PSTAT 160A **Applied Stochastic Processes** **Winter 2019**

(This version: 01/08/2019)

Instructor: Nils Detering (detering@pstat.ucsb.edu)

Lectures: Tuesday and Thursday 3:30 – 4:45 p.m. in BIOEN 1001.

Office Hours: Wednesday 5:00 – 6:00 p.m. in SH 5505.

Course Webpages: GauchoSpace (Python homework handin) and Piazza (Discussions).

Teaching Assistants and Discussion Sections:

Name	Email	Section time/location
TBA	TBA	Monday 5:00- 5:50 HSSB 1231
TBA	TBA	Tuesday 1:00- 1:50 SSMS 1303
TBA	TBA	Friday 10:00-10:50 GIRV 1115

Prerequisites: Mathematics 4A or 4AI or 5A, Mathematics 8, and PSTAT 120A. A minimum letter grade of C or better must be earned in each course.

Catalog Description: Discrete probability models. Review of discrete and continuous probability. Conditional expectations. Simulation techniques for random variables. Discrete time stochastic processes: random walks and Markov chains with applications to Monte Carlo simulation and mathematical finance. Introduction to Poisson process.

Textbooks:

1.) Robert P. Dobrow, *Introduction to Stochastic Processes with R*, John Wiley & Sons Inc., 2016. **(main reference)**

2.) David F. Anderson, Timo Seppäläinen, Benedek Valkó, *Introduction to Probability*, Cambridge University Press, 2018. **(for review PSTAT 120)**

3.) David Stirzaker, *Elementary Probability*, 2nd edition, Cambridge University Press, 2003.

4.) Rick Durrett, *Essentials of Stochastic Processes*, 2nd Edition, Springer, 2012.

We will cover following topics (in brackets only if time permits):

Chapter 1. Review of Probability Theory.
Chapter 2. Conditional Expectation.
Chapter 3. Moment Generating Functions.
Chapter 4. Tail Bounds & Limit Theorems.
Chapter 5. Random Walk.
Chapter 6. Markov Chains.
Chapter 7. (Branching Process).
Chapter 8. Simulation and Markov Chain Monte Carlo.
Chapter 9. (Poisson Process).
Chapter 10. (Application to Mathematical Finance).

Homework: Homework assignments will be posted usually Fridays (with homework 1 already on Tuesday January 8th) on our Piazza homepage and will be collected before class usually on Thursdays two weeks later. No late homework will be accepted! Two problems at random will be graded by your TA. Graded homework are returned during the sections. Keep them for your records. Homework will count for final grade (see below). The lowest homework grade will be dropped.

Python Homework: Python homework assignments in the format of *Jupyter Notebooks* will be posted every Friday (starting from January 18th) on our Piazza homepage and will be due on Mondays two weeks later at 11:59 p.m. They will be submitted via GauchoSpace. **We only accept jupyter notebook files (.ipynb)**. No late homework will be accepted! Python homework will count for final grade (see below). The lowest Python homework grade will be dropped.

Group Work Policy: You are encouraged to discuss the homework problems and Python programming problems together with your classmates but you have to submit your own work! Exact copies will all be graded with 0 points! Also Python homework will be checked for exact copies.

Exams:

Midterm Exam: Tuesday, February 12th, during lecture in BIOEN 1001 (+ overflow room)
Final Exam: Thursday, March 21th, 4:00 – 7:00 p.m. in BIOEN 1001 (+ overflow room)

No electronic devices, textbooks or handwritten notes will be allowed during the midterm and final exams. Students will not be allowed to take makeup exams.

Grading: Your cumulative average will be based on whichever of the following two weighted averages is better.

Scheme 1	Weight
Python Homework	15%
Homework	15%
Midterm	30%
Final Exam	40%

Scheme 2	Weight
Python Homework	15%
Homework	15%
Final Exam	70%

Your course grade will be determined by your cumulative average at the end of the term and will be based on the following scale:

Grade	Percentage in Course
A	$100 - 93.00$
A−	$92.99 - 90.00$
B+	$89.99 - 87.00$
B	$86.99 - 83.00$
B−	$82.99 - 80.00$
C+	$79.99 - 77.00$
C	$76.99 - 73.00$
C−	$72.99 - 70.00$
D+	$69.99 - 67.00$
D	$66.99 - 63.00$
D−	$62.99 - 60.00$
F	$59.99 - 0$

Academic Dishonesty: Academic dishonesty is considered a serious offense at UCSB. Students caught cheating shall be subject to the sanctions and other remedies described in UCSBs Academic Misconduct Policy and Procedures. It is in your best interest to maintain your academic integrity!

Lecture Schedule: (Topics are approximate for these dates)

Date	Subject	Homework	Refs + add. reading (TBA)
Tuesday Jan. 8th	Introduction		
Thursday Jan. 10th	Review of Probability		2.) 1.1.-1.4., 2.1.-2.4., Appendix. B
Tuesday Jan. 15th	Conditional Expectation		
Thursday Jan. 17th	Conditional Expectation		
Tuesday Jan. 22nd	Moment Generating Function	Hand in HW1	
Thursday Jan. 24th	Tail Bounds & Limit Theorems	Hand in HW2	
Tuesday Jan. 29th	Random Walk		
Thursday Jan. 31th	Random Walk	Hand in HW3	
Tuesday Feb. 5th	Random Walk		
Thursday Feb. 7th	Random Walk	Hand in HW4	
Tuesday Feb. 12th	MIDTERM EXAM		
Thursday Feb. 14th	Markov Chains	Hand in HW5	
Tuesday Feb. 19th	Markov Chains		
Thursday Feb. 21st	Markov Chains		
Tuesday Feb. 26th	Markov Chains		
Thursday Feb. 28th	Markov Chains	Hand in HW6	
Tuesday Mar. 5th	Simulation and MCMC		
Thursday Mar. 7th	Poisson Process	Hand in HW7	
Tuesday Mar. 12th	Poisson Process		
Thursday Mar. 14th	Application to Math. Finance		

Subject to change without notice!