

Worcester Polytechnic Institute
Department of Mathematical Sciences
Professor: Stephan Sturm
Teaching and Peer Learning Assistants: Sara Amato, Will Folan

Spring 2024 - D Term

MA 2621

Probability for Applications

Sections DL01 / DD01–03

Syllabus

1. **Contact & student hours:** All student (office) hours are open to all students, irrespectively of their section. Please come with your questions or also if you want to hear the questions of others. These times are reserved for **YOU!**

Stephan Sturm

Salisbury Labs 405B

(508) 831-59 21

ssurm@wpi.edu

Monday, 5:00–5:50pm,

Tuesday, 2:00–2:50pm

Thursday, 2:30–3:20pm,

Friday, 2:00–2:50pm

and upon request via <https://calendly.com/ssurm-2>

<https://users.wpi.edu/~ssurm/>

Sara Amato (DD01 & DD03)

samato@wpi.edu

Monday 3:00–3:50pm in SL 412

Thursday 2:00–2:50pm in SL 412

Math Tutoring Center (Gordon Library, room 302): Wednesday 12:00–2:00pm

Will Folan (DD02)

wtfolan@wpi.edu

Tuesday 12:00–12:50pm over zoom: <https://wpi.zoom.us/j/98985778088>

Math Tutoring Center (Gordon Library, room 302): Thursday 12:00–1:00pm

2. Class and discussion:

Lecture:	DL01	Mon, Tue, Thu, Fri,	4:00–4:50pm,	Fuller Labs, LPH
Discussions:	DD01	Thu,	1:00–1:50pm,	Portable Classroom
	DD02	Thu,	2:00–2:50pm,	Portable Classroom
	DD03	Thu,	3:00–3:50pm,	Portable Classroom

In the case of inclement weather, lectures might be moved to zoom. In that case a decision will be made by noon (class) or midnight (discussions) before the class and announced via Canvas.

3. Textbooks (recommended):

No book is required for the class, class material (slides and videos) is available for download on Canvas. I will post empty slides (to fill in) before class, and will add after class the slides from class as well as a typed version. For those who want to have a little bit a deeper look (and in particular more exercises), I recommend the following two books

Rick Durrett, *Elementary Probability for Applications*. Cambridge University Press, 2009. ISBN 978-0-521-86756-6

A draft for the (upcoming) third edition available at

https://services.math.duke.edu/~rtd/EP4A/EP4A_April2021.pdf

Matthew A. Carlton, Jay L. Devore, *Probability with Applications in Engineering, Science, and Technology*. Second Edition. Springer, 2017. ISBN 978-3-319-52400-9

Available for free via the Gordon Library <https://link-springer-com.ezpv7-web-p-u01.wpi.edu/book/10.1007/978-3-319-52401-6>

For those who want also understand the rigorous proofs behind probability, I will also share my lecture notes for MA 2631 Probability Theory via Canvas.

4. Videos: The class will be captured on Echo 360, the recordings can be found on Canvas.

5. Expectations:

The time spent in class is a **small** fraction of the time you should work for the class. WPI expects about 17h work for a 1/3 unit course (as MA 2621 Probability for Applications) for the *average* student. As the organized part consists of 4h class instruction per week, it follows that 13h / week are expected for work **outside** the classroom: revision, discussions, student hours, **homework**, preparation.

6. Resources:

- The learning management system for the course is Canvas, <https://canvas.wpi.edu/courses/58384/>. Homework, lecture notes and videos will be posted there. Solutions to homework problems will not be published, but students who do not understand the problem after receiving the graded homework are *highly encouraged* to discuss it in office hours and discussions sessions (please let your TA/PLA know in advance that you want to discuss a specific problem that they can prepare for it). Problems that are challenging to many students might be discussed in a special video upon several students' request.
- A discussion forum will be hosted on piazza, <https://piazza.com/wpi/spring2024/ma2621>. The forum supports different formatting options, and in particular the inclusion of mathematical symbols via L^AT_EX. See <https://piazza.com/help/formatting.html> for the general formatting guidelines and <https://en.wikibooks.org/wiki/LaTeX/Mathematics#Symbols> for a list of commands for specific symbols. While discussions (also about homework) are encouraged, please refrain from giving complete solutions of homework questions. Providing hints is okay, an entire solution is *dishonest* and will be treated as violation of the academic honesty policy, see 11. Instructors will endorse correct student answers and provide only answers if there is no student answer given in reasonable time. Feel free to ignore the requests for contributions on piazza!
- Grades will be posted on Canvas
- The Math Tutoring Center, <https://wpi.edu/+mtc> in the Gordon Library, Room 302, is available Monday-Thursday 10:00am–6:00pm and Friday 10:00am–2:00pm.
- Both individual peer tutoring and Math and Science Help (MASH, group drop-in tutoring) will be offered in person in the Academic Resources Center (ARC), located on the 5th floor of Unity Hall. Some MASH sessions that occur after 6pm may take place in the Exam Proctoring Center (EPC, UH 505). Tutoring sessions are 50 minutes long and are facilitated by peer undergraduate students. Tutoring availability is dependent on tutor's schedules within the ARC hours of operation. Students should use tutortrac.wpi.edu to sign up for individual tutoring appointments that fit their schedule. Students are encouraged to schedule 1-on-1 appointments in advance. No appointments are needed for MASH group drop-in sessions. If a student has a scheduling conflict, they can submit an ARC Tutoring Inquiry Form ([Bit.ly/ARCTutor](http://bit.ly/ARCTutor)) to seek an appointment that aligns with their schedule. Students should only submit this form if all available tutoring slots do not work with their schedule. The form is not intended for the purpose of to request next day tutoring. While we work to accommodate an alternative tutoring time, alternative availability is not guaranteed.

D Term 2024 tutoring will begin on Wednesday March 13, 2024 and end on Monday April 29, 2024. There will be no tutoring on March 26, 2024; April 15, 2024; and April 19, 2024. Further information about MASH and tutoring offered by the ARC are located on the [Academic Resources Center Canvas Page](#) and on the [Academic Advising and Academic Resources Center WPI Webpage](#).

7. **Help:**

You have not only the possibility to ask for help, you are encouraged to do so. However, it is expected that you invest a major effort (i.e., several hours of work) in your work and you provide an explanation about what you have done and tried so far. Sources for help are in particular.

- Discussion session
- Discussions with peers
- Online discussions on piazza
- Office hours by the professor (best for fundamental questions about the material learned)
- Office hours by the TA/PLA (best for questions concerning homework problems)
- Math Tutoring Center
- ARC/MASH Peer Tutoring

Questions per email about the mathematical content of class are **explicitly discouraged**, please post instead your questions on piazza (you can do this anonymously or semi-anonymously). In this way not only you, but all your classmates can learn from your questions, so this is beneficial for everybody. (If you have personal questions, of course please reach out to instructors per email.)

8. **Course description** as per course catalog:

This course is designed to introduce the student to probability. Topics to be covered are: basic probability theory including Bayes theorem; discrete and continuous random variables; special distributions including the Bernoulli, Binomial, Geometric, Poisson, Uniform, Normal, Exponential, Chi-square, Gamma, Weibull, and Beta distributions; multivariate distributions; conditional and marginal distributions; independence; expectation; transformations of univariate random variables.

Recommended background: Multivariable Differential and Integral Calculus (MA 1024, or equivalent). We will extensively use material from Calculus III and IV in this class.

Note: This course is designed primarily for students interested in applications and not major in in the Mathematical Sciences department. Mathematical Sciences and Actuarial Mathematics majors and those interested in the deeper mathematical issues underlying probability theory are encouraged to take MA 2631 Probability Theory instead. Undergraduate credit may not be earned both for this course and for MA 2631 Probability Theory.

9. **Preliminary course outline:**

Topic 1: Rules of Probability, Combinatorial Probability

Topic 2: Independence

Topic 3: Discrete random variables & their distributions

Topic 4: Continuous random variables & their distributions

Topic 5: Joint distributions

Topic 6: Limit theorems

Topic 7: Conditional Probability and Markov Chains or Information Theory – tentative, if time permits

10. **WeBWorK:** WeBWorK aim to practice your calculation skills in probability. There will be eleven (11) WeBWork problem sets per week. The links to WeBWorK problems will be posted on Canvas. You will have up to ten attempts to solve a given problem.

WeBWork due dates: Friday 03/15, Tuesday 03/19, Friday 03/22, Thursday 03/28, Monday 04/01, Thursday 04/04, Monday 04/08, Thursday 04/11, Tuesday 04/16, Monday 04/22, Thursday 04/25

11. **Homework:** (Written) homework problem aims to test your conceptual understanding of probability. There will be five written homeworks in total. The problem sets will be posted on Canvas. Written homework problems will be submitted via Canvas, as **single .pdf file per homework** (there are many free apps that allow to scan work on paper on a phone into a single pdf document, if you need help with this please ask).

Homework due dates: Thursday 03/21, Friday 03/29, Tuesday 04/09, Friday 04/19, Wednesday 05/01

Guidelines:

- The homework submission has not only to contain the result, but carefully developed calculations and proofs that can actually be followed by a reader.
- Whereas the discussion of homework problems in (small) groups is not only okay but encouraged, the final write-up has to be done individually. Any copying of homework is a violation of the academic honesty policy (see below) and will be treated as such.

12. **Projects:** The projects will be devoted to more independent explorations of applications of probability. They will be done in groups up to four students, set up by the instructor at the beginning of the term. If projects are done as group, they will have to contain a contributions section that details the work done by each group member. There will be four projects in total.

Due dates of the projects will be Monday 03/25, Thursday 04/05, Tuesday 04/18, Friday 04/26,

13. **Quizzes:** The in-class quizzes are regular checks for comprehension. There will be six quizzes, each of them 10 minutes, with the lowest grade being dropped.

Dates of the quizzes will be Tuesday, 03/19, Thursday 03/28, Thursday 04/04, Friday 04/12, Tuesday 04/23, Monday 04/29.

14. **Late submission & makeup policy:** There is no late submission option for WeBWork. Up to three (3) late submissions of written homework or projects are allowed without cause. However, as these should not be accidents but results of intentional planning, the extensions of the deadline will be granted **ONLY** as long as they are requested per email at least 24 hours in advance to the professor **and** TA/PLA. All other late written homework/projects (when submitted before the corrected work of the other students are returned) will be graded with a reduction by 50% of the points. There are no makeup quizzes (but you can miss one quiz, as it will be automatically dropped). This excludes of course extenuating circumstances such as long, severe illness, in which case you contact the instructors as soon as possible.

15. **Grading:** The total score will be composed from the individual scores by using the following weighting:

- 15% WeBWork problem sets — lowest result will be dropped
- 30% Written homework
- 40% Projects
- 10% Quizzes
- 5% Active participation (in class, discussion session or via piazza)

The achievement of the following total score will be sufficient for the stated letter grades:

- A 90%
- B 75%
- C 60%

16. **Electric Recordings:** If you wish to record any meeting (from class to office hour), you will have to ask all participants for permission and can do so only if permission is granted. All recordings are for strictly for personal use only and any distribution is not permitted.

17. **Students with Accessibility Needs:** Students with approved academic accommodations should plan to submit their accommodation letters through the Office of Accessibility Services Student Portal. Should you have any questions about how accommodations can be implemented in this particular course, please contact us as soon as possible. Students who are not currently registered with the Office of Accessibility Services (OAS) but who would like to find out more information regarding requesting accommodations and what that entails should plan to contact them via email: AccessibilityServices@wpi.edu, by phone (508) 831-4908, or by stopping by the office on the 5th floor of Unity Hall.
18. **Academic Honesty:** Each student is expected to familiarize him/herself with WPI's Academic Honesty policies which can be found at <https://www.wpi.edu/about/policies/academic-integrity/dishonesty>. All acts of fabrication, plagiarism, cheating, and facilitation will be prosecuted according to the university's policy. If you are ever unsure as to whether your intended actions are considered academically honest or not, please contact your instructor in advance. Further information is available via <https://www.wpi.edu/about/policies/academic-integrity>. Let us highlight in particular the definition of plagiarism:

Plagiarism: Using as one's own the words, ideas, data, code, or other original academic material of another without providing proper citation or attribution. Plagiarism can apply to any assignment, including final or drafted copies. Examples include, but are not limited to:

- Misrepresenting the work of another as one's own,
- Inaccurately or inadequately citing sources,
- Paraphrasing (using the ideas of others in your own words) without citation.

Note that this includes in particular the use of generative learning AI models such as ChatGPT. If you use such tools you will have to provide both prompt and answers received as an appendix (as well as check the claims independently!).

19. **Further Resources:** Even the best of learners need help along the way. WPI has some great resources to support you in this class and beyond. Here are some to check out:

- Academic Resource Center, <https://www.wpi.edu/student-experience/resources/academic-resources-center>
- IT Service & Support, <https://www.wpi.edu/offices/services-support>
- Student Development and Counseling Center, <https://www.wpi.edu/offices/student-development-counseling-center>
- Accessibility Services, <https://www.wpi.edu/offices/office-accessibility-services>
- Health Services, <https://www.wpi.edu/student-experience/health-counseling/health-services>
- Office of Diversity, Inclusion, and Multicultural Education (ODIME), <https://www.wpi.edu/offices/diversity>
- LGBTQAP+ Support, <https://www.wpi.edu/student-experience/resources/lgbtq-support>
- International House, <https://www.wpi.edu/offices/international-house>