Spring 2019 **Probability 21-325** **CMU**

Lecture: MWF 1:30 – 2:20 pm, Wean Hall 8220

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

Office Hours: Mon 12:30 – 1:20 pm, Tue 5:00 – 6:00 pm or by email appointment

Course website: `https://www.mimuw.edu.pl/~tkocz/teaching_1819.php`

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 and Markov chains (as time permits)

Learning objectives:

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

Course oragnisation: There are three lectures per week. We follow rather closely the classical textbook by Grimmet and Welsh *Probability: an introduction*. Handwritten lecture notes will be regularly uploaded on the course website. There are weekly assignments. There are two midterms and the final exam.

Homework: This is the essential part of the learning process in this course. Simply listening in class or reading texts is not sufficient. Understanding mathematics requires practice. The course will be fast-paced, therefore weekly assignments will help you study systematically, without gaps in comprehending the material.

Weekly assignments will be posted on the course website at least one week before the due date. The assignments will be due on Wednesdays, collected in class, *before* the lecture begins. Late submissions will not be accepted. At the end of the course, the two lowest homework scores will not count towards the final grade. You may lose points for poor presentation. Please write neatly and provide complete solutions, all explanations and arguments, not just answers. Plagiarism is not tolerated.

Exams: There will be two 50 min midterm exams taken during class: 25th of February and 19th of April (covering the material done until 15th of February and 5th of April respectively). There will be a 3h final exam covering all the material (scheduled by the registrar). Exam questions will mainly be homework-style problems.

Books, notes, or any electronic devices (including calculators) will not be allowed in exams.

Grades: The midterm grade will be based solely on the first midterm exam. The final grade will be based on homework, midterms and the final exam, computed as a weighted average: 30% Homework + 30% Midterms + 40% Final exam