Syllabus (Wide)

Overview

This course gives an introduction to probability theory and statistics with applications to computer science. It is foundational for more advanced computer science courses including data science and machine learning.

Topics include: visualizing datasets, summarizing data, basic descriptive statistics, conditional probability, independence, Bayes theorem, random variables, joint and conditional distributions, expectation, variance and covariance, central limit theorem. Markov inequality,

Chebyshev inequality, law of large numbers, simulation, populations and sampling, sample mean, standard error, maximum likelihood estimation, Bayes estimation, hypothesis testing, confidence intervals, linear regression, principal component analysis, classification, clustering methods, Markov chains and the PageRank algorithm.

Course Structure

This is a 3 credit hour course that lasts 16 weeks. The lectures will be offered in person for students who are in Champaign campus. Office hours will be offered either through Zoom and/or in-person as well. All contents will be accessible on the course Canvas site including lecture notes, lecture videos, discussion videos, quizzes, HW, team assignments, project, course helps, etc. Therefore, you are expected to regularly log onto Canvas course site to keep up with the course. Including attending the lectures and discussion/recitation per week, you should dedicate approximately 8 -12 hours per week to working on the course itself, but actual time commitments will vary depending on your input, needs, and personal study habits. For additional information about student commitment, please see the section activity tables for each week on Canvas.

Goals

At the end of CS 361, you will be able to:

- Visualize and summarize data and reason about outliers and relationships
- Apply the principles of probability to analyze and simulate random events
- Use inference to fit statistical models to data and evaluate how good the fit is
- Apply machine learning tools to dimension reduction, classification, clustering, regression and Markov modeling problems

Throughout the course, we emphasize **mathematical principles**, **critical thinking**, and dealing with **real data**.

Prerequisites

- **Calculus**. You should know how to find maxima/minima and the area under a curve and how to use the chain rule in calculating the derivative of a composite function and integration of common expressions. Official prerequisite: Math 220 (https://math.illinois.edu/resources/department-resources/syllabus-math-220) or Math 221 (https://math.illinois.edu/resources/department-resources/syllabus-math-221). Please use the following optional quiz (https://us.prairielearn.com/pl/course_instance/173170/instructor/instance_admin/assessments) to test your preparedness.
- **Linear algebra**. By the ninth week of semester, you should know how to diagonalize matrices (i.e. find eigenvalues and eigenvectors). Official corequisite: Math 225 (https://math.illinois.edu/resources/department-resources/syllabus-math-225) (or Math 415 (https://math.illinois.edu/resources/department-resources/syllabus-math-415)), but these courses do not cover diagonalization until the last few weeks of semester, so we highly recommend that you watch this visual introduction to linear algebra from 3Blue1Brown (https://www.youtube.com/playlist?list=PLZHQObOWTQDPD3MizzM2xVFitgF8hE_ab) ahead of time.

Textbook

Prof. David Forsyth's (http://luthuli.cs.uiuc.edu/~daf/) textbook was written specifically for this course and is available for download (https://link.springer.com/book/10.1007/978-3-319-64410-3) for free within the University network.

Communication

We will post important announcements on Canvas Course site (https://canvas.illinois.edu/courses/58398/discussion_topics/888282), so you should monitor it regularly. You can ask questions on the discussion forum of Canvas and/or on CS 361 Ed (https://edstem.org/us/join/WwEkQS) (Request with https://edstem.org/us/join/WwEkQS (https://edstem.org/us/join/WwEkQS)) publicly, so that you can reach the entire course staff and allow your classmates to participate in the discussion. If you have a question about your grades or some

other personal matter, you may write privately to the course staff on Canvas. For non-technical interpersonal issues, please contact the course instructor privately. In addition, do not post answers of any kind regarding graded course assignments publicly on a discussion forum. Finally please defer complex questions about the course assignment to your recitation session or **office hours (https://canvas.illinois.edu/courses/58398/pages/office-hour-info)** . More detailed instruction/policy on using Ed in this course are linked **here (https://canvas.illinois.edu/courses/58398/pages/ed-forum-policy)** .

The teaching staff will respond to Canvas inbox or e-mail messages within 24 hours of receiving them Monday through Friday 9am -5pm central time. On Saturday and Sunday, we will continue to check such messages, but the response time may take up to 48 hours. **Personal messages on Canvas inbox or CS361 Ed are the preferred communication approach.**

Netiquette Statement

In any social interaction, certain rules of etiquette are expected and contribute to more enjoyable and productive communication. The following are tips for interacting online via e - mail or discussion board messages, adapted from guidelines originally compiled by Chuq Von Rospach and Gene Spafford (1995):

- Remember that the person receiving your message is someone like you, deserving and appreciating courtesy and respect
- Avoid typing whole sentences or phrases in Caps Lock
- Be brief; succinct, thoughtful messages have the greatest effect
- Your messages reflect on you personally; take time to make sure that you are proud of their form and content
- Use descriptive subject headings in your e-mails
- Think about your audience and the relevance of your messages
- Be careful when you use humor and sarcasm; absent the voice inflections and body language that aid face-to-face communication, Internet messages are easy to misinterpret

- When making follow-up comments, summarize the parts of the message to which you are responding
- Avoid repeating what has already been said; needless repetition is ineffective communication
- Cite appropriate references whenever using someone else's ideas, thoughts, or words.

Attendance and participation

Attendance to live lectures and discussions is expected and the attendance to the lectures will be scored. If you can not attend the live lectures, you are expected to watch the video recordings and attend office hours that fit your schedule. Attendances and participation to exams are required unless there is an unresolvable conflict.

Illinois law requires the University to reasonably accommodate its students' religious beliefs, observances, and practices in regard to admissions, class attendance, and the scheduling of examinations and work requirements. You should examine this syllabus at the beginning of the semester for potential conflicts between course deadlines and any of your religious observances. If a conflict exists, you should notify your instructor of the conflict and follow the procedure at **https://odos.illinois.edu/community-of-care/resources/students/religious-observances/ (https://odos.illinois.edu/community-of-care/resources/students/religious-observances/)** to request appropriate accommodations. This should be done in the first two weeks of classes.

If illness or personal crisis (e.g. car accident, required court appearance, death of a close relative) prevents you from attending an exam, you must provide the course instructor with an official excuse letter from the **Dean on Duty (http://odos.illinois.edu/community-of-care/student-assistance-center/#dean-on-duty)** within two weeks of the exam date and no later than reading day. If you have an exam conflict with an official university activity (e.g. varsity athletics, band concert), you must provide the course instructor with an official letter from the designated university official at least one week before the exam date.

Course work

Grading

You will submit homework/midterm1 exam/project through **Gradescope** (https://www.gradescope.com/) and we will return homework/project and exam grades to you also through Gradescope. As soon as grades are posted, you will be notified immediately so that you can log in and see your feedback. You may also submit regrade requests within **7** days of grades posting of homework and midterm exams. The request should be made at office hours to the course staff. The request of regrading of project and final exam will have a narrower time limit. You will be notified per situation. Your Gradescope login is your university email, and your password can be changed **here** (https://gradescope.com/reset_password) . The same link can be used if you need to set your password for the first time. In order to subscribe to our course there, you need to use the Entry code: **ZYP7YP**.

You will submit your online team work assignments through **Canvas** (https://canvas.illinois.edu/courses/58398) , details will be listed in the corresponding Canvas content folders.

You will take the technical Quizzes, Examlet1, 3, 4 and the Final Exam on PrairieLearn or PrairieTest, for which the instructions are linked to the corresponding week on the frontpage schedule and the module's folder. The Quizzes can be attempted twice and the score is averaged.

Grading Scheme

Category	Points	Notes
Lecture attendance	27	1 point for the attendance to each lecture
Homework	350	50 points each; There are 10 HW assignments while lowest three scores will be automatically dropped unless the HW has academic integrity issue

Category	Points	Notes
Graded Group discussion	Pass or Not-Pass for each assignment	There are 10 optional graded group discussion assignments.
Quiz	92	There are one orientation quiz and 7 normal quizzes with 8, 7, 7, 14, 14, 14, 14,14 points respectively
Project	80	
Midterms	300	Examlet1:30 pts; Examlet2:120 pts: Examlet3:70pts, Examlet4:80 points
Final exam	180	

The total number of points for the required work without the extra credit work is **1029**. The final score of points is the sum of all points. Letter grade cutoffs will be at least as generous as the ones shown below.

					Letter Grade Cut-Off					
A+	**A**	**A-**	**B+**	**B**	**B-**	**C+**	**C**	**C-**	**D+**	**D**
971	931	902	866	834	805	775	746	717	688	659

Extra Points

Extra points are given for working on optional problems given in homework and project, attendances to office hours, team work, exam wrappers, or other efforts that contribute to the

courses. The extra points a student received will be counted toward the final score of points. Please read details of **extra points (https://canvas.illinois.edu/courses/58398/modules/520783)** on Canvas.

Homework and project

There will be 10 homework assignments (in addition to a pre-homework HW0), consisting of problems, proofs and/or problem solving that needs Python programming. HW0 is for the purpose of helping students get familiar with the submission and will not be counted for points. There will also be a project assignment which will be involving Python programming and concepts from several chapters.

The homework and project are individual assignments. You may verbally discuss your approach with fellow students, but neither your write-up nor your code. Verbal discussion should NOT include comparing solutions. By submitting your assignment, you are certifying that the homework/project is your own independent work.

Submission instructions. Each of your homework/project submissions must be **typed** and submitted as a single PDF file on **Gradescope (https://www.gradescope.com/)** unless we give you other instructions. In the Gradescope interface, you must properly mark up the locations of each of your answers so that the graders can find them. No handwritten/scanned solutions will be accepted. **More detailed guideline and an example of homework submission** is linked **here (https://canvas.illinois.edu/courses/58398/pages/homework-info-stat)** .

Late policy. The homework/project due days will be all specified on the assignments. Late submissions can only be accepted and excused for students who have obtained accommodations for documented reasons through the instructor.

Team work

There are two types of teamwork that give credits:1) the graded group discussion 2) problem solving during recitation session.

The graded group discussion (https://canvas.illinois.edu/courses/58398/pages/gradedonlinegroupdiscussion-info-stat-opt-in-or-out) are topic based pass or no-pass activities for student peer-learning. In addition, they can be used for making up lost points in a homework of similar topic. You can choose to **opt out before 11:59pm Central Time of Sept. 12**. If you opt out for this type of teamwork, there is no penalty. Students who do not opt-out are expected to be in active contact with their team for each assignment. Irresponsible team members will lose the membership and won't be able to make up for lost HW points. Detailed assignments and rubrics will be linked to Canvas course site under the corresponding week. The groups will be specified through Canvas and the size will be ~4 students.

If it's for problem solving during TA led Monday recitation session in the designated classroom, ad hoc teams will be formed with random group of 2-4 students and extra points will be given for good performance.

Quizzes

Technical Quizzes are formative assessments as check points for students to keep up with the course material. They will be in the format of multiple choice questions on PrairieLearn. Students are allowed to have access to the text book and lecture notes, but not other resources. In addition, no communication with other people is allowed. The instruction for each Quiz will be on PrairieLearn accordingly. The Quizzes are open until the next midterm or final exam. We apply a flexible deadline policy with different grading accordingly. Details are in **the info page of quizzes (https://canvas.illinois.edu/courses/58398/pages/quiz-info-stat)** .

Midterms and final exam

All exams will be proctored in person in a classroom by the staff or CBTF. Details of the exams will be posted on Canvas and Ed well in advance.

- Examlet1 will cover chapters 1 to 4.3.2, Lecture 1-8, HW 1-4, Quiz1-3, the format is MC (Multiple Choices) tested in CBTF.
- Examlet2 will cover chapters 2.2 to 5, Lecture 3-11, HW 2-5, Quiz2-4, the format is free

response and submitted to Gradescope.
- Examlet3 and Examlet4 together will cover chapters 6 to 10 except 8. Examlet3 is at CBTF on PrairieTest and the format of Examlets 3&4 is MC+filling blanks and submitted to PrairieTest.
- The final exam (~3 hours) will cover chapters 1 to 14 except 8, the format is MC and submitted to PrairieTest.

All exams will be open book and open lecture notes but the work should be individual, no discussions in any media or any format during the exam with any person other than the course staff are allowed.

Conflict/Makeup exam policies

Conflict or makeup exam should be made at least one week before the exam through the instructor, please see the CS department's policy on **conflict exams (https://cs.illinois.edu/academics/undergraduate/policies-and-procedures)** .

Academic integrity

"Above all else, guard your heart, for everything you do flows from it." --- Prov. 4:23

The University of Illinois at Urbana-Champaign Student Code should also be considered as a part of this syllabus. Students should pay particular attention to Article 1, Part 4: Academic Integrity. Read the Code **here. (https://studentcode.illinois.edu/)** As a student it is your responsibility to refrain from infractions of academic integrity and from conduct that aids others in such infractions. Facilitating infractions of academic Integrity is sanctioned the same way as that for direct infractions.

Regarding homework/project, we expect you to do your own work in this course - copying solution from someone else or an online resource is unacceptable. Collaborations in HWs/project should remain verbal or text-based (Graphs or pictures from assignments should **NOT** be shared on Canvas or Ed). Sharing/Comparing results with other students are **NOT** allowed.

Regarding team work, collaboration should be within the team for the specific assignment. In addition, we expect you to understand and abide by the **CS department honor code (https://cs.illinois.edu/academics/honor-code)** . Assignments with close matches to other work will be flagged and investigated.

Course assessment material including HWs, midterms, quizzes, project, discussion quizzes and final exam are **NOT** allowed to be shared to public sites such as CourseHero etc. Students who share them will be considered as committing infraction of copyright and potentially facilitating cheating. Due to our policy of assignments, ChatGPT or other similar AI query system is **NOT** allowed for the assignments in CS361.

Sanctions for student infractions of academic integrity will be consistent with the CS department's recommendations in the **CS department honor code (https://cs.illinois.edu/academics/honor-code)** . That is: for a first offense for cheating, if it's on an exam the sanction is zero on the exam; if it's on a programming assignment, quiz, or written homework the sanction is zero on the assignment and final course grade is lowered by one whole letter grade (ie. from **A to B**). The HW assignment that is sanctioned will not be dropped as one of the lowest scored assignments. For multiple instances of infractions of any kind, the sanction is failure in the course. No matter in what format, all infractions will be reported to the university through the **FAIR** system.

Tips For Success

Avoid the following pits:

- Academic integrity infraction
- Missing homeworks or project
- Missing quizzes
- Late/Poor homeworks or project
- Insufficient attendances to or review of the lectures
- Poor time management

- Procrastination
- Not enough attention to announcements
- Too many challenging classes at the same time
- Not motivated/not interested in the topic

Try the following tips:

- Get oriented well in the beginning which will help a lot and save you time eventually, don't miss the **Orientation Quiz (8pts)**.
- Try to make use of the course resources, especially the **office hours**.
- Try your best to be **engaged/motivated** by talking to the instructor, learning from the course and from each other.
- Be **Active** in class participation, recitation, discussion, etc.
- **Clear** your doubts/misconceptions **asap**.
- Stay **on top of** the most recent communications or updates about the course.
- **Plan** your study according to your style.
- **Do NOT hesitate to ask for help.**
- **Do take advantage of the course calendar on Canvas for reminders.**
- Take advantage of the opportunities to **earn extra points in many ways.**
- Do as much practice as possible, such as discussion problems and practice problems/tests in addition to the homeworks and project.
- Stay **connected** with your teammates and the course staff considering them as reality checkers and accountability partners.
- Read the textbook and other recommended books.
- Brush up or begin to learn essential Python programming before the semester.
- Brush up your calculus skills in the beginning of the class.
- Brush up before the course your counting skills and set theory knowledge from your discrete math course.
- Brush up your linear algebra earlier than lecture 18.
- Study and prepare for the course with a growth mindset because **students usually improve**

over the course.

Safety

The university values your safety. Please **read this document (https://police.illinois.edu/wp-content/uploads/2017/08/syllabus-attachment.pdf)** or **watch this video (http://police.illinois.edu/emergency-preparedness/run-hide-fight/)** .

Accommodations

To obtain disability-related academic adjustments or auxiliary aids, students with disabilities must contact the course instructor and the Disability Resources and Educational Services (DRES) as soon as possible. To contact DRES, you may visit 1207 S. Oak St., Champaign, call 217-333-4603, e-mail disability@illinois.edu or go to the **DRES website (http://disability.illinois.edu/)** . Students are encouraged to arrange a personal meeting with the instructor to talk about their needs and accommodations especially those who have obtained DRES accommodation letter. **You are encouraged to contact the instructor directly about other needs as well, the earlier the better, for example we need to set up the accommodated quiz times in the beginning of the semester.**

To obtain privacy regarding family educational rights and privacy act (FERPA) Statement, please self-identify to the instructor to ensure protection of the privacy of their attendance in this course. See **https://registrar.illinois.edu/academic-records/ferpa/ (https://registrar.illinois.edu/academic-records/ferpa/)** for more information on FERPA.

Statement on CS CARES and CS Values and Code of Conduct

All members of the Illinois Computer Science department - faculty, staff, and students - are expected to adhere to the **CS Values and Code of Conduct. (https://cs.illinois.edu/about/values)** The **CS CARES Committee (https://cs.illinois.edu/about/cs-cares)** is available to serve as a resource to help people who are concerned about or experience a potential violation of the Code. If you experience such issues, please contact the **CS CARES Committee (https://**

cs.illinois.edu/about/cs-cares/contact) . The instructor of this course is also available for issues related to this class.

Sexual Misconduct Policy and Reporting Statement

The University of Illinois is committed to combating sexual misconduct. Faculty and staff members are required to report any instances of sexual misconduct to the University's Title IX and Disability Office. A list of the designated University employees who, as counselors, confidential advisors, and medical professionals, though not having reporting responsibility, can maintain confidentiality and can be found here: **https://wecare.illinois.edu/resources/students/#confidential (https://wecare.illinois.edu/resources/students/#confidential)** Other information about resources and reporting is available here: wecare.illinois.edu .

Anti-Racism and Inclusivity

The Grainger College of Engineering is committed to the creation of an anti-racist, inclusive community that welcomes diversity along a number of dimensions, including, but not limited to, race, ethnicity and national origins, gender and gender identity, sexuality, disability status, class, age, or religious beliefs. The College recognizes that we are learning together in the midst of the Black Lives Matter movement, that Black, Hispanic, and Indigenous voices and contributions have largely either been excluded from, or not recognized in, science and engineering, and that both overt racism and micro-aggressions threaten the well-being of our students and our university community.

The effectiveness of this course is dependent upon each of us to create a safe and encouraging learning environment that allows for the open exchange of ideas while also ensuring equitable opportunities and respect for all of us. Everyone is expected to help establish and maintain an environment where students, staff, and faculty can contribute without fear of personal ridicule, or intolerant or offensive language. If you witness or experience racism, discrimination, micro-aggressions, or other offensive behavior, you are encouraged to bring this to the attention of the course director if you feel comfortable. You can also report

these behaviors to Campus Belonging Resources (**https://diversity.illinois.edu/diversity-campus-culture/belonging-resources/ (https://diversity.illinois.edu/diversity-campus-culture/belonging-resources/)**). Based on your report, Members of the Office of the Vice Chancellor for Diversity, Equity & Inclusion staff will follow up and reach out to students to make sure they have the support they need to be healthy and safe. If the reported behavior also violates university policy, staff in the Office for Student Conflict Resolution may respond as well and will take appropriate action.

Other personal situations

You are welcome to keep your instructor aware of any situation that may hinder your learning and/or wellness in this course.

As members of the Illinois community, we each have a responsibility to express care and concern for one another. If you come across a classmate whose behavior concerns you, whether in regards to their well-being or yours, we encourage you to refer this behavior to the Student Assistance Center (1-217-333-0050) or online at **odos.illinois.edu/community-of-care/referral/ (https://odos.illinois.edu/community-of-care/referral/)** . Based upon your report, staff in the Student Assistance Center reaches out to students to make sure they have the support they need to be healthy and safe.

Further, as a Community of Care, we want to support you in your overall wellness. We know that students sometimes face challenges that can impact academic performance (examples include mental health concerns, food insecurity, homelessness, personal emergencies, significant stress, mood changes, excessive worry, substance/alcohol abuse). Should you find that you are managing such a challenge and that it is interfering with your coursework, you are encouraged to get help because that is a smart and courageous thing to do -- for yourself and for those who care about you. You can contact the Student Assistance Center (SAC) in the Office of the Dean of Students for support and referrals to campus and/or community resources. The SAC has a Dean on Duty available to see students who walk in, call, or email the office during business hours. In addition, you can get help from the following services such

as Counseling Center: 217-333-3704, 610 East John Street Champaign, IL 61820 or McKinley Health Center:217-333-2700, 1109 South Lincoln Avenue, Urbana, Illinois 61801