Industrial and Management Engineering *IIT Kanpur*

IME625A: Introduction to Stochastic Processes 3-0-0-0-9

Course Objectives

IME625 introduces theories of the basic stochastic processes with applications. It mainly covers discrete-state processes such as Markov chain, Poisson and renewal processes, and continuous-time Markov chain. It is expected to equip students with the relevant modelling and analytical skills for studying any given stochastic system.

Prerequisites

Basic probability theory

Course Contents

Review of probability theory.
Markov chain: Definition and examples; Transition probabilities; Absorbing Markov chain – Gambler's ruin problem; Branching chain; Classification of states – Simple random walk; Long-run behaviour of Markov chains; Stationary and limiting distributions.
Poisson and renewal processes: Definition and examples; Inter-arrival and waiting times; Selected conditional distributions in Poisson process; Superposition and thinning of Poisson processes; Renewal phenomena; Age and residual life; Renewal-reward process.
Continuous-time Markov chain: Definition and examples; Birth & death process; Holding times and transitions; Transition rate and transition probabilities; Embedded Markov chain and classification of states, Long-run behaviour of continuous-time Markov chains.

Special Emphasis

- Theory building from scratch
- Real-life application through project

Class Schedule

Time: 2:00 pm to 3:15 pm, Monday and Wednesday
Class room: C4, IME Building

Instructor

Dr. Avijit Khanra (Phone: 6180, Email: kavijit)
Office hour: Immediately after the classes

Evaluation

1) End-sem exam 35%
2) Mid-sem exam 25%
3) Quizzes* 15%
4) Project** 15%

5) Class participation***	10%
Total	100%

* There will be four in-class quizzes, two before the mid-semester examination and two after it. A quiz date will be announced in the previous class. Marks of the best three quizzes will be considered for grading. **There will be no make-up for a missed quiz**.

** In the project, a real-life problem is to be studied using stochastic processes. It is to be done in groups of three/four. The project topic must be identified before the mid-sem exam, and the final submission, which includes a presentation and a report, is due on the last class.

*** Evaluation of class participation is subjective. It will be measured primarily by student's preparedness and inquisitiveness during the classes. In the absence of relevant data, which can happen for some students, cues will be taken from the other components.

Home assignments: At the end of most classes, to supplement the class discussions, a home assignment will be given. The solution will be discussed in the next class.

Grading Policy

A mix of absolute and relative grading policies will be adopted. First, a pass mark will be decided; students failing to secure the pass mark will get F grade. Then the interval between the pass mark and the maximum score will be split into four (or five) intervals corresponding to A, B, C, D (and E) grades. **UG and PG students will be graded separately**.

Attendance Policy

It goes without saying that 100% attendance is compulsory. Any student who is granted leave shall inform the instructor regarding his/her absence.

Books & References

This being a PG course, there is no prescribed textbook. However, the following books are recommended as references, with the first two likely to be the most useful.

1. Sheldon Ross, Introduction to Probability Models, Academic Press.
2. Taylor and Karlin, An Introduction to Stochastic Modeling, Academic Press.
3. Sheldon Ross, Stochastic Processes, Wiley India.
4. Karlin and Taylor, A First Course in Stochastic Processes, Academic Press.
5. Hoel, Port, and Stone, Introduction to Stochastic Processes, Waveland Press.

06 January, 2018 Sd/- Avijit Khanra