

# Stochastic Processes – 18.445

MIT, FALL 2011

## COURSE INFORMATION

**Instructor:** Alberto De Sole, room: 2-470, phone: (617) 253-4326, email: [desole@mat.uniroma1.it](mailto:desole@mat.uniroma1.it)

**Graders:** Wenzhe Wei, room: 2-251, email: [wenzhe@math.mit.edu](mailto:wenzhe@math.mit.edu)

Ivan Borsenco, email: [borsenco@MIT.EDU](mailto:borsenco@MIT.EDU)

**Textbook:** S. Karlin and H.M. Taylor *An introduction to stochastic modeling* (III edition)

**Meeting times:** Lectures: Tue-Thu, 9:30–11 pm, in room 4–270. Office hours: Wed 5:00–7:00 pm in the instructor’s office.

**Course Web Page:** <http://math.mit.edu/classes/18.445>

Course announcements and homework assignments will be posted here.

## COURSE DESCRIPTION

We will cover material from Karlin and Taylor’s book, Chapters 3–9, omitting some parts. The main topics are: basics of stochastic processes, random walk, Markov chains, Poisson process, birth and death processes, and Brownian motion. Time permitting, we will also cover something (about one week) of mathematical finance. A day by day lecture outline will be available on the course web page as we go along.

## COURSE REQUIREMENT

Usually, the homework will be assigned on Thursday and will be due next Thursday, in class. Late homework will be accepted at 10% off per school day, and 50% off after solutions are given out.

There will be two in class midterm exams and no final exam. The midterm exams will be on **Thursday, October 27**, and on **Thursday, December 8**. The final grade will be based on homework grades (counting 40%), and the exams grades (counting 60%).

## WEEKLY SYLLABUS (tentative)

Suggested Reading

<b>Week 1</b> (thu 9/8) Presentation of the course. The random walk.	
<b>Week 2</b> (9/13–15) Markov chains. ( <b>PS1 due</b> )	K&T ch.3
<b>Week 3</b> (9/20–22) Classification of states. Branching processes. ( <b>PS2 due</b> )	K&T ch.3-4
<b>Week 4</b> (9/27–29) The exponential distribution and the Poisson process.	K&T ch.5
<b>Week 5</b> (10/4–6) Continuous time Markov chains. ( <b>PS4 due</b> )	K&T ch.6
Holiday (tue 10/11): <b>Columbus day</b>	
<b>Week 6</b> (10/13) Time reversibility in a continuous time Markov chain	K&T ch.6
<b>Week 7</b> (10/18–20) Renewal theory ( <b>PS5 due</b> )	K&T ch.7
<b>Week 8</b> (10/25–27) Review and <b>Mid Term Exam 1</b> (on 10/27)	
<b>Week 9</b> (11/1–3) Queueing Theory ( <b>PS6 due</b> )	K&T ch.9
<b>Week 10</b> (11/8–10) Queueing networks ( <b>PS7 due</b> )	K&T ch.9
<b>Week 11</b> (11/15–17) Brownian motion and Gaussian processes ( <b>PS8 due</b> )	K&T ch.8
<b>Week 12</b> (11/22) Martingales	K&T 2.5
Holiday (thu 11/24): <b>Thanksgiving</b>	
<b>Week 13</b> (11/29–12/1) Finance ( <b>PS9 due</b> )	K&T ch.8
<b>Week 14</b> (tue 12/6–8) Review and <b>Mid Term Exam 2</b> (on 12/8)	
<b>Week 15</b> (tue 12/13) Review	