Worcester Polytechnic Institute   Spring 2023 - D Term
Department of Mathematical Sciences
Professor: Stephan Sturm
Teaching and Peer Learning Assistants: Dane Johnson, Frederick "Forrest" Miller

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

   Stephan Sturm
   Salisbury Labs 405B   (508) 831-59 21
   ssturm@wpi.edu
   Monday, 5:00–5:50pm,
   Tuesday, 12:00–12:50pm
   Thursday, 1:00–1:50pm,
   Friday, 3:00–3:50pm
   and upon request via https://calendly.com/ssturm-2
   https://users.wpi.edu/~ssturm/

   Dane Johnson* (DD01 & DD02)
   djohnson3@wpi.edu
   Monday, 12:00–12:50pm in Salisbury Labs 412
   Wednesday 11:00–11:50am in Stratton Hall 306
   Math Tutoring Center: Monday 1:00–3:00pm

   Frederick "Forrest" Miller* (DD03)
   fimiller@wpi.edu
   Wednesday, 4:00–4:50pm in Stratton Hall 014
   Math Tutoring Center: Thursday 2:00–3:00pm

2. **Class and discussion:**

Lecture:	DL01	Mon, Tue, Thu, Fri,	4:00–4:50pm,	Fuller Labs, UPH
Discussions:	DD01	Wed,	9:00–9:50am,	Stratton Hall 106
	DD02	Wed,	10:00–10:50am,	Stratton Hall 106
	DD03	Wed,	12:00–12:50pm,	Stratton Hall 306

   In the case of inclement weather, lectures might be moved to zoom. In that case a discussion 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. 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.* Springer, 2014. ISBN 978-3-319-52400-9
   Available for free via the Gordon Library
   https://link.springer.com/book/10.1007%2F978-3-319-52401-6

   For those who want also understand the rigorous proofs behind probability, I will also shae 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/44391. 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/spring2023/ma2621. The forum supports different
  formatting options, and in particular the inclusion of mathematical symbols via
  LaTeX. 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.

- Peer tutoring and Math and Science Help (MASH) will be offered in person by the
  Academic Resources Center (ARC) tutors in D term on the 5th floor of Unity Hall
  in the ARC or the Exam Proctoring Center (EPC, UH 505). Individual tutoring
  will be available from 10am-9pm Mondays through Thursdays, 10am-5pm Fridays,
  and 12pm-9pm Sundays. Students should use tutortrac.wpi.edu to sign up for
  individual tutoring appointments that fit their schedule. No appointments are
  needed for MASH group sessions. If a student has a time conflict or there is limited
  tutoring availability, they can complete and submit an ARC Inquiry Form to
  request an appointment that aligns with their schedule.

  D Term 2023 MASH and tutoring will begin on Wednesday March 15, 2023, and
  end on Monday May 1, 2023. There will be no tutoring or MASH on March 28,
  2023; April 17, 2023; and April 21, 2023. 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 are **explicitly discouraged**, please post instead your questions on piazza (you can do this anonymously or semi-anonymously)

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: 03/17, 03/21, 03/24, 03/30, 04/03, 04/06, 04/10, 04/13, 04/18, 04/24, 04/27

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: 03/21, 03/31, 04/13, 04/21, 05/03

    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. **Mini projects**: The mini-projects will be devoted to more independent explorations of applications of probability. They can be done in groups up to four students. 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 mini projects in total.

    Due dates of the mini projects will be Monday 03/27, Thursday 04/06, Tuesday 04/18, Friday 04/28,

13. **Late submission policy**: There is no late submission option for WeBWorK. Up to three (3) late submissions of written homework or mini-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/mini projects (when submitted before the corrected work of the other students are returned) will be graded with a reduction by 50% of the points. This excludes of course extenuating circumstances such as long, severe illness, in which case you contact the instructors as soon as possible.

14. **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
    - 35% Written homework
    - 45% Mini projects
    - 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%

15. **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.

16. **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.

    Access friendly instructors for the class that have received special training to take care of students with accessibility needs are designated on the contact data above with an asterisk (*).

17. **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!).

18. **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

Enjoy the Course!