of Texas System, Part 1, Chapter VI, Section 3*, and in Title V, Rules on Student Services and Activities of the university's *Handbook of Operating Procedures*. Copies of these rules and regulations are available to students in the Office of the Dean of Students, where staff members are available to assist students in interpreting the rules and regulations (SU 1.602, 972/883-6391).

A student at the university neither loses the rights, nor escapes the responsibilities of, citizenship. He or she is expected to obey federal, state, and local laws as well as the Regents' Rules, university regulations, and administrative rules. Students are subject to discipline for violating the standards of conduct whether such conduct takes place on or off campus, or whether civil or criminal penalties are also imposed for such conduct.

Academic Integrity:

The faculty expects from its students a high level of responsibility and academic honesty. Because the value of an academic degree depends upon the absolute integrity of the work done by the student for that degree, it is imperative that a student demonstrate a high standard of individual honor in his or her scholastic work.

Scholastic dishonesty includes, but is not limited to, statements, acts or omissions related to applications for enrollment or the award of a degree, and/or the submission as one's own work or material that is not one's own. As a general rule, scholastic dishonesty involves one of the following acts: cheating, plagiarism, collusion and/or falsifying academic records. Students suspected of academic dishonesty are subject to disciplinary proceedings.

Any form of plagiarism, including from the WWW, from portions of papers for other classes, and from any other source is unacceptable and will be dealt with under the university's policy on plagiarism (see general catalog for details). This course may use the resources of turnitin.com, which searches the web for possible plagiarism and is highly effective.

Email Use:

The University of Texas at Dallas recognizes the value and efficiency of communication between faculty/staff and students through electronic mail. At the same time, email raises some issues concerning security and the identity of each individual in an email exchange. The university encourages all official student email correspondence be sent only to a student's U.T. Dallas email address and that faculty and staff consider email from students official only if it originates from a UTD student account. This allows the university to maintain a high degree of confidence in the identity of all individual corresponding and the security of the transmitted information. UTD furnishes each student with a free email account that is to be used in all communication with university personnel. The Department of Information Resources at U.T. Dallas provides a method for students to have their U.T. Dallas mail forwarded to other accounts.

Withdrawal From Class:

The administration of this institution has set deadlines for withdrawal of any college-level courses. These dates and times are published in that semester's course catalog. Administration procedures must be followed. It is the student's responsibility to handle withdrawal requirements from any class. In other words, the instructor cannot drop or withdraw any student. The student must do the proper paperwork to ensure that s/he will not receive a final grade of "F" in a course if the student chooses not to attend the class once s/he are enrolled.

Student Grievance Procedures:

Procedures for student grievances are found in Title V, Rules on Student Services and Activities, of the university's *Handbook of Operating Procedures*.

In attempting to resolve any student grievance regarding grades, evaluations, or other fulfillments of academic responsibility, it is the obligation of the student first to make a serious effort to resolve the matter with the instructor, supervisor, administrator, or committee with whom the grievance originates (hereafter called "the respondent"). Individual faculty members retain primary responsibility for assigning grades and evaluations. If the matter cannot be

resolved at that level, the grievance must be submitted in writing to the respondent with a copy of the respondent's School Dean. If the matter is not resolved by the written response provided by the respondent, the student may submit a written appeal to the School Dean. If the grievance is not resolved by the School Dean's decision, the student may make a written appeal to the Dean of Graduate or Undergraduate Education, and the deal will appoint and convene an Academic Appeals Panel. The decision of the Academic Appeals Panel is final. The results of the academic appeals process will be distributed to all involved parties.

Copies of these rules and regulations are available to students in the Office of the Dean of Students, where staff members are available to assist students in interpreting the rules and regulations.

Incomplete Grades:

As per university policy, an incomplete grade will be granted only for work unavoidably missed at the semester's end and only if 70% of the course work has been completed. An incomplete grade must be resolved within eight (8) weeks from the first day of the subsequent long semester. If the required work to complete the course and to remove the incomplete grade is not submitted by the specified deadline, the incomplete grade is changed automatically to a grade of **F**.

Disability Accommodations:

The University of Texas at Dallas is committed to providing reasonable accommodations for all persons with disabilities. The syllabus is available in alternate formats upon request. If you are seeking classroom accommodations under the Americans with Disabilities Act (2008), you are required to register with the AccessAbility Resource Center, located in the Administration Building (AD), Suite 2.224. Their phone number is 972-883-2098, email: accessability@utdallas.edu and website is https://accessability.utdallas.edu(opens in a new tab) . To receive academic accommodations for this class, please obtain the proper AccessAbility Resource Center letter of accommodation and meet with me at the beginning of the semester."

It is the student's responsibility to notify his or her professors of the need for such an accommodation. AccessAbility Resource Center provides students with letters to present to faculty members to verify that the student has a disability and needs accommodations. Individuals requiring special accommodation should contact the professor after class or during office hours.

Religious Holy Days:

The University of Texas at Dallas will excuse a student from class or other required activities for the travel to and observance of a religious holy day for a religion whose places of worship are exempt from property tax under Section 11.20, Tax Code, Texas Code Annotated.

The student is encouraged to notify the instructor or activity sponsor as soon as possible regarding the absence, preferably in advance of the assignment. The student, so excused, will be allowed to take the exam or complete the assignment within a reasonable time after the absence: a period equal to the length of the absence, up to a maximum of one week. A student who notifies the instructor and completes any missed exam or assignment may not be penalized for the absence. A student who fails to complete the exam or assignment within the prescribed period may receive a failing grade for that exam or assignment.

If a student or an instructor disagrees about the nature of the absence [i.e., for the purpose of observing a religious holy day] or if there is similar disagreement about whether the student has been given a reasonable time to complete any missed assignments or examinations, either the student or the instructor may request a ruling from the chief executive officer of the institution, or his or her designee. The chief executive officer or designee must take into account the legislative intent of TEC 51.911(b), and the student and instructor will abide by the decision of the chief executive officer or designee.

Prepared by: Z.J. Haas, August 20, 2023 (version 4.0)