Syllabus for M560: Applied Stochastic Processes

Class: Location, Days, and Times Swain West 220, MWF, 9:05-9:55 am

Section Number: 27935

Textbook: Stochastic Processes by Sheldon Ross. Adventures in Stochastic Processes by Sidney Resnick is on reserve as back-up in the Swain Library.

Course Website: http://mypage.iu.edu/~ehouswor/Spring2011/MathM560/index.html

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Office Hours: TBA

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Important Dates: Last day for Automatic Withdrawal: Wednesday, March 9. Final Exam 8-10 am, Friday, May 6.

Religious Holiday Policy: If you will miss class, especially a class during which there will be an exam or other required work, for a religious holiday, you must inform me during the first two weeks of the semester.

Cheating: It is not possible to cheat on homeworks. These will all be open note, open text, open friend, etc... However, all exam work must be your own and no cheating will be tolerated. All suspected cases of cheating will be handled in accordance with University procedures found at http://dsa.indiana.edu/ethics.html. If you do cheat, you will receive an F in the course. Additional sanctions may be imposed by the Dean.

Homework: Homework will be assigned roughly weekly.

Grading:

	Percentage
Attendance	15%
Homework	20%
First Exam	20%
Second Exam	20%
Final Exam	25%

Very Tentative Schedule

Dates	Topics
January 10	What you should already know about probabilities, random variables, distributions, moments, and moment generating functions.
January 12	Increasing and decreasing sets, limit theorems for their probabilities, First Borel-Cantelli Lemma, applications.
January 14	Pairwise versus mutual independence, Second Borel-Cantelli Lemma assuming mutual or pairwise independence, applications.
January 17	Martin Luther King Jr. Holiday
January 19	Limit theorems and the Strong Law of Large Numbers
January 21	The Probabilistic Method
January 24	Conditional moments and applications
January 26	Memoryless distributions and hazards
January 28	Poisson counting processes
January 31	Interarrival and waiting times, renewals, relation to the uniform distribution.
February 2	Different types of events, introduction to queues
February 4	Non-homogeneous and compound Poisson processes
February 7	Renewal theory as a generalization of the Poisson process, modified and alternating renewal processes, convolutions, and examples
February 9	First renewal limit theorem and Wald's equation.
February 11	Elementary renewal theorem, applications, and the central limit theorem for renewals.
February 14	Blackwell's theorem and applications
February 16	Key Renewal Theorem and applications
February 18	Exam 1
February 21	Regeneration
February 23	Markov Chains
February 25	Classification of states
February 28	Transience and recurrence
March 2	Applications and examples, absorption probabilities
March 4	Gambler's ruin

Very Tentative Schedule - Continued

Dates	**Topics**
March 7	Other applications of Markov chains
March 9	Time reversibility
March 11	Semi-Markov Processes
Spring Recess	
March 21	Continuous Time Markov Chains
March 23	Kolmogorov Differential Equation
March 25	Transition Probabilities
March 28	Limiting Probabilities
March 30	Time Reversibility
April 1	Exam 2
April 4	Martingales
April 6	Stopping times and an extension of Wald's theorem
April 8	Random walks and returning to the origin
April 11	Brownian Motion (BM): definition, preliminaries, relationship to random walks
April 13	BM properties: Markov, differential, scaling, symmetry, Gaussian process, time reversal, reflection
April 16	BM: hitting times, maximum, arc sine laws
April 18	BM: variations and applications
April 20	BM: variations and applications
April 23	Optional topics, catch-up day
April 25	Optional topics, catch-up day
April 27	Optional topics, catch-up day
April 29	Review, Evaluations, etc...
Final Exam 8-10 am on Friday, May 6	