COMPSCI 240: Reasoning under Uncertainty, L01

I. Course Catalog

Development of mathematical reasoning skills for problems that involve uncertainty. Counting and probability: basic counting problems, probability definitions, mean, variance, binomial distribution, discrete random variables, continuous random variables, Markov and Chebyshev bounds, laws of large number, and the central limit theorem. probabilistic reasoning: conditional probability and odds, Bayes' rule, Markov chains, Bayesian networks, parameter estimation, linear and binary regression.

II. Course Description

The goal of this course is to help students develop mathematical reasoning skills for problems that involve uncertainty. Each concept will be illustrated by real-world examples and demonstrated through in-class and homework exercises. Topics covered include counting and probability: basic counting problems, probability definitions, mean, variance, binomial distribution, discrete random variables, continuous random variables, Markov and Chebyshev bounds, laws of large numbers, and central limit theorem, as well as probabilistic reasoning: conditional probability and odds, Bayes' rule, game theory, Markov chains, and Bayesian networks. We will also cover the basics of estimation theory, including maximum likelihood and maximum a posteriori estimation, and linear/binary regression.

III. Course details

Instructor: Andrew S. Lan, andrewlan@cs.umass.edu; L01 and L02 will **NOT** be synced in any way
Office hours: CS Building Room 230, Wednesdays 5:00-6:00PM for the instructor, TBD for TAs
TAs: Alex Scarlatos (ajscarlatos@umass.edu), Nigel Fernandez (nigel@cs.umass.edu),
Zonghai Yao (zonghaiyao@umass.edu)
Class meeting time: TTh 10:00-11:15AM, Bartlett 65
Format: All course sessions will be in-person. Recordings of live sessions and other course videos will be uploaded to Echo360: https://echo360.org/section/34ecf5d3-96d3-42b2-b220-18c0161ef1df/home
Credits: 4 **Textbooks (optional)**:
Introduction to Probability, 2nd Edition by Dimitri P. Bertsekas and John N. Tsitsiklis
Discussion sessions: See your own schedule and https://www.cics.umass.edu/content/spring-24-course-schedule
Quizzes: Weekly, 1-2hrs On Canvas
Homeworks/Exam grading: Gradescope: https://www.gradescope.com/courses/725833 entry code VBRENJ
Submission: Late submissions will not be accepted unless for medical reasons. All quizzes/homeworks due midnight on the due date.
Support: TA office hours weekly TBA, Piazza: https://piazza.com/umass/spring2024/cs240, access code 931g3hqbf0t

IV. Grading

- 10 weekly quizzes, 10%
- 6 homeworks, 30%
- Midterm exam, 30%
- Final exam, 30%
- Grading scale: no exact numbers since I will curve: A: xx-xx%, A-: xx-xx%, B+: xx-xx%, B: xx-xx%, B-: xx-xx%, C+: xx-xx%, C: xx-xx%, C-: xx-xx%, D+: xx-xx%, D: xx-xx%, F: xx% and below

V. Tentative Schedule, Subject to Change

- Week 1: Intro, probability, conditional probability, total probability theorem, quiz 1
- Week 2: Bayes' rule, independence, counting, quiz 2, homework 1
- Week 3: Counting, random variables, common discrete random variables quiz 3
- Week 4: Expected value and variance, function of random variables, quiz 4, homework 2
- Week 5: Multiple random variables, continuous random variables, quiz 5
- Week 6: Common continuous random variables, joint probability density functions, quiz 6, homework 3
- Week 7: Covariance and correlation, quiz 7
- Spring break
- Week 8: Markov and Chebyshev bounds, central limit theorem, homework 4, in-class midterm exam on Mar. 28
- Week 9: Game theory, quiz 8
- Week 10: Markov chains, quiz 9, homework 5
- Week 11: Bayesian networks, quiz 10
- Week 12: Estimation theory, homework 6
- Week 13: Linear and binary regression
- Final exam (non-cumulative, May. 14)

VI. Accommodation Statement

The University of Massachusetts Amherst is committed to providing an equal educational opportunity for all students. If you have a documented physical, psychological, or learning disability on file with Disability Services (DS), you may be eligible for reasonable academic accommodations to help you succeed in this course. If you have a documented disability that requires an accommodation, please notify me within the first two weeks of the semester so that we may make appropriate arrangements.

VII. Academic Honesty Statement

Since the integrity of the academic enterprise of any institution of higher education requires honesty in scholarship and research, academic honesty is required of all students at the University of Massachusetts Amherst. Academic dishonesty is prohibited in all programs of the University. Academic dishonesty includes but is not limited to: cheating, fabrication, plagiarism, and facilitating dishonesty. Appropriate sanctions may be imposed on any student who has committed an act of academic dishonesty. Instructors should take reasonable steps to address academic misconduct. Any person who has reason to believe that a student has committed academic dishonesty should bring such information to the attention of the appropriate course instructor as soon as possible. Instances of academic dishonesty not related to a specific course should be brought to the attention of the appropriate department Head or Chair. Since students are expected to be familiar with this policy and the commonly accepted standards of academic integrity, ignorance of such standards is not normally sufficient evidence of lack of intent. See https://www.umass.edu/honesty/.