

MA41600-002/STAT41600-002 SUMMER 2025 COURSE SYLLABUS

Course Information

1. MA 41600 (STAT 41600) – Probability
2. CRN: 30245 (30246)
3. Course Description: An introduction to mathematical probability suitable as a preparation for actuarial science, statistical theory, and mathematical modeling. General probability rules, conditional probability and Bayes theorem, discrete and continuous random variables, moments and moment generating functions, joint and conditional distributions, standard discrete and continuous distributions and their properties, law of large numbers and central limit theorem.
4. Credit Hours: 3.00.
5. Prerequisites: Multivariate Calculus: Undergraduate level MA 26100 Minimum Grade of C- or Undergraduate level MA 17200 Minimum Grade of C- or Undergraduate level MA 26300 Minimum Grade of C- or Undergraduate level MA 17400 Minimum Grade of C- or Undergraduate level MATH 26100 Minimum Grade of C- or Undergraduate level MA 18200 Minimum Grade of C- or Undergraduate level MA 27100 Minimum Grade of C- or Undergraduate level MA 27101 Minimum Grade of C-.

Instructors Contact Information

Instructor: Steven Lancette

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Office: MATH 845 / Zoom

Office Hours: 2-3, M-F, June 16-August 5; Zoom, by appointment

Learning Resources, Technology & Texts

- **Students must have a reliable computer and stable internet access. In general, extensions won't be granted due to technical issues.**
- Required text – NONE. Materials will be provided online.
- Multiple texts (free or Purdue access) posted or linked in Brightspace.
- Other common texts at a similar level
 - Sheldon Ross, *A First Course in Probability*. Chapters 1-8. The text typically used at Purdue for MA 41600 (STAT 41600).
 - Robert Hogg, Elliot Tanis, Dale Zimmerman, *Probability and Statistical Inference*. Chapters 1-5. A text commonly used for a two-semester sequence in probability and statistical inference.
 - Both texts (among others) are on the readings list for the SOA P exam.

Course Learning Objectives

1. Core Probability Concepts: Students will be able to precisely define and distinguish between essential concepts in probability, including sample spaces, outcomes, events, and probability (axiomatic).
2. Set Theory in Probability: Students will apply set theory to probability, using concepts such as unions, intersections, complements, and mutual exclusivity to analyze events and compute probabilities.
3. Conditional Probability and Independence: Students will derive and apply the formulas for conditional probability, the law of total probability, and Bayes' Rule, demonstrating an understanding of independent events through both definitions and examples.
4. Random Variables: Students will identify and define both discrete and (absolutely) continuous random variables, their probability mass functions (PMFs – discrete) and probability density functions (PDFs – continuous), and understanding their role in probabilistic modeling.
5. Key Named Probability Distributions: Students will analyze and compare the properties of fundamental probability distributions (e.g., Bernoulli, Binomial, Poisson, Uniform, Exponential, Normal), including their cumulative distribution functions (CDFs) and characteristics.
6. Expectations and Moments: Students will compute expected values, variances, and higher-order moments for random variables, developing an understanding of their significance in describing distributions.
7. Transformations of Random Variables: Students will learn how to derive the distributions of functions of random variables, including finding the distribution of sums and differences of random variables through techniques such as the moment-generating function.
8. Joint Distributions (and Independence): Students will study joint, marginal, and conditional distributions for multiple random variables, learning how independence among variables affects these distributions.
9. The Law of Large Numbers: Students will explore both the Weak and Strong Law of Large Numbers, providing a rigorous understanding of convergence concepts and their implications in probabilistic scenarios.
10. The Central Limit Theorem: Students will apply the Central Limit Theorem, emphasizing its conditions and implications for the distribution of sums (and averages) of random variables.

Grades

The following table represents the floor for grades that a student will receive. Final course grades may be more generous, but will not be worse.

Letter Grade	Score Interval (%)	Letter Grade	Score Interval (%)	Letter Grade	Score Interval (%)	Letter Grade	Score Interval (%)
A+	[97,104.5]	B+	[87,90)	C+	[77,80)	D+	[67,70)
A	[93,97)	B	[83,87)	C	[73,77)	D	[63,67)
A-	[90,93)	B-	[80,83)	C-	[70,73)	D-	[60,63)
						F	[0,60)

Points will be earned via the following assessments and according to their percentage of the final grade.

SOURCE	PERCENT
HW (Automated)	6
HW (Gradescope)	18 (22.5% possible)
HW (Zoom, Live Student Demo)	10
Exams	30
Final Exam	36

HW (Automated):

- There will be six online homeworks that will cover definitions and basic (but essential) computations.
- In Variate, unlimited attempts.

HW (Gradescope):

- There will be thirty (30) homeworks that will be submitted and graded via Gradescope.
- Each HW will consist of roughly 3 problems.
- There will be a HW due most class days (M-F, not holiday, not exam day).
- Grading will be primarily on the clarity, correctness, and completeness of the solution (i.e., the **work** and its **presentation**).
- Detailed solutions will be posted for a HW soon after its deadline, so no extensions will be possible.
- There are 300 possible points. For full category score 240 points are required. That is, perfect scores on all 30 HW would result in 125% in the category. Equivalently stated, the **maximum percentage for the course is 104.5%**.
- For a HW assignment to be excused (imputed with average score at end of semester), the documented reason must generally be at the ODOS excused absence level.

HW (Zoom, Live Student Demo): Two times during the semester (once in weeks 2-4, once in weeks 5-7), the student will present a solution to a new (but related to content that has already been covered (e.g., Gradescope HW)) probability problem. So, something of an individualized zoom quiz.

- The student will need to choose a time slot (schedule will be up a week before the block of Zoom demos (so at start of semester for the first)).
- The student will need a reliable computer with a stable internet connection.
- A microphone.
- The student will need to be able to present both themselves and their work (second web cam, doc cam or tablet to show work, a whiteboard and a good enough camera to show both the student and their work on the whiteboard, ...)

Exams: There will be three (3) exams each worth 10% of the final grade.

- Exams will be in Gradescope (download/upload).
- There will be a 24-hour exam window in which the exam can be taken.
- Only passive resources may be used (e.g., course notes). No outside help from people, AI, HW assistance sites (when in doubt, assume it is not allowed).

- Exam 1 (core probability concepts, roughly equivalent of Ross chapters 1-3). After week 2, tentatively Tuesday, July 1st.
- Exam 2 (random variables, roughly equivalent of Ross chapters 4-5). After week 4, tentatively Tuesday, July 15th.
- Exam 3 (transformations of random variables). After week 6, tentatively Tuesday, July 29th.

Final Exam: The final exam counts for 36% of the final grade.

- The final exam will be comprehensive (material covered on exams 1-3 plus material covered after exam 3).
- The final will be paper-and-pencil, two hours long.
- You are not permitted to use calculators, books, notes, electronic devices, websites, or to consult a peer or any other person on the exams.
- You are required to find a proctor for your exam (**subject to verification and approval** by the 41600 instructor). The proctor **cannot** be a family member, a cohabitant, an employee, or a close friend.
- Recommended proctor options include, but are not limited to, library staff, community or area learning center staff, university/college/institute education staff, human resource staff, workplace supervisor, and testing center staff.
- Proctor instructions, along with an online proctor form via Qualtrics, will be accessible on the Brightspace course page starting from the first day of class. In particular, the proctor will need internet access, need to print off an exam, scan it once complete, and upload to portal.
- An option to take the exam on campus (PWL) will be provided.
- The exam will be taken in a 24-hour window of time starting on Wednesday, August 6.

The Use of Artificial Intelligence

Students may use artificial intelligence tools to help them understand the course material (e.g., to generate additional examples for study). While AI tools that may help students learn the subject, they should be careful about using these resources and make sure they are getting correct information.

Moreover, no electronic assistance devices of any kind are allowed during the final exam.

Quiet Period

Per university regulations, the week preceding the final exams week is designated as the "Quiet Period." During this time, no assignments (including homework) can be assigned or collected, unless your course has no exams scheduled for the final exam week. Further details regarding this policy can be found at:

<https://catalog.purdue.edu/content.php?catoid=16&navoid=19719#c-quiet-period>

For our course, the "Quiet Period" is Saturday, August 2 to Tuesday, August 5.

Important Dates

Students should *consult the academic calendar to find information about important dates, such as the last day to withdraw from the course, etc. Other important dates are*

1. *Classes begin Monday, June 16*
2. *Independence Day (no class)—Friday, July 4*
3. *Exam 1 – Date (tentatively July 1)*
4. *Exam 2 – Date (tentatively July 15)*
5. *Exam 3 – Date (tentatively July 29)*
6. *Quiet Period—Sunday, August 3 – Tuesday, August 5*
7. *Final Exam—Wednesday, August 6.*
8. *Term ends—Friday, August 8*
9. *Grades due to the Registrar—Tuesday, August 12*
10. *Students should consult the academic calendar regarding the last days to add or drop a class.*

Accessibility

Purdue University strives to make learning experiences accessible to all participants. If you anticipate or experience physical or academic barriers based on disability, you are encouraged to contact the Disability Resource Center at: drc@purdue.edu or by phone at 765-494-1247.

If you have been certified by the Disability Resource Center (DRC) as eligible for accommodations, you should contact your instructor to discuss your testing accommodations as soon as possible. You should make sure you send your Course Accessibility Letter to your instructor. Instructions for how to do this can be found at: <https://www.purdue.edu/drc/students/course-accessibility-letter.php>

Nondiscrimination Statement

Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life.

Medically Excused Absence Policy (MEAPS)

MEAPS joins Grief/Bereavement, Military Service, Jury Duty and Parenting Leave as specific situations with university-defined procedures and instructor/student expectations. Consult the **university regulations on class attendance** for specific details. This policy is intended for emergent care only and those to pose a serious threat to the health of a student (e.g., serious burns, seizures, severe cuts requiring stitches, broken/dislocated limbs or joints, head injuries). **Note that urgent care visits are no longer included in this policy.** The Office of the Dean of Students will not provide notes to instructors for primary care medical appointments or routine care.

Students are encouraged to speak with their instructors regarding other situations. Only your instructor can excuse absence under situations not covered by MEAPS. Instructors will decide if and how students can make up missed work.

Mental Health Statement

If you find yourself beginning to feel some stress, anxiety and/or feeling slightly overwhelmed, try WellTrack. Sign in and find information and tools at your fingertips, available to you at any time.

If you need support and information about options and resources, please contact or see the Office of the Dean of Students. Call 765-494-1747. Hours of operation are M-F, 8 am- 5 pm.

If you find yourself struggling to find a healthy balance between academics, social life, stress, etc. sign up for free one-on-one virtual or in-person sessions with a Purdue Wellness Coach at RecWell. Student coaches can help you navigate through barriers and challenges toward your goals throughout the semester. Sign up is completely free and can be done on BoilerConnect. If you have any questions, please contact Purdue Wellness at evans240@purdue.edu.

If you're struggling and need mental health services: Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of mental health support, services are available. For help, such individuals should contact Counseling and Psychological Services (CAPS) at 765-494-6995 during and after hours, on weekends and holidays, or by going to the CAPS office of the second floor of the Purdue University Student Health Center (PUSH) during business hours.

Emergency Preparation

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor's control. Relevant changes to this course will be posted onto the course website. You are expected to read your @purdue.edu email on a frequent basis.

Related Considerations and Guidelines.

Emergency preparedness is your personal responsibility. Purdue University is actively preparing for natural disasters or human-caused incidents with the ultimate goal of maintaining a safe and secure campus. Let's review the following procedure:

- For any emergency text or call 911.
- There are more than 300 Emergency Telephones (aka blue lights) throughout campus that connect directly to the Purdue Police Department (PUPD). If you feel threatened or need help, push the button and you will be connected right away.

- If we hear a fire alarm, we will immediately evacuate the building. Do not use the elevator. Go over the evacuation route (see specific Building Emergency Plan).
- If we are notified of a Shelter in Place requirement for a tornado warning we will stop classroom or research activities and shelter in the lowest level of this building away from windows and doors.
- If we are notified of a Shelter in Place requirement for a hazardous materials release, we will shelter in our classroom shutting any open doors and windows.
- If we are notified of a Shelter in Place requirement for an active threat such as a shooting, we will shelter in a room that is securable preferably without windows.
- **(NOTE: Each building will have different evacuation & shelter locations. The specific Building Emergency Plan will provide specific locations and procedures)**