Probability Theory

Class: Tue, Thu 11:00 am - 12:20 pm, Room: A117

Instructors: Kyle Bradford, Hongshik Ahn, Joseph Mitchell

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Office Hours: Tue, Thu 1-3 pm, Tue, Thu 9:30-10:30 am, 2-3 pm or by appointment


Prerequisites: AMS 301 and 310 or permission of instructor.
Corequisites: MAT 203 or 205 or AMS 261

Chapters to be Covered: Chapters 1 through 8

Topics to be Covered: Combinatorial analysis; axioms of probability, conditional probability and independence; random variables; continuous random variables; jointly distributed random variables; properties of expectation; limit theorems

Homework: Assignments will be given weekly. No late homework will be accepted. The lowest two homework scores will be dropped before computing the average.

Homework Policy: You may discuss problems with other students, but you must write up your homework completely on your own. Your writings must be independent: Do not look at another writeup, either of classmate or of anything you found on internet when writing your own solution. To do otherwise is a case of Academic Dishonesty and is subject to University policy through CASA.

Tests
Exam I: Tuesday, March 28, in class
Exam II: Tuesday, May 2, in class
Final: Friday, June 16, 9:00-11:30 am. Room: TBD

Grading of Tests and Homework
Grading will be based on the following:
Homework (10%), midterms and final exam (30% each)
Any trend in your progress will also be taken into account.
If a student has more than 6 unexcused absence, the student’s final grade will be an F.
See Attendance on p3.
Learning Outcomes

1. Demonstrate an understanding of core concepts of probability theory and their use in applications:
   - experiments, outcomes, sample spaces, events, and the role of set theory in probability;
   - the axioms of probability and the theorems and their consequences;
   - using counting principles to calculate probabilities of events in sample spaces of equally likely outcomes;
   - independence and disjointness;
   - conditional probability;
   - the law of total probability and Bayes’ law;
   - the method of conditioning to solve problems;
   - Markov chains and associated conditioning arguments.

2. Demonstrate an understanding of the theory of random variables and their applications:
   - the difference between discrete random variables, continuous random variables, and random variables with hybrid distributions;
   - cumulative distribution functions and their properties;
   - probability mass functions for discrete random variables and computations to evaluate probabilities;
   - properties of commonly used discrete distributions, such as binomial, geometric, Poisson, and hypergeometric distributions;
   - probability density functions, computing them from cumulative distribution functions, and vice versa;
   - properties of commonly used density functions, such as uniform, exponential, gamma, beta, and normal densities;
   - means, variances, and higher moments of random variables, and their properties;
   - connections and differences between different distribution functions, e.g., normal approximation to binomial, Poisson approximation to binomial, and the difference between binomial and hypergeometric;
   - Markov and Chebyshev inequalities and utilizing them to give bounds and estimates of probabilities.

3. Demonstrate an understanding of the theory of jointly distributed random variables and their applications:
   - computations with joint distributions, both for discrete and continuous random variables;
   - computations with joint density functions and conditional density functions;
   - conditional expectation and conditioning arguments in computations involving two or more random variables;
   - computations with the bivariate normal distributions, the t-distribution, and chi-squared distributions, order statistics;
• applying indicator random variables to compute expectations;
• using moment generating functions in solving problems with sums of independent random variables;
• the weak and strong laws of large numbers;
• applying the central limit theorem in estimating probabilities.

Academic Integrity
Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person’s work as your own is always wrong. Faculty are required to report any suspected instances of academic dishonesty to the Academic Judiciary. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at http://www.stonybrook.edu/uaa/academicjudiciary/

School Policy on Attendance
1. If a student has over 20% unexcused absences, the student’s final course grade will be an F.
2. Students should report the reason of absence to the professor in advance, or immediately after the absence.
3. When a student excuses his/her absence, the student must provide documentation of the reason for the absence to the professor.
4. The professor of the course reserves the right to excuse absences.
5. The professor may excuse the absence if the submitted documentation fulfills the following conditions: extreme emergences, severe medical reasons with doctor’s note, very important events.

Critical Incident Management
Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students’ ability to learn.

Course Evaluations
Stony Brook University values student feedback in maintaining the high quality education it provides and is committed to the course evaluation process, which includes a mid-semester assessment as well as an end-of-the-semester assessment, giving students a chance to provide information and feedback to an instructor which allows for development and improvement of courses. Please click the following link to access the course evaluation system: http://stonybrook.campuslabs.com/courseeval/
## Tentative Course Schedule

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