Spring 2023 **Probability 21-325** **CMU**

Lecture: MWF 9:00 – 9:50 am, Wean Hall 8220

Lecturer: Tomasz Tkocz, Wean Hall 7206, `ttkocz@math.cmu.edu`

Office Hours: Mon 10-11 and 2-3, or by email appointment

Course website: `Canvas` and/or `http://math.cmu.edu/~ttkocz`

Course description: This course is an elementary introduction to probability theory, starting from the definition of a probability space, with the main objectives being (versions of) the law of large numbers and the central limit theorem.

Literature:

- G. Grimmett, D. Welsh, *Probability: an introduction.* Clear and concise, covers most of the material of this course
- G. Grimmett, D. Stirzaker, *One thousand exercises in probability.* Good resource for exercises, perfect for self-study
- S. Ross, *A first course in probability.* Contains many examples and worked-through problems; may serve as additional detailed explanation in the first part of the course
- R. Durrett, *Probability: Theory and Examples.* More advanced. Available online on the author's website `https://services.math.duke.edu/~rtd/PTE/PTEv5a.pdf`

Course content: probability spaces, random variables, random vectors, distribution functions, densities, examples of important discrete and continuous distributions, moment generating functions, independence, conditioning; limit theorems: strong law of large numbers and the central limit theorem; as well as additional topics such as large deviations, Poisson process, random walks, concentration inequalities (as time permits)

Learning objectives:

- gain understanding of the role of a probability space and basic distributions in building appropriate probabilistic models
- advance several important basic probabilistic techniques with applications in e.g. analysis and combinatorics
- develop insights into several important probabilistic phenomena related to independence: law of large numbers and central limit theorem

Course format: This is an in person class. You are expected to fully participate in class, viz. please ask and answer questions, initiate or participate in discussions. We follow rather closely Grimmett and Welsh's textbook.

Homework: There will be around 10 homework assignments during the semester (`Gradescope`). Late submissions will not be accepted, but the lowest two homework scores will not count towards the final grade.

Exams: There will be 3 in-class tests throughout the semester (based on HW problems and the lecture material). *No* final exam, *but* suggested grades will be out before the end of the semester and you can request an oral final examination to improve your grade. Plagiarism and cheating are not tolerated.

Grades: The midterm grade will be based solely on Test 1. The final grade will be based on all the tests (each contributing equally), and homework (each contributing equally):

$$40\% \textbf{ Homework } + 60\% \textbf{ Tests}$$

We will follow the usual cut-offs: `https://en.wikipedia.org/wiki/Academic_grading_in_the_United_States` (but the grades will be "curved" if needed)

In mathematics you don't understand things.
You just get used to them.

–J. von Neumann [to Felix Smith on the method of characteristics]