

STT 441-001: Probability and Statistics I: Probability

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Room and Time: MWF 3:00PM-3:50PM, Wells Hall A126

Office Hours: M/F 1:45PM-2:45PM, or by appointment, in Wells Hall C423 (except during holidays and fall break).

Course Description: This is the first course in a two-course sequence on introductory probability and statistical inference for students with a calculus background. STT 441 covers the probability theory and modeling portion of the sequence at an intermediate mathematical level. Topics include basic probability, conditional probability and independence; random variables—discrete and continuous; univariate and multivariate distributions; expectation and its properties; moment generating functions; the (weak) law of large numbers; and the central limit theorem. The course will cover Chapters 1–8 of the textbook.

Textbook:

- Ross, Sheldon M. A First Course in Probability, 10th edition, ISBN 9780134753119, Copyright 2018.

Prerequisite: MTH 234 or MTH 254H or LB 220 or approval of college.

Course Details

Homework Assignments:

- There will be **eleven** homework assignments. The lowest score will be dropped.
- Homework is due at the beginning of class on Fridays (except HW11, which is due on Wednesday, 11/26) and must be submitted in **hard copy**.
- **No** late homework will be accepted.
- Show all work and circle the final answer for numerical questions. Please staple your homework in the correct order (the order in which the problems were assigned) before submitting it.
- Make sure that your name appears on every page, and that the assignment number is written on the first page.

Quizzes:

- There will be **two** 50-minute quizzes during the semester. Quizzes cover a much smaller scope than exams.
- Quiz questions will be based on homework problems and examples given in class.
- Quiz problems are categorized into four levels of difficulty, with the following weights in the total quiz score:
 - Level 1: 20%
 - Level 2: 20%
 - Level 3: 20%
 - Level 4: 40%
- There will be **no** make-up quizzes.
- All quizzes are **closed notes** and will be taken **in person** on the following dates in the classroom:

Quiz 1: 09/24; Quiz 2: 11/12

- 3-minute bonus quizzes (1% each) may be given at the end of some classes. These credits will be added to your quiz scores, but the total quiz score is capped at 30%.

Exams:

- There will be **one non-comprehensive 50-minute midterm** and **one cumulative 120-minute final exam**.
- Exam problems are categorized into four levels of difficulty, with the following weights in the total exam score:
 - Level 1: 20%

- Level 2: 20%
- Level 3: 20%
- Level 4: 40%
- There will be **no** make-up exams.
- All exams are **closed notes** and will be taken **in person** on the following dates in the classroom:

Midterm: 10/22; Final: 12/08.

Course Evaluation: eleven homework assignments (3% each; lowest score dropped, total 30%), two quizzes (10% each, plus extra credit from bonus quizzes, totaling up to 30%), one midterm exam (20%), and one final exam (30%).

The current plan is to categorize textbook examples, theoretical proofs, and homework problems into Levels 1–4, post the lists one week before Quiz 1, Quiz 2, the Midterm, and the Final. This plan is tentative and subject to change. Quizzes and exams may include extra-credit problems on advanced topics. The grades will be given roughly according to the following scheme:

Grade	Range
4.0	90% and above
3.5	80% - 89.99%
3.0	70% - 79.99%
2.5	65% - 69.99%
2.0	60% - 64.99%
1.5	55% - 59.99%
1.0	50% - 54.99%
0	0% - 49.99%

Summary of Score Components and Example Scenarios:

Component	Individual Weight	Total Weight
11 Homework Assignments	3% each	30% (lowest score dropped)
2 Quizzes	10% each	20%
Midterm Exam	20%	20%
Final Exam	30%	30%
Total	-	100%
3-minute Bonus Quizzes	1% each	TBD (added to quiz scores, but the total quiz score is capped at 30%)

Extra-Credit Problems on 2 Quizzes, the Midterm, and the Final	TBD	TBD
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The following are example cases for earning grades of 3.0, 3.5, and 4.0, respectively. If you lose points on homework assignments or miss many bonus quizzes, you will need to make up for them by earning higher scores on the more difficult problems in Quiz 1, Quiz 2, the Midterm, and the Final in order to achieve comparable final grades.

1) Example Case for a Grade of 3.0: When a student receives full credit for homework assignments, full credit on **all Level 1 problems** in the two quizzes, the midterm, and the final exam, and earns full extra credit from bonus quizzes (but no credit from any other components), the breakdown is as follows:

Component	Total Earned Score
11 Homework Assignments	30% (lowest score dropped)
2 Quizzes	4% (= 20% x 0.2)
Midterm Exam	4% (= 20% x 0.2)
Final Exam	6% (= 30% x 0.2)
Total	44%
3-minute Bonus Quizzes	26% (in addition to the 4% earned from Quizzes 1 and 2; the total quiz score is capped at 30%)
Extra-Credit Problems on 2 Quizzes, the Midterm, and the Final	0%
Final Score including Extra-Credit	70% (= 44% + 26%)

2) Example Case for a Grade of 3.5: When a student receives full credit for homework assignments, full credit on **all Level 1 and 2 problems** in the two quizzes, the midterm, and the final exam, and earns full extra credit from bonus quizzes (but no credit from any other components), the breakdown is as follows:

Component	Total Earned Score
11 Homework Assignments	30% (lowest score dropped)
2 Quizzes	8% (= 20% x 0.4)
Midterm Exam	8% (= 20% x 0.4)
Final Exam	12% (= 30% x 0.4)
Total	58%
3-minute Bonus Quizzes	22% (in addition to the 8% earned from Quizzes 1 and 2; the total quiz score is capped at 30%)
Extra-Credit Problems on 2 Quizzes, the Midterm, and the Final	0%
Final Score including Extra-Credit	80% (= 58% + 22%)

3) Example Case for a Grade of 4.0: When a student receives full credit for homework assignments, full credit on **all Level 1, 2, and 3 problems** in the two quizzes, the midterm, and the final exam, and earns full extra credit from bonus quizzes (but no credit from any other components), the breakdown is as follows:

Component	Total Earned Score
11 Homework Assignments	30% (lowest score dropped)
2 Quizzes	12% (= 20% x 0.6)
Midterm Exam	12% (= 20% x 0.6)
Final Exam	18% (= 30% x 0.6)
Total	72%
3-minute Bonus Quizzes	18% (in addition to the 12% earned from Quizzes 1 and 2; the total quiz score is capped at 30%)
Extra-Credit Problems on 2 Quizzes, the Midterm, and the Final	0%
Final Score including Extra-Credit	90% (= 72% + 18%)

Academic Honesty: The Department of Statistics and Probability adheres to the policies of academic honesty as specified in the General Student Regulations 1.0, Protection of Scholarships and Grades and in the All-University Policy on Integrity of Scholarship and Grades which are included in Spartan Life: Student Handbook and Resource Guide. Students who plagiarize will receive a grade 0.0 on the assignment or exam.

Accommodation for Students with Disabilities: Students with disabilities should contact the Resource Center for People with Disabilities at 517-884-RCPD or on the web at rcpd.msu.edu. If you are eligible for an accommodation, you will be issued a verified individual service accommodation (VISA) form. Please present this form to me at the start of the term or two weeks prior to the accommodation date.

Diversity Statement: I am committed to fostering a learning environment that respects and embraces diversity in all its forms. Our classroom is a space where everyone, regardless of race, ethnicity, gender, sexual orientation, religion, age, disability, socioeconomic status, or background, is valued and heard. I consider it part of my responsibility as an instructor to address the learning needs of all students in this course. It is also the responsibility of all students to exhibit professional courtesy and respect for all members of the class. The course materials and discussions are intended to be respectful of social identities. Any suggestions that you have about other ways to incorporate diverse experiences in the course materials or discussions are welcome. Together, we can create a classroom environment that not only values diversity but also actively leverages it to enhance our collective learning experience.

Statistics Learning Center:

- The Statistics Learning Center (SLC) will be delivered through in-person only in Wells Hall D101.
- **What can students expect from the tutors at SLC?** - SLC service exists and is designed to supplement a student's learning and comprehension of classroom material. It is not a substitute for attending lectures and recitation meetings. SLC tutors will not check the homework answers or solve the homework problems for students.

Students should go to SLC with specific questions after having done their best to find the answers in the course lectures and other learning materials. Students should be aware that the SLC tends to be crowded in the hours just before assignments are due and before exams. Students should go early to get more attention and to have more time to ask questions.

- Check further details at <https://stt.natsci.msu.edu/academics/statistics-learning-center-1.aspx>

Disclaimer: The instructor reserves the right to make any changes considered academically advisable. Changes will be announced in class. It is your responsibility to keep up with any changed policies.

Weekly Schedule: Details can change.

Week	Date	Topic	Remark
1	08/25 (M)	Orientation (Course logistics) 1.1. Introduction 1.2. The Basic Principle of Counting	
	08/27 (W)	1.3. Permutations 1.4. Combinations (Part 1)	
	08/29 (F)	1.4. Combinations (Part 2) 1.5. Multinomial Coefficients	HW01 released
2	09/01 (M)	Holiday – University Closed	
	09/03 (W)	2.1. Introduction 2.2. Sample Space and Events	
	09/05 (F)	2.3. Axioms of Probability	HW01 due (beginning of class); HW02 released
3	09/08 (M)	2.4. Some Simple Propositions	
	09/10 (W)	2.5 Sample Spaces Having Equally Likely Outcomes 2.7. Probability as a Measure of Belief	
	09/12 (F)	3.1. Introduction 3.2. Conditional Probabilities (Part 1)	HW02 due (beginning of class); HW03 released
4	09/15 (M)	3.2. Conditional Probabilities (Part 2)	
	09/17 (W)	3.3. Bayes's Formula (Part 1)	
	09/19 (F)	3.3. Bayes's Formula (Part 2) 3.4. Independent Events (Part 1)	HW03 due (beginning of class)

5	09/22 (M)	3.4. Independent Events (Part 2) 3.5. $P(\cdot F)$ Is a Probability	
	09/24 (W)	Quiz 1 (50 mins)	Quiz 1: 1.1. ~ 2.7.
	09/26 (F)	4.1. Random Variables 4.2. Discrete Random Variables	HW04 released
6	09/29 (M)	4.3. Expected Value 4.4. Expectation of a Function of a Random Variable (Part 1)	
	10/01 (W)	4.4. Expectation of a Function of a Random Variable (Part 2) 4.5. Variance	
	10/03 (F)	4.6. The Bernoulli and Binomial Random Variables	HW04 due (beginning of class); HW05 released
7	10/06 (M)	4.7. The Poisson Random Variable (Part 1)	
	10/08 (W)	4.7. The Poisson Random Variable (Part 2)	
	10/10 (F)	4.8. Other Discrete Probability Distributions	HW05 due (beginning of class); HW06 released
8	10/13 (M)	4.9. Expected Value of Sums of Random Variables 4.10. Properties of the Cumulative Distribution function	
	10/15 (W)	5.1. Introduction	
	10/17 (F)	5.2. Expectation and Variance of Continuous Random Variables	HW06 due (beginning of class)
9	10/20 (M)	Fall Break	
	10/22 (W)	Midterm Exam (50 mins)	Midterm Exam: 3.1.~ 4.10.
	10/24 (F)	5.3. The Uniform Random Variables 5.4. Normal Random Variables (Part 1)	HW07 released
10	10/27 (M)	5.4. Normal Random Variables (Part 2)	
	10/29 (W)	5.5. Exponential Random Variables 5.6. Other Continuous Distributions (Part 1)	
	10/31 (F)	5.6. Other Continuous Distributions (Part 2) 6.1. Joint Distribution Functions (Part 1)	HW07 due (beginning of class); HW08 released
11	11/03 (M)	6.1. Joint Distribution Functions (Part 2) 6.2. Independent Random Variables	
	11/05 (W)	6.3. Sums of Independent Random Variables 6.4. Conditional Distributions: Discrete Case	
	11/07 (F)	6.5. Conditional Distributions: Continuous Case 6.6. Order Statistics	HW08 due (beginning of class)
12	11/10 (M)	7.1. Introduction	

		7.2. Expectation of Sums of Random Variables (Part 1)	
	11/12 (W)	Quiz 2 (50 mins)	Quiz 2: 5.1. ~ 5.6.
	11/14 (F)	7.2. Expectation of Sums of Random Variables (Part 2) 7.4. Covariance, Variance of Sums, and Correlations (Part 1)	HW09 released
13	11/17 (M)	7.4. Covariance, Variance of Sums, and Correlations (Part 2)	
	11/19 (W)	7.5. Conditional Expectation (Part 1)	
	11/21 (F)	7.5. Conditional Expectation (Part 2)	HW09 due (beginning of class); HW10 released
14	11/24 (M)	7.7. Moment Generating Functions	
	11/26 (W)	8.1. Introduction 8.2. Chebyshev's Inequality and the Weak Law of Large Numbers (Part 1)	HW10 due (beginning of class); HW11 released
	11/28 (F)	Holiday – University Closed	
15	12/01 (M)	8.2. Chebyshev's Inequality and the Weak Law of Large Numbers (Part 2)	
	12/03 (W)	8.3. The Central Limit Theorem (Part 1)	
	12/05 (F)	8.3. The Central Limit Theorem (Part 2)	HW11 due (beginning of class)
16	12/08 (M)	Final Exam (120 mins): 3:00PM – 5:00PM (Wells Hall A126)	Final Exam: All course content