COURSE: Special Topics in Applied Mathematics
- Introduction to Stochastic Processes with Applications in Biology
TuTh 5:30pm-6:45pm in Sondheim Hall #112

PROFESSOR: Hye-Won Kang
Office: Math/Psychology Building #424
Email: hwkang@umbc.edu
Office Hours: Tuesday 1:30pm-2:30pm, Thursday 3:45pm-4:45m, or by appointment.
I will try to respond to all emails in the same day. However during the weekends, I am not available to answer them.

TEXT: Introduction to Stochastic Processes with Applications in the Biosciences, lecture notes by David F. Anderson.
Alternative references are "An introduction to stochastic modeling" by Mark A. Pinsky and Samuel Karlin and "Adventures in stochastic processes" by Sidney I. Resnick.

COURSE DESCRIPTION:

This course is an introduction to stochastic processes with applications in biology. Audience of the course is expected to have knowledge in introductory probability. We will cover:

- discrete time Markov chains
- branching processes
- the basics of point processes
- continuous time Markov chains, and
- diffusion processes,

with emphasis on modeling and simulation of biochemical processes using the continuous time Markov chains. Stochastic processes will be introduced with connections to biological problems. Computational methods for stochastic processes will take a certain amount of the course (30%-40%). We will use Matlab and spend time to learn various stochastic simulation methods such as Gillespie's algorithm. Intended audiences are graduate students in mathematics and statistics who are interested in probability and biological applications. No prior experience with Matlab will be assumed and no previous biological background is required.

PREREQUISITE:

Basic probability or statistics background is required. Measure theory is not necessary. The course includes introduction to some biological knowledge.

GRADING POLICY:

Grades are based on homework, final project, and presentation. Final letter grade is decided based on the total grade as follows:

Letter Grade	**Total Scores**
A	$85 \leq \text{Total} \leq 100$
B	$70 \leq \text{Total} < 85$
C	$\text{Total} < 70$

However, factors such as overall distributions of grades or consistency in homework will affect on the final letter grade. Contributed portions of the total score are as follows:

	HOMEWORK	**FINAL PROJECT**	**PRESENTATION**	**TOTAL**
Percentage	50%	35%	15%	100%

HOMEWORK:

There will be biweekly assignments and it is due every Tuesday. You are required to turn in your homework to me before the class. All problems in every homework will be graded. You are encouraged to discuss together but copying from other students is NOT allowed. Any violation will result in ZERO grade and will be reported to the University Academic Integrity Committee. Late homework will NOT be accepted.

FINAL PROJECT:

All Math 710 students are required to work on a final individual project covering the topics discussed later. The final project is due by Dec 17, 2014. The final project should be submitted ELECTRONICALLY ONLY. You can write the project by hand or you can type it using latex or other software. In case you write them by hand, they should be LEGIBLE.

PRESENTATION:

December 2, 4, 9, and 11 in 2014 during the lectures
Presentation of the final project will be performed individually. Presentation time per each student is $15 - 20$ minutes. Presentation is not required to include completed version of the final project. You may introduce your problem and discuss your progress.

ATTENDANCE:

The attendance is highly recommended. Based on the previous experience, students who attend every lecture have a very higher tendency to get a higher score at the end. When you come to the class, you are expected to participate in the class. I ask that you are on time and pay attention to the class. No excuse for being habitually late and the use of smartphones during class is strongly discouraged. Please do not distract yourselves and other students.

INCOMPLETE:

If you do complete the course successfully except for a very small portion or a final project due to very extraordinary and emergence situation (such as to stop attending school for the rest of the semester due to injury in an accident), you will be considered to get Incomplete. You are required to submit a written statement and evidence describing reason to get Incomplete. If the reason to get Incomplete is because you are behind in the course, I would recommend to drop the course, instead.

ACADEMIC INTEGRITY:

By enrolling in this course, each student assumes the responsibilities of an active participant in UMBC's scholarly community in which everyone's academic work and behavior are held to the highest standards of honesty. Cheating, fabrication, plagiarism, and helping others to commit these acts are all forms of disciplinary action that may include, but is not limited to, suspension or dismissal. See the Faculty Handbook, or the UMBC Policies section of the UMBC directory. http://www.umbc.edu/gradschool/essentials/proc_academic_integrity.html

APPROXIMATE COURSE SCHEDULE:

This course will cover various topics. The below is the approximate schedule of the course which is subject to change. The changed schedule will be updated regularly on the course web page in Blackboard.

WEEK	DATES	SECTIONS	TOPICS
1	Tu Aug 26		No class
	Th Aug 28	1	Introduction
2	Tu Sep 2	2-1	Discrete Time Markov Chains
	Th Sep 4	2-2	Discrete Time Markov Chains
3	Tu Sep 9	2-3	Discrete Time Markov Chains
		HW1 due	From Section 2
Wednesday, September 10, is the last day to withdraw from the course without receiving a 'W' on your transcript.			
	Th Sep 11	3-1	Discrete Time Markov Chain Models in the Biosciences
4	Tu Sep 16	3-2	Discrete Time Markov Chain Models in the Biosciences
	Th Sep 18	3-3	Discrete Time Markov Chain Models in the Biosciences
5	Tu Sep 23	4-1	Renewal and Point Processes
		HW2 due	From Section 3
	Th Sep 25	4-2	Renewal and Point Processes
6	Tu Sep 30	4-3	Renewal and Point Processes
	Th Oct 2	5-1	Continuous Time Markov Chains
7	Tu Oct 7	5-2	Continuous Time Markov Chains
	Th Oct 9	5-3	Continuous Time Markov Chains
		HW3 due	From Section 4 and 5
8	Tu Oct 14	5-4	Continuous Time Markov Chains
	Th Oct 16	5-5	Continuous Time Markov Chains

WEEK	DATES	SECTIONS	TOPICS
9	Tu Oct 21	6-1	Continuous Time Markov Chain Models for Biochemical Reaction Networks
	Th Oct 23	6-2	Continuous Time Markov Chain Models for Biochemical Reaction Networks
		HW4 due	From Sections 5 and 6
10	Tu Oct 28	6-3	Continuous Time Markov Chain Models for Biochemical Reaction Networks
	Th Oct 30	6-4	Continuous Time Markov Chain Models for Biochemical Reaction Networks
11	Tu Nov 4	6-5	Diffusion Processes
		HW5 due	From Section 6
	Th Nov 6	6-6	Diffusion Processes
12	Tu Nov 11	Project-1	Discuss possible project topics
Tuesday, November 11, is the last day to withdraw from the course with receiving a 'W' on your transcript.			
	Th Nov 13	Project-2	Discuss possible project topics
13	Tu Nov 18	Project-3	Discuss possible project topics
		HW6 due	From Section 6
	Th Nov 20		No class (Class will be on Dec 11 instead.)
14	Tu Nov 25		No class (Class will be on Dec 11 instead.)
	Th Nov 27	Thanksgiving	No class
15	Tu Dec 2	Presentation-1	Present your final project for $15-20$ minutes.
	Th Dec 4	Presentation-2	Present your final project for $15-20$ minutes.
16	Tu Dec 9	Presentation-3	Present your final project for $15-20$ minutes.
	Th Dec 11	Presentation-4	Present your final project for $15-20$ minutes (Check the classroom number).
17	Wed Dec 17	**Final Project**	**Final Project due date; submit electronic copy only by email.**