University of Pennsylvania
STAT 5330 – Stochastic Processes (Course Outline)

Instructor: Dr. Michael A. Carchidi

Textbooks:	1.)	*Introduction to Stochastic Processes with R* by Robert P. Dobrow
(Required)		(1st Edition, Wiley Publishers, @2016)
(Required)	2.)	*Class Notes* placed online by Michael A. Carchidi

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| **Week** | **Topics Covered** |

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1   *Introduction and Review*: Deterministic and Stochastic Models, what is a Stochastic Process, Monte Carlo Simulation, Conditional Probabilities, Conditional Expectation and Variances

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2   *Markov Chains, First Steps*: Introduction, Markov Chain Cornucopia, Basic Computations

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3   *Markov Chains, First Steps*: Long-Terms Behavior, Numerical Evidence, Simulation, Mathematical Induction

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4   *Markov Chains for the Long Term*: Limiting Distributions, Stationary Distributions, finding a way to State *a*, Irreducible Markov Chains

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5   *Markov Chains for the Long Term*: Periodicity, Ergodic Markov Chains, Time Reversibility

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6   *Markov Chains for the Long Term*: Absorbing Markov Chains, Means and Variances and Covariances

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7   *Branching Processes*: Introduction, Mean Generation Size, Probability Generating Functions, Extinction is Forever

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Week	Topics Covered
8	*Poisson Processes*: Introduction, Arrival and Interarrival Times, Infinitesimal Probabilities, Thinning and Superposition
9	*Poisson Processes*: Uniform Distributions, Spatial Process Processes, Nonhomogeneous Poisson Processes
10	*Continuous-Times Markov Chains*: Introduction, Alarm Clocks, Infinitesimal Generator, Long-Term Behavior
11	*Continuous-Times Markov Chains*: Time Reversibility, Queueing Theory, Poisson Subordination
12	*Brownian Motion*: Introduction, Brownian Motion and Randon Walks, Gaussian Processes
13	*Brownian Motion*: Transformation and Properties, Variation and Applications, Martingales
14	*Introduction to The Stochastic Calculus*: Introduction, Ito Integral, Stochastic Differential Equations

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General Information about the STAT 5330 Course

1.) **Official Class Time:** From 8:30 AM – 10:00 AM on TR in JMHH F50

2.) **Prerequisites:** Probability (ENM 5030, STAT 4300 or STAT 5100).

3.) **Instructor:** Dr. Michael A. Carchidi. I am available in my office at Towne 208, by phone at (215)898-8342, and by e-mail at carchidi@seas.upenn.edu

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4.) **TA/Grader:** See the Canvas site at https://canvas.upenn.edu/

5.) **Grading Policy:** A total of 10-13 homework assignments will be handed out, collected, and graded. The average of these will count for 25% of the final grade. Two midterms will count for 25% + 25% of the final grade and then the Final Exam will count for the remaining 25% of the final grade. When studying for exams, the following order of priority should be adhered to:

1.) Discussions in class (This makes classroom attendance mandatory.)

2.) Examples worked out in the textbook (You should therefore purchase a textbook.)

3.) Suggested problems from the textbook (You should do as many as you can.)

Please note that I encourage students to work together on homework problems since you can learn much from each other. However, I strongly discourage any copying of homework.

6.) **Letter Grades:**   (98 – 100) A+, (93 – 97) A, (90 – 92) A-, (87 – 89) B+,

(83 – 86) B, (80 – 82) B-, (77 – 79) C+, (73 – 76) C, (70 – 72) C-,

(67 – 69) D+, (63 – 66) D, (60 – 62) D-, (0 – 59) F

University Policies and Resources

My objective is to build a comfortable and supportive learning environment in ENM503. As such, there are several policies that we will abide by and resources available to improve learning in the course. Please reach out to me or the graders/TA with any questions or concerns that you may have and note the following:

Code of Academic Integrity

All written assignments must be the product of your own effort, consistent with the University's Code of Academic Integrity, available at

https://provost.upenn.edu/policies/pennbook/2013/02/13/code-of-academic-integrity

You may not refer to other student's(s') work in preparing individual assignments. Violation of University Code of Academic Integrity may result in failure of course.

Sexual Harassment and related policies

All forms of sexual violence, relationship violence and stalking and attempts to commit such acts are considered to be serious misconduct and may result in disciplinary action up to and including expulsion or termination of employment. In addition, such acts may violate federal, state and local

laws and perpetrators of such acts may be subject to criminal prosecution. For more information, please refer to Penn' Sexual Harassment Policy,

http://provost.upenn.edu/policies/pennbook/2013/02/15/sexual-harassment-policy,

as well as the other related policies available at this link.

Students with Disabilities and Learning Differences

Students with disabilities are encouraged to contact Weingarten Learning Resource Center's Office for Student Disabilities Services for information and assistance with the process of accessing reasonable accommodations. For more information, visit

http://www.vpul.upenn.edu/lrc/sds/ or email lrcmail@pobox.upenn.edu.

Counseling and Psychological Services (CAPS)

CAPS is the counseling center for the University of Pennsylvania. CAPS offers free and confidential services to all Penn undergraduate, graduate, and professional students. For more information, visit http://www.vpul.upenn.edu/caps/.