DA 244: Applied Probability and Random Processes

Basic Information

- Instructor: Rhythm Grover
- Office: 414, 3rd floor, Core 2, HSS Extension Building
- Email: rhythmgrover@iitg.ac.in
- Webpage: https://rhythmgrover.github.io
- Teaching Assistant: To be decided

Course Logistics

- Schedule: This course has three lectures a week scheduled in Slot D.
  - 9:00 am - 9:55 am Thursday,
  - 10:00 am - 10:55 am Friday,
  - 11:00 am - 11:55 am Monday
  - *Office hour:* 12:00 pm - 1:00 pm Monday
- Venue: 5103, Core 5.
- Attendance is compulsory.

Course Description

The course is broadly divided into 3 modules:

- Module 1: Review of Probability
- Module 2: Random Number Generation
- Module 3: Random Processes

Course Syllabus

Review of basic probability: Random variables and random vectors, Classical Inequalities and limit theorems

Random Number Generation; Generation of Random Variables: Inverse Transform method, Acceptance-rejection method, Variance Reduction methods: Control Variate, Conditioning, Importance Sampling; Uncertainty, Entropy.

Random Processes: Definition and classification of random processes, Autocorrelation and properties, Random process through LTI systems, Bernoulli processes, Markov Chains (MCs): Preliminaries, Discrete-time MC: Transition Probability Matrix, Classification of states, Chapman-Kolmogorov Equation, Limiting & stationary Distributions, Ergodic MC; Continuous time MC: Poisson Process, Weiner process, Birth and Death Processes; Application and Case Studies. '

Prerequisites

- Thorough understanding of elementary probability/ DA241.
- Proficiency in R.

Course Evaluation

- Attendance: 10%
- Quizzes: 30%
- Mid semester exam: 30%
- End semester exam: 30%

Honor Code

Be honest and transparent with your exams, quizzes, and assignments. Any form of cheating is unacceptable and will lead to disciplinary actions.

Course materials and references

- We will maintain a course webpage: https://rhythmgrover.github.io
- These are some of the books that we will refer:
    - Ross, S.M., 2022. Simulation. Academic Press.
    - Ross, S.M., 1995. Stochastic processes. John Wiley & Sons.
    - Bertsekas, D. and Tsitsiklis, J.N., 2008. Introduction to probability (Vol. 1). Athena Scientific.
- We will add references on the webpage as we move along.