MTH 490B – Stochastic Processes, Class Policies  
Fall 2017, CRN 54616 (Section 1)  
TTh 12–1:50pm, SI 1010  
Instructor: Dr. Ben Dyhr  
Office: SI 3030  
Email: bdyhr@msudenver.edu  
Course Website: http://sites.msudenver.edu/bdyhr/  
Regular Office Hours: M 2-3:30pm, T 2-3pm, W 2-3:30pm, Th 10:30-11:30am

Office Hours Statement: The regular office hours listed above do not require an appointment, and I will inform the class if I ever need to cancel any regular office hours. Any others hours I have available can be used for office hours by appointment. Please do not hesitate to contact me by email or in person if you would like to schedule office hours by appointment. Feel free to suggest a meeting time that is convenient for you, but please allow me at least 24 hours advanced notice before any proposed meeting time. Taking advantage of your instructor’s office hours is a critical component of your university education.

Distraction-Free Classroom Statement: An utmost priority in my classroom is to maintain a distraction-free classroom. The following items are common classroom distractions we need to avoid:

- Use of portable electronic devices like smart phones during class or leaving the classroom at inappropriate times to use these devices. Please turn your phone or portable electronic device OFF during class and put away your headphones.
- Arriving at class late (or leaving early) for avoidable circumstances and failing to enter (or leave) the classroom discretely for unavoidable circumstances.
- Attending class unprepared. We will often do activities that require a calculator, notepad and writing utensil. I expect students to have these items ready to use during our entire class session.
- Socializing that is not related to course content. Lecture will not be our only activity and socializing is acceptable for some classroom activities, but discussing topics not related to our classroom activities is not allowed.


Software and Calculator: No personal software is required, but I will use Mathematica to visualize and demonstrate various concepts. A graphing calculator is required for the course. The recommended calculators are the TI-83, TI-83 Plus or TI-84 Plus graphing calculators. Calculators with comparable capabilities to the recommended calculators are also allowed. Calculators that do closed form differentiation or integration like the TI-92 are not allowed on exams.
Exams: There will be two regular exams worth 100 points and a Final Exam worth 150 points. A tentative exam schedule and points allocation is given in the following table (dates will be finalized at least 2 weeks before each exam):

<table>
<thead>
<tr>
<th>Exam</th>
<th>Date</th>
<th>New Topics covered</th>
<th>Textbook Chapters</th>
<th>Points</th>
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<tbody>
<tr>
<td>Exam 1</td>
<td>10/5/17</td>
<td>Limit theorems, Markov chains, Poisson processes and other continuous time Markov chains</td>
<td>4, 5, 6</td>
<td>100</td>
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<tr>
<td>Exam 2</td>
<td>11/16/17</td>
<td>Queuing theory, random walk, Brownian motion</td>
<td>7, 8, 10</td>
<td>100</td>
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<tr>
<td>Final</td>
<td>5/9/17 or 5/11/17*</td>
<td>No new topics</td>
<td>Cumulative</td>
<td>150</td>
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*- Auraria Campus will give exact dates and times by late March

If a verifiable emergency arises which prevents you from taking an exam at a regularly scheduled time, you must notify me as soon as possible, prior to the exam. Make-up exams will be administered at my discretion. Failure to contact me in a timely manner or inability to produce sufficient evidence of a real emergency will result in zero points on that exam.

Homework: Your total homework grade makes the same contribution to your overall grade as a regular test grade, 100 points. Homework will be assigned regularly.

Short homework assignment will be assigned weekly (handouts and online posts). These assignments will feature 5 problems each. Your lowest written assignment grade will be dropped.

Your final homework score will be out of 100 points and will be determined by the your percentage homework score on all of the assignments. The assignments should be neatly written and multiple pages must be stapled together. Homework may be submitted early and/or digitally in a .pdf format as a single document sent to my email address, bdyhr@msudenver.edu

Projects: Each student is required to write and present projects covering two probability models related to a discipline of stochastic processes (e.g. biostatistics, physics, population dynamics, internet traffic, stochastic analysis, ect...). Presentations will be given during the last two weeks of the semester, after Fall Break, and will include a computer simulation component. Final projects are worth 150 points. A detailed grading rubric and suggested topics list for the project will be provided in September; you are welcome to contact me by email or during office hours if you have specific stochastic models you may want to investigate as part of your project.

(Continued on next page...)
**Grades:** 200 exam points + 150 final exam points + 100 homework points + 150 project points = 700 total points

The following scale for semester average will not be raised:
- 90-100% (629 < points) A
- 80-89% (559 < points ≤ 629) B
- 70-79% (489 < points ≤ 559) C
- 60-69% (419 < points ≤ 489) D
- 0-59% (points ≤ 419) F

**Attendance:** Students are expected to attend every scheduled class. An absence can be excused only in the case of verifiable emergencies I am notified of (by email) prior to the end of class.

**Holidays:**
- September 4, Labor Day (No classes, Campus Closed)
- November 20-26, Fall Break (No classes, Campus Open except for Thanksgiving Day, Nov. 23)

**Withdrawal:** The student may withdraw from the course with a 100% refund and deletion from record through Sunday, August 27, 2017. The student may withdraw from the course with a 50% refund and deletion from record through Wednesday, September 6, 2017. A student may withdraw with a “W” through Wednesday, November 8.

**Official Syllabus and Learning Objectives:** A copy of the official syllabus is attached to this document.

**University Policy statements:** Students are responsible for full knowledge of the provisions and regulations pertaining to all aspects of their attendance at MSU Denver, and should familiarize themselves with the following policies:
1. GENERAL UNIVERSITY POLICIES
2. GRADES AND NOTATIONS including WITHDRAWAL FROM A COURSE, ADMINISTRATIVE WITHDRAWAL, and INCOMPLETE POLICIES
   Students should be aware that any kind of withdrawal can have a negative impact on some types of financial aid, including scholarships.
3. ACADEMIC DISHONESTY
4. PROHIBITION ON SEXUAL MISCONDUCT
5. ACCOMMODATIONS TO ASSIST INDIVIDUALS WITH DISABILITIES
6. CLASS ATTENDANCE ON RELIGIOUS HOLIDAYS
7. ELECTRONIC COMMUNICATION (STUDENT EMAIL) POLICY
   For a complete description of these policies go to [https://mcs.msudenver.edu/policies](https://mcs.msudenver.edu/policies)
**OMNIBUS* COURSE SYLLABUS**

School of LAS

**Department:** Mathematical & Computer Sciences  
**Instructor:** TBD

**Prefix and Course Number:** MTH490J  
**Semester/year offered:** Fall 2014

**Banner Number (for Academic and Student Affairs use):**

(Students registering after Census date will be ineligible for the COF stipend and must pay the full tuition for the omnibus course. Please see COF-FAQ for details regarding registration deadlines: [http://www.mscd.edu/news/cof/cof_faq.htm](http://www.mscd.edu/news/cof/cof_faq.htm))

**Course Title:** Introduction to Stochastic Processes

**Credit Hours:** 4 (+) 0

**Total Contact Hours per semester (assuming 15-16 week semester):**
- Lecture 4
- Lab 0
- Internship 0
- Practicum 0
- Other (specify type and hours): 0

**Meeting Times/Dates:** TBD

**Grading Mode(s):** Letter  
**Schedule Type(s):** Lecture

**Prerequisites:** MTH 3210, MTH 2140 or MTH 3130 or MTH 3140

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### Approved - Omnibus course:

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<th>Department Chair OR Program Director</th>
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<tr>
<th>Dean OR Associate Dean of School</th>
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<th>Office of Academic and Student Affairs Designee</th>
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### Approved - Field Experience/Internship Only:

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<th>Location of Internship</th>
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<th>Faculty Evaluation Group</th>
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<th>Field Supervisor**</th>
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**Approval by the Field Supervisor is required and must be indicated by the original signature of that supervisor on the syllabus.

*Guidelines as set forth in Section V. F. of the MSU Denver Curriculum Guidelines, Policies and Procedures must be followed. A copy of the omnibus course syllabus must be on file in the Office of Academic and Student Affairs prior to the listing of the course in any semester schedule.*
Corequisites: _____
Banner Enforced:
    Prerequisite(s): _____
    Corequisite(s): _____
    Prerequisite(s) or Corequisite(s): _____

Course Description:
This course gives a general introduction to random processes and their applications. It includes Markov chains, Markov processes, random walks, branching processes, the Poisson process, queuing theory, and Brownian motion.


Evaluation of Student Performance (*format* - 1, a, i, ii, etc.):
1. Homework assignments
2. Midterm exams
3. Comprehensive final exam

Specific **Measurable** Student Behavioral Learning Objectives (*format* - 1, a, i, ii, etc.):
At the end of the course the student should:
1. Be familiar with the Poisson and exponential distributions and their properties.
2. Be able to define, characterize and give examples of stochastic processes.
3. Be able to define discrete-time Markov processes, and determine classes.
4. Be able to calculate steady-state probabilities of discrete-time Markov processes.
5. Be able to define and illustrate Poisson processes, and calculate probabilities.
6. Be able to describe non-homogenous Poisson process, compound Poisson processes, and Renewal processes.
7. Be able to solve basic problems regarding continuous-time Markov processes.
8. Be able to calculate gambling-related probabilities, and some other probabilities regarding random walks.
9. Be able to define the Brownian motion and describe its basic properties.
10. Be familiar with the M/M/1 and M/G/1 queuing systems.
   A. Discrete and continuous random variables and their distributions
   B. The Poisson distribution and its properties
   C. The exponential distribution and its properties
   D. Conditional expectation

II. Markov Chains (Discrete time Markov processes).
   A. Transition probability matrices and the Chapman-Kolmogorov equations
   B. Steady state solutions
   C. Classification of states
   D. Branching processes
   E. Time reversibility

III. The Poisson Process and Renewal Processes
   A. Definition and derivation
   B. Properties of the Poisson process, including inter-arrival and waiting time distributions
   C. Nonhomogeneous and compound Poisson processes.
   D. Renewal processes

IV. Continuous-Time Markov Processes
   A. Definition
   B. Transition probability functions
   C. Birth and death processes

V. Random Walks
   A. Definition and basic calculations
   B. Gamblers ruin problems
   C. Connection to Brownian motion
   D. Properties and variations of the Brownian motion
   E. Other applications

VI. Queuing Theory
   A. Single-server exponential queuing systems (M/M/1)
   B. M/G/1 queuing systems and variations

Optional:

VII. Stopping times and stochastic optimization
   A. Definition of stopping times, and some properties
   B. Optimal stopping problems

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1 NOTE: If the omnibus course includes student and/or course instructor research that involves (1) interviewing subjects and/or (2) handling personal data and/or (3) topics which could be viewed as “sensitive” (e.g., personal political views, health data, sexuality, etc.), then approval by the Office of Academic and Student Affairs will require assurance that the guidelines described at the end of this document have been followed.
ADA Syllabus Statement

The Metropolitan State University of Denver is committed to making reasonable accommodations to assist individuals with disabilities in reaching their academic potential. If you have a disability which may impact your performance, attendance, or grades in this class and are requesting accommodations, then you must first register with the Access Center, located in the Auraria Library, Suite 116, 303-556-8387.

The Access Center is the designated department responsible for coordinating accommodations and services for students with disabilities. Accommodations will not be granted prior to my receipt of your faculty notification letter from the Access Center. Please note that accommodations are never provided retroactively (i.e., prior to the receipt of your faculty notification letter.) Once I am in receipt of your official Access Center faculty notification letter, I would be happy to meet with you to discuss your accommodations. All discussions will remain confidential. Further information is available by visiting the Access center website, msudenver.edu/access/.

Excerpt from
METROPOLITAN STATE UNIVERSITY OF DENVER
GUIDELINES FOR THE PROTECTION OF HUMAN SUBJECTS

Available in full on the MSU Denver website:
http://www.msudenver.edu/irb/gettingstarted/studentresearch/

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This required course content MUST be part of the “Detailed outline of course content” section of the independent study course syllabus OR a statement must be attached that clearly states how the proper procedures have been followed by the course instructor and/or the student.

THE ASSOCIATE VP FOR ACADEMIC AND STUDENT AFFAIRS CANNOT SIGN AN INDEPENDENT STUDY SYLLABUS THAT APPEARS TO INVOLVE HUMAN SUBJECTS AND/OR PERSONAL DATA UNLESS THIS INFORMATION IS PROVIDED.