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STAT 421.01: Probability Theory

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Syllabus

Instructor: Brian Steele Office: Math 314
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Course Format: 3 lectures/week: MWF 10:10-11 (section 1: Math 311).

Course website: <http://www.math.umt.edu/Steele/Stat421>

Course Objectives: Present techniques and basic results of probability and mathematical statistics at a rigorous and advanced calculus level.

In Stat 421, we develop the probabilistic tools and language of mathematical statistics. The course describes probabilistic models for and properties of random variables and vectors, moments and common probability distributions. In the second semester course, Stat 422, the structure of statistical inference is studied. In particular, the theory of estimation, confidence sets and hypothesis testing for common parametric models are investigated.

Students taking the course must have completed a year long course in calculus and had some exposure to basic probability and statistics. Stat 421-422 is a required sequence for Master's and PhD students majoring in mathematics with statistics emphasis.

Learning Goals:

1. To understand the axiomatic approach to probability, counting and combinatorial methods, and Bayes' Theorem.
2. To understand random variables and their properties, including marginal and conditional distributions, expectation, conditional expectation, covariance and correlation, moment generating functions, and distributions of functions of one or more random variables.
3. To recognize and learn the properties of important probability distributions.
4. To gain the ability to prove results in probability.
5. To use statistical software to simulate random phenomena and to carry out probability computations for standard distributions.

Course Content: In Stat 421, we shall cover most, but not all of the material in chapters 1 through 6 of the text book.

1. Introduction to Probability: Sections 1.1-1.10
2. Conditional Probability: Sections 2.1-2.3
3. Random Variables and Distributions: Sections 3.1-3.9
4. Expectation: Sections 4.1-4.7
5. Special Distributions: Sections 5.1-5.10
6. Large Random Samples: Sections 6.1-6.4

Prerequisites: : Math 251 (multivariable calculus), Math 305, and Stat 341 (Introduction to Probability and Statistics) or consent of the instructor

Textbook: DeGroot and Schervish, *Probability and Statistics*, Fourth Edition, Addison Wesley 2012.

1. Hogg, McKean and Craig, *Introduction to Mathematical Statistics*, Sixth Edition, Prentice Hall 2005.
2. Mood, Graybill and Boes, *Introduction to the Theory of Statistics*, Third Edition, McGraw-Hill 1974. (available online : <http://www.e-booksdirectory.com/details.php?ebook=3627>).

Home work: There are two types of homework assignments. *Lecture exercises* are problems which arise while lecturing. Lecture exercises will be assigned as they occur (almost every class) and will be due next class meeting. *Major home works* are comprised of a set of problems that are assigned weekly and are usually due on Friday. Home works will not be accepted after the time that the solutions are posted or returned. Major homework problems designated *G* are for mathematics graduate students only and those designated *U* are for everyone except mathematics graduate students. Problems without a designation are for everyone. Some of the homework problems (lecture exercise or major) may be based on materials that are discussed in the book but not directly treated in class. Lecture exercises and major homework are to be submitted separately.

In the interest of covering the course topics, it may not be possible to entertain questions related to homework problems in class. However, I will be more than happy to assist you during office hours or by setting up an appointment. Homework assignments should be submitted on paper (electronic copies are acceptable if an exigency presents itself). Proofs and answers must be written in complete sentences. You are encouraged to work with others in the class but home works must be written up individually and should not be exact or near copies of other individuals' solutions.¹

Missed exams and home works: If you can't attend a class exam due to a documentable reason, please let me know as soon as possible. Home works will not be accepted after the time that the solutions are posted or returned. However, I will double count your previous or future graded assignments in the cases of excused absences.

Attendance: I expect you to attend class regularly. However, attendance and class participation will have only the obvious indirect bearing on your course grade.

Incomplete (I) Grades: Incompletes (I's) are given at the discretion of the instructor. See the 2009-2010 UM catalog for the conditions under which an incomplete may be given. Incompletes will not be given under any other circumstances.

Grading: Your final grade for this course will be given according to the +/- grading system and based on the weights shown to the right. The final exam will be cumulative.

Homework	25%
Exams (2)	50%
Final Exam	25%

There is no strict grading scale for this course; however, the table below shows a possible scenario for the letter grade breakdown in this course.

Grade	A- to A+	B- to B+	C- to C+	D- to D+	F	CR (Credit)
Percentage	90-100%	80-89%	68-79%	57-67%	Less than 57%	57-100%

¹Please staple pages. Staplers are available in the Math Dept. office.

Exams: There will be 2 exams during the semester during the weeks shown below. If you cannot make it to an exam, please let me know before the exam. No make-up exams will be given without a documented reason.

<u>Exam</u>	<u>Date</u>
I	First week of October
II	Third week of November

Final exam: The final exam will be cumulative with an emphasis on the material since Exam II. The scheduled time is Friday December 13 from 8:10-10:00; I will attempt to schedule an additional early and optional time for the final.

Extra credit: No extra credit will be offered to compensate for a low grade at any point during this course or after the course is complete.

Adding/dropping the course: Deadline to Add/Drop without petitioning: October 28. The last day to petition for a drop or change of grading options is December 6.

Academic Misconduct: All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University. All students need to be familiar with the Student Conduct Code. The Code is available for review online at <http://life.umn.edu/sa/documents/fromWeb/StudentConductCode1.pdf>.