STAT 410-0501 - Spring 2019

Course Syllabus

Course Title: **Introduction to Probability Theory**
Time and Place : **TuTh 12:30 - 1:45 PM, MTH 0106**
Textbook: Sheldon Ross, *A First Course in Probability*, 9-th edition, Prentice Hall, ISBN-13 978-0-321-79477-2
Instructor: **Prof. Abram Kagan**
Office: **MTH 2306, phone x5-5476**
Office Hours: **TuTh 11 AM - 12 (noon) or by appointment**
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Prerequisite: **MATH 240-241 or consent of the instructor**

STAT 410 (cross listed as SURV 410) is an introduction to basic concepts and results of probability theory presented with mathematical rigor and, thus, requires from the students certain math background. The students are expected to be relatively proficient at handling integration, transformations and limits. After discussing axioms of probability and properties of probability and conditional probability, I'll turn to random variables and vectors. They will be studied using the moment generating functions, a powerful tool that allows, among other things, to prove the Central Limit Theorem. Distributions of special interest (binomial, Poisson, multinomial, normal, gamma and a few more) will be studied in detail.
The students are responsible for all the material covered in class. Out of respect for other students please no food in the class.

Homework, tests, grading

Homework will be assigned and graded and represent 30% of the total score. Three 75 min exams will be given **tentatively** on Thursday, February 21, Tuesday, April 2, and Thursday, April 25, each representing 10% of the total score. Three quizzes will be given(their dates will be announced one week in advance) each representing 5% of the total score. The final exam represents the remaining 25% of the total. Its date will be announced once it is available.

A student who missed an exam/quiz and wants to take the make-up is required to submit a written explanation with supporting documents attached.

Topics to be covered:

- Sample space. Events, elementary events, algebra of events. Axioms of probability. Inclusion-Exclusion formula. Conditional probability. Bayes' Theorem. Independence (Weeks 1, 2, 3).
- Discrete random variables. Expected value and variance. Basic discrete distributions (binomial, hypergeometric, Poisson, negative binomial) (Weeks 4, 5, 6).
- Continuous random variables. Probability density function. Basic continuous distributions (uniform, normal, exponential, gamma). (Weeks 7, 8).
- Random vectors. Joint, marginal, and conditional distributions. The bivariate normal distribution (Weeks 9, 10).
- Expectation and variance of sums of random variables. Moment generating functions. Conditional expectation and prediction (Weeks 11, 12).
- Chebyshev's inequality, Markov's inequality, Chernoff's bounds, Jensen's inequality, the Law of Large Numbers (LLN), the Strong LLN, the Central Limit Theorem (Weeks 13, 14).
- Review and solution of sample problems (Week 15).