Probability I (SI 427)

Department of Mathematics, IIT Bombay

July, 2022–November, 2022

Class Timing:

- Monday (11:35-12:30), Tuesday (8:30-9:25) and Thursday (9:30-10:25).
- Venue: 216, Second Floor, Mathematics Department.

Tutorial Session:

- Friday (8:30-9:25).
- Venue: 216, Second floor, Mathematics Department.

Syllabus:

- Examples of random phenomena, sample spaces, events, sigma algebra, probability space, properties of probabilities, conditional probability, independence, Bayes formula, Polya's urn model, some combinatorial problem.
- Discrete random variables, probability mass function, independent random variable, sum of random variables, random vector, expectation of discrete random variable, properties of expectation and variance.
- Continuous random variable, distribution function, density of a continuous random variable, expectation, change of variable formula, random vector, joint distribution of random variables, joint density, distribution of sums and products of random variables, conditional density, conditional expectation, order statistics, moment generating function, charecteristic function.
- Inequalities: Markov, Chebyshev, one sided chebyshev, Schwarz and Chernoff bound.
- Mode of convergence: convergence in probability, almost sure convergence and convergence in distribution. Relation between three mode of convergence, Weak law of large number (WLLN), Strong law large number (SLLN), Central limit theorem (CLT).

Texts:

- Introduction to probability theory, by Hoel, Port and Stone.
- A First course in Probability, by Sheldon Ross.
- An introduction to probability and statistics, by Rohatgi and Saleh.
- Probability, by Alan F. Karr.

Prerequisite: First course in Calculus or Real Analysis. In particular, one should be familiar with the notion of function, limit, sequence, series, continuity, differentiation and integration.

Aim: This is the first course in probability in the Mathematics department. We aim to give a rigorous introduction to probability theory without using measure theory. A natural continuation of this course is **Probability II**, offered in odd semester, where you will learn the measure theoretical foundation of probability.

Quiz timing:

- Quiz 1, Date: August 26, 2022. Time: 8:15 a.m.-9:25 a.m. Venue: 216 and Ramanujan Hall
- Quiz 2, Date: October 17, 2022 Time: 11:35 a.m.–12:45 p.m. Venue: 216 and Ramanujan Hall
- Quiz 3: Surprise
- No **extra** quiz or **make up** quiz. So, don't miss any quiz without a valid (medical) reason.

Grading policy: Quiz: 30%; Midsem: 30% and Endsem: 40%

Some important points:

- Check your moodle account for updates (notes, assignments) on this course.
- Attend classes (including tutorial sessions) unless you think that you can do really well by your own.
- Solve problems as much as possible (at least the problems given in the course).
- Participate actively during tutorial sessions.
- Your mobile phone must be in silent mode/Air plane mode/switched off during classes and tutorial sessions.
- Use of any unfair means in any exam would lead you to **FR** grade.