MATH171: STOCHASTIC PROCESSES

Winter 2019

GENERAL INFORMATION

Instructor	Hanbaek Lyu	(Email: *hlyu@math.ucla.edu*, Office: MS 6156)
Lectures	MWF 11:00AM - 11:50AM at MS 5137	Course webpage
Office hours	(tentative) M 09:55AM - 10:55AM and T 10:00AM - 12:00AM	
Textbook	Rick Durrett, *Essentials of Stochastic Processes*, 2nd edition. (Free download)	
Prerequisites	Math 33A and Math 170A (or Statistics 100A).	
TA	Fan Yang	(Email: *yangf.cuhk@gmail.com* , Office: MS 3949)

COURSE DESCRIPTION

A stochastic process is a sequence of random variables, evolving in time according to some underlying mechanism that is designed to capture some natural phenomena. We will study some essential stochastic processes such as Markov chains, Martingales, Poisson Processes, Renewal Processes, and Brownian Motion. We will also study some applications in queuing theory, communication networks, and mathematical finance.

GRADING

- Final score will be the maximum of the following two schemes:
  - **Scheme 1**: Homework (15%) + Midterm 1 (20%) + Midterm 2 (20%) + Final (45%)
  - **Scheme 2**: Homework (15%) + Better of the midterms (30%) + Final (55%)
- All grades will be posted via MyUCLA gradebook.

HOMEWORK

- Homeworks will be assigned weekly on every Wednesdays, and are due at the beginning of the class on following Wednesday.
- No late homeworks will be accepted.
- Two lowest homework scores will be dropped.
- A random sample of problems will be graded by the TA.
- Solutions on some selected problems will be posted in the course website.
- Discussing homework problems with the instructor, TA, or classmates are encouraged. But you need to write your own solution with your own understanding.

EXAMS

- There are two midterms and one final exam.
  - **Midterm 1**: Monday, Jan.28 in class.
  - **Midterm 2**: Wednesday, Feb.27 in class.
  - **Final**: Monday, Mar. 18, 11:30AM - 2:30PM (location TBD)
- There is no make-up exam. You should attend the final exam to pass the course.
- Please bring your UCLA ID card to all exams.

TENTATIVE COURSE SCHEDULE

Below is a tentative course schedule based on the departmental guideline. There could be a slight change depending on our progress.

Week	Date	Section	Topics
1	M 1/7		Review of limit theorems
	W 1/9	1.1-1.2	Markov chains (intro & examples)
	F 1/11	1.4	Markov chains (stationary distributions)
2	M 1/14		Markov chains (random walk on graphs)
	W 1/16	1.3	Markov chains (classification of states)
	F 1/18	1.7	Markov chains (convergence)
3	M 1/21		No Class
	W 1/23	1.6.4	Markov chain Monte Carlo
	F 1/25	1.10	Markov chains (infinite state space)
4	M 1/28		**Midterm 1**
	W 1/30	2.1	Poisson processes
	F 2/1	2.2	Poisson processes
5	M 2/4	2.3	Poisson processes
	W 2/6	2.4	Poisson processes
	F 2/8	3.1	Renewal processes and laws of large numbers
6	M 2/11	3.2.1	Queuing theory (G/G/1)
	W 2/13	3.2.3	Queuing theory (M/G/1)
	F 2/15	5.1	Conditional expectation
7	M 2/18		No class
	W 2/20	5.2	Martingale: Examples and basic properties
	F 2/22	5.3	Gambling strategies and stopping times
8	M 2/25	5.4	Applications of martingales
	W 2/27		**Midterm 2**
	F 3/1	5.5	Martingale convergence
9	M 3/4	6.1-6.2	Mathematical finance
	W 3/6	6.3 - 6.4	Mathematical finance
	F 3/8	6.5-6.6	Mathematical finance
10	M 3/11		Brownian motion
	W 3/13		Brownian motion
	F 3/15		Review
11	F 3/18		**Final**