

## MATH 448: Stochastic Simulation

### *Fall 2018 Course Syllabus*

**NJIT Academic Integrity Code:** All Students should be aware that the Department of Mathematical Sciences takes the University Code on Academic Integrity at NJIT very seriously and enforces it strictly. This means that there must not be any forms of plagiarism, i.e., copying of homework, class projects, or lab assignments, or any form of cheating in quizzes and exams. Under the University Code on Academic Integrity, students are obligated to report any such activities to the Instructor.

### COURSE INFORMATION

**Course Description:** An introduction in the use of computer simulation to study stochastic models. Topics include the generation of samples of continuous and discrete random variables and processes with applications to stochastic models, statistical analysis of the results, and variance reduction techniques.

**Number of Credits:** 3

**Prerequisites:** **MATH 333** with a grade of C or better and **MATH 340** with a grade of C or better.

**Course-Section and Instructors**

Course-Section	Instructor
Math 448-001	Professor W. Guo

**Office Hours for All Math Instructors:** [Fall 2018 Office Hours and Emails](#)

**Required Textbook:**

Title	<i>Simulation</i>
Author	Ross
Edition	5th
Publisher	Academic Press
ISBN #	978-0125980630
Reference Book	<i>Introductory Statistics with R</i> by Peter Dalgaard (2008, 2 edition)

**University-wide Withdrawal Date:** The last day to withdraw with a **W** is **Monday, November 12, 2018**. It will be strictly enforced.

### POLICIES

**DMS Course Policies:** All DMS students must familiarize themselves with, and adhere to, the **Department of Mathematical Sciences Course Policies**, in addition to official **university-wide policies**. DMS takes these policies very seriously and enforces them strictly.

**Grading Policy:** The final grade in this course will be determined as follows:

Attendance	5%
Homework	25%
Midterm Exam	30%
Final Exam	40%

Your final letter grade will be based on the following tentative curve.

A	90 - 100	C+	70 - 75
B+	85 - 90	D	62 - 70
B	80 - 85	F	0 - 62
C	75 - 80		

**Attendance Policy:** Attendance at all classes will be recorded and is **mandatory**. Please make sure you read and fully understand the **Math Department's Attendance Policy**. This policy will be strictly enforced.

**Homework:** Homework will be assigned in class.

**Exams:** There will be one midterm exams held in class during the semester and one comprehensive final exam. The final examination date, time, and location will be determined by the university during the final exam week. Midterm exam dates given below are tentative and subject to change.

Midterm Exam	October 25, 2018
Final Exam	December 15 - 21, 2018

The final exam will test your knowledge of all the course material taught in the entire course. Make sure you read and fully understand the **Math Department's Examination Policy**. This policy will be strictly enforced.

**Makeup Exam Policy:** There will be **NO MAKE-UP QUIZZES OR EXAMS** during the semester. In the event an exam is not taken under rare circumstances where the student has a legitimate reason for missing the exam, the student should contact the Dean of Students office and present written verifiable proof of the reason for missing the exam, e.g., a doctor's note, police report, court notice, etc. clearly stating the date AND time of the mitigating problem. The student must also notify the Math Department Office/Instructor that the exam will be missed.

**Cellular Phones:** All cellular phones and other electronic devices must be switched off during all class times.

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## **ADDITIONAL RESOURCES**

**Math Tutoring Center:** Located in the Central King Building, Lower Level, Rm. G11 (See: **Fall 2018 Hours**)

**Further Assistance:** For further questions, students should contact their instructor. All instructors have regular office hours during the week. These office hours are listed on the Math Department's webpage for **Instructor Office Hours and Emails**.

All students must familiarize themselves with and adhere to the Department of Mathematical Sciences Course Policies, in addition to official university-wide policies. The Department of Mathematical Sciences takes these

policies very seriously and enforces them strictly.

**Accommodation of Disabilities:** Disability Support Services (DSS) offers long term and temporary accommodations for undergraduate, graduate and visiting students at NJIT.

If you are in need of accommodations due to a disability please contact Chantonette Lyles, Associate Director of Disability Support Services at [973-596-5417](tel:973-596-5417) or via email at [lyles@njit.edu](mailto:lyles@njit.edu). The office is located in Fenster Hall Room 260. A Letter of Accommodation Eligibility from the Disability Support Services office authorizing your accommodations will be required.

For further information regarding self identification, the submission of medical documentation and additional support services provided please visit the Disability Support Services (DSS) website at:

- <http://www5.njit.edu/studentsuccess/disability-support-services/>

**Important Dates** (See: [Fall 2018 Academic Calendar](#), [Registrar](#))

Date	Day	Event
September 4, 2018	T	First Day of Classes
September 10, 2018	M	Last Day to Add/Drop Classes
November 12, 2018	M	Last Day to Withdraw
November 20, 2018	T	Thursday Classes Meet
November 21, 2018	W	Friday Classes Meet
November 22 - 25, 2018	R - Su	Thanksgiving Recess
December 12, 2018	W	Last Day of Classes
December 13 & 14, 2018	R & F	Reading Days
December 15 - 21, 2018	Sa - F	Final Exam Period

## Course Outline

Date	Lecture	Chapter	Topic	Assignment
WEEK 1 9/4	1	Chapter 1	COURSE INTRODUCTION	
		Chapter 2	Elements of Probability (I): Conditional probability, independence, random variables, expectation, variance, Chebyshev's inequality, law of large numbers	
WEEK 2 9/11	3	Chapter 2	Elements of Probability (II): Discrete random variables -- binomial, Poisson, geometric, negative binomial, and hypergeometric Continuous random variables -- uniform, normal, and exponential. Conditional expectation and variance	Homework 1
WEEK 3 9/18	5	Chapter 2	Elements of Probability (III): The Poisson process and gamma random variables, The nonhomogeneous Poisson process	
		Chapter 3	Random Numbers	
WEEK 7		Chapter	Generating Discrete Random Variables:	Homework

4 9/25		4	The inverse transform method, acceptance-rejection technique, the composition approach	2
WEEK 5 10/2	9	Chapter 5	Generating Continuous Random Variables (I): Inverse transform and Rejection method	
WEEK 6 10/9	11	Chapter 5	Generating Continuous Random Variables (II): Polar method and Generating a Poisson process	Homework 3
WEEK 7 10/16	13	Chapter 5	Generating Continuous Random Variables (III): Generating a nonhomogeneous Poisson process	
WEEK 8 10/23	15	Chapter 9	Variance Reduction Techniques (I): Antithetic variates	Homework 4
			<b>MIDTERM EXAM: THURSDAY - OCTOBER 25, 2018</b>	
WEEK 9 10/30	16	Chapter 9	Variance Reduction Techniques (II): Control variates	
WEEK 10 11/6	18	Chapter 9	Variance Reduction Techniques (III): Variance reduction by conditioning, Stratified sampling	Homework 5
WEEK 11 11/13	20	Chapter 9	Variance Reduction Techniques (IV): Importance sampling	
WEEK 12 11/20	22	Chapter 9	Variance Reduction Techniques (V): Importance sampling (Cont.)	
			<b>THANKSGIVING RECESS</b>	
WEEK 13 11/27	23	Chapter 8	Statistical Analysis of Simulated Data: Sample mean and sample variance, Interval estimates of a population mean, Bootstrap	Homework 6
WEEK 14 12/4	25	Chapter 7	The Discrete Event Simulation Approach: Queuing systems	Homework 7
WEEK 15 12/11	27		<b>REVIEW FOR FINAL EXAM</b>	
			<b>THURSDAY: READING DAY</b>	
WEEK 16 12/18			<b>FINAL EXAM: TUESDAY - DECEMBER 18, 2018</b>	

*Updated by Professor W. Guo - 9/4/2018  
Department of Mathematical Sciences Course Syllabus, Fall 2018*

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