Manhattan College

Department of Mathematics

MATG 635 Section 01 ***Probabilistic Methods*** Spring 2020

Class Time: Tuesday 5:30-8:15 P.M. *Class Room*: RLC 104
Instructor: Angel R. Pineda, Ph.D. *Office*: RLC 201B
Email: angel.pineda@manhattan.edu *Phone*: 718-862-7730
Website: https://turing.manhattan.edu/~apineda01/

Office Hours: Tuesdays, 1-1:50 pm, 5-5:30 P.M., or by appointment.

Required Textbook:
Sheldon Ross, *Introduction to Probability Models, 12th Edition*, Academic Press: 2019.

Recommended Textbooks:
Cowpertwait and Metcalfe. *Introductory Time Series with R*, Springer: 2009 (available as PDF from O'Malley Library and our Moodle page).
Baumer, Kaplan and Horton. *Modern Data Science with R*, CRC Press: 2017.

Course Description:
An introduction to probability models including random variables, conditional probability and expectation, Markov chains and time series. Additional topics may include Poisson processes, continuous time Markov processes, queueing theory, spatial, text and network models.

Prerequisite: MATH 331 or MATG 630

Learning Outcomes: Upon successful completion of this course, the student will be able to:

- utilize probability distributions such as normal, uniform, exponential, Poisson, and mixtures thereof to model real-world scenarios.
- utilize technology for solving such problems.
- characterize discrete-time Markov chains.
- analyze and understand time series.
- analyze higher-level probability and statistics topics including random walks, Poisson processes, Brownian motion, basic queueing theory, spatial, text and network models.

Course Homepage (Moodle):
Here you will find four features that will be used in this course:

- *Email:* make sure that your email on Moodle is one that you check regularly. Homework assignments, announcements and other class related information will be sent via email.
- *Course Information and Documents:* material covered each week, assignments and solution keys.
- *Student Discussion Board:* this online forum allows for students and faculty to communicate about the course.
- *Grades:* students will be able to keep track of their grades online.

Assessment of Student Learning:
Homework (50 %)
There will be weekly assignments. Most of the learning will be in these weekly assignments.

Take-Home Midterm Exam (25 %): Tuesday February 25 (due Tuesday March 3)

Final Project (25 %),
Project Proposal: March 31
Initial Project Presentation (in class): April 14
Initial Paper: April 21
Final Project Presentations: Tuesday May 5th, 6:30 pm – 8:30 pm
Final Paper: Tuesday May 5th, 6:30 pm – 8:30 pm

Students will work in teams of two to investigate an application of probabilistic methods in the real-world, first proposing a topic and then submitting both a written report and oral presentation on their analysis.

Tentative Grading Scale

Percent	90-100	85-89	80-84	75-79	70-74	65-69	60-64	50-59	0-49
Grade	A	A-	B+	B	B-	C+	C	D	F

The exact grading scale will be determined after the final exam. The numerical scores in the tentative grading scale guarantee the associated letter grade but the instructor may change the scale to the student's benefit.

Dates to Remember:

January 20: Monday, Martin Luther King Holiday (No Classes)
January 21: (Tuesday) Monday Schedule
January 22: Late Registration & Add/Drop Ends
March 5: Midterm Grades Due
March 16-20: Spring Break
April 9-13: Easter Holiday (No Classes)
April 14: Last Day to Withdraw from Courses
April 15: (Wednesday) Monday Schedule
May 1: Last Day of Classes

Class Policies

- Late homework will not be accepted after the solutions are distributed. In case the homework is handed in before the solutions are posted it will be marked 20% off for every day (or part thereof) it is late.
- No make-up exams will be given, unless you have a medical or family emergency. These emergencies require valid documentation. The grade for a missed exam is zero.
- Calculators are allowed in this class but most of the computation will be done using the R computing language using the RStudio graphical user interface.
- Attendance is expected. In the case of an absence, you should notify the instructor of the reason.
- Cell phones (or other technology not related to the class) in the classroom is only allowed with express permission of the instructor for special circumstances. In general cell phone or other potentially disruptive technology use is not allowed in class.

Suggestions for Success

- The course requires a time commitment of about 9 hours outside of class time per week (about 3 per class hour). The material builds on itself, so it is very important not to fall behind. Make sure to make enough space in your schedule to spend the time needed.
- I suggest you work in groups on your homework but hand in individual solutions, not copied from each other. Doing the homework is when most of the learning occurs.

- Treat your homework as a study guide for exams. Write solutions to problems in a neat and organized fashion.
- Review your notes from the previous lecture before each class.
- Read the textbook. It will complement the presentation in lecture and help give you the big picture of the material.
- I encourage you to come to office hours regularly. I will do my best to help you.

Academic Integrity:
As students of Manhattan College, you have each signed The Manhattan College Honor Pledge:

As a Manhattan College student, I will not lie, cheat, or steal in my academic endeavors, nor will I accept the actions of those who do. I will conduct myself responsibly and honorably in all my activities as a Manhattan College student. I am accountable to the Manhattan College community and dedicate myself to a life of honor.

Whenever you put your name on work to be handed in for grading in this class, you are reaffirming the above pledge. Violations of the Honor Code include, but are not limited to, cheating, plagiarism, fabrication, and other forms of academic misconduct. Students should familiarize themselves with the Manhattan College Student Code of Conduct and Academic Policies found at:
https://inside.manhattan.edu/student-life/dean-of-students/code-conduct.php#academicintegrity

Special Accommodations:
- Students with special needs should bring appropriate documentation to the Specialized Resource Center, Thomas Hall 3.15, https://inside.manhattan.edu/academic-resources/specialized-resource-center/, to obtain an Academic Adjustment/Auxiliary Aid form. Bring the completed form to me as soon as possible, and together we will decide on how best to fulfill the adjustments and/or aids listed on the form.
- Student athletes should bring their event schedules to me as soon as possible.

Course Outline, Timeline:

Area	Specific Topics	Week
Review of probability	Basic probability tools; conditional probability	1
Random variables	Single & joint densities; moments	2-3
Markov chains	DTMCs and applications in queueing theory	4-5
Time series	Moving-average & auto-regressive models	6-8
Selected topics	*From*: Poisson processes, CTMCs, queueing theory, spatial, text and network models	9-14

The material in this syllabus may be changed at the instructor's discretion. Any changes will be communicated to the students.