

COURSE SYLLABUS

Course Title: Computational Probability Theory

Abbreviated Title
As Appears on Transcript Probability Theory

Course Number: DMAT 311

Credit Hours: 3 credits [semester credit hours]

Course Description: A first course in calculus-based statistics and probability with emphasis on computational software techniques, geometrical analysis, and numerical processes applications. Topics include Monte-Carlo method, measurements of probability, distributions, applications to data analysis, discrete and random variables, conditional and joint probability concepts, Central Limit Theorem, correlation and regression, confidence intervals.

Prerequisite: Successful completion (C- or higher) of Calculus II or equivalent, or consent of instructor.

Course Workload: 3 semester credit hours • 3 student work hours per credit hour • 14 week Carnegie semester = 126 hours student course workload average

Examination Requirements: Proctored written and oral final examination must be passed at 70% or higher to earn passing grade in course. “B” and “A” grade paths have additional examinations and assignments. See <https://www.distancecalculus.com/grades/> for more information.

Course Professor: Robert R. Curtis, Ph.D. <rcurtis@rwu.edu>, <robert@distancecalculus.com>
Roger Williams University, Extension School, 1 Empire Plaza, Providence, RI, USA 02903.
Roger Williams University, 1 Old Ferry Road, Bristol, RI 02809.
Accredited by New England Commission of Higher Education (NECHE).
See <https://www.rwu.edu/academics/accreditation/> for more information.

E-Textbook:

Probability, Statistics & LiveMath by Curtis
Adapted from *Probability, Statistics & Mathematica* Davis/Porta/Uhl

Mathematical Software: LiveMath Computer Algebra & Graphing System

ADA ACCOMMODATIONS

Roger Williams University has a continuing commitment to providing reasonable accommodations for students with documented disabilities. Students with disabilities who need accommodations in order to fully

participate in this class are urged to contact Student Accessibility Services, as soon as possible, to explore the arrangements needed to be made to assure access. Student Accessibility Services is open Monday through Friday from 8:00AM to 5:00PM Eastern Time; Email: sas@rwu.edu or Voice: 401-254-3841. For more information about SAS, visit

<https://www.rwu.edu/undergraduate/academics/student-academic-success/student-accessibility-services-sas>

COURSE RULES

Academic Honesty

Academic Dishonesty in a Distance course includes copying or relying upon another person's work. Working with other students is good and encouraged, but the work you submit for this course must be genuinely your own work. Private tutors are allowed, but you must notify the instructor that you have obtained a private tutor to aid in your studies. Any documented instance of Academic Dishonesty will be grounds for immediate failure in this course.

Final (and Other) Examinations

A written and oral proctored final exam will occur at the student's location over video with the course professor; The student must score 70% or higher on this final exam to be eligible to earn a passing grade in the course.

Communication

Communication is the key to success in a Distance course. It is the student's responsibility to keep good communication channels with the instructors during the course; failure to participate in the course does not constitute "dropping" the course (Withdrawal from the course must be requested in writing to the instructors before the completion date deadline)

Roger Williams University Policies & Procedures

Roger Williams University has Policies & Procedures that all students must follow, including the Roger Williams University Student Handbook. Student must agree to follow all stated rules governing student conduct listed on the Roger Williams University website, and at the [Roger Williams University Course Catalog](#)

Course Completion 1 Year Rule

All Distance Calculus students are afforded 1 Year to finish their course from the Date of Enrollment. Students will be placed in the Academic Semester based upon their Date of Enrollment for academic records purposes. If a student does not finish the course, and does not request a Course Withdrawal for a W, then an "F" grade will be issued.

No Chatbots / AI

Students must pledge to **not** use any Chatbot/AI at all - **period**. Student must pledge to **limit** use of search engines (Google, Bing, etc) to a minimal level. Student must pledge to not engage in dishonest disguise of any Chatbot/AI/Search Engine source of information as student's own honest academic work. Verified chatbot usage will result in an "F" course grade, and will be referred to the Roger Williams University Academic Integrity Committee.

Learning Outcomes for DMAT 311 - Computational Probability Theory

1. To understand the core concepts of Probability, Sampling, Distributions, and Density
2. To understand and compute Monte-Carlo method for integration
3. To understand and compute Expected Value, Variance, Mean, Mode, Median
4. To understand and compute Probability and Conditional Probability
5. To understand and compute Markov's and Chebyshev's Theorems
6. To understand and compute normally and exponentially distributions
7. To understand and compute calculus-based formulas and relationships between Cumulative Distribution Functions and Probability Density Functions
8. To understand and compute the Central Limit Theorem
9. To understand the core concepts of discrete and random variables
9. To understand and compute Joint Distributions, Correlations, and Covariance
10. To understand the Law of Total Probability
11. To understand and compute the classic statistics measures of Confidence Intervals and Hypothesis testing.

Syllabus Topics Outline for DMAT 311 - Computational Probability Theory

1. Getting Started
 - 1.1. Email and Chat
 - 1.2. Learning About the Course
 - 1.3. Required Hardware
 - 1.4. Software Fundamentals
2. Simulations
 - 2.1. Uniform Distributions
 - 2.2. Monte Carlo Methods
 - 2.3. Random Walks
 - 2.4. Shooting craps; Iterated Fractals.
3. Data Analysis
 - 3.1. Frequency
 - 3.2. Expected Value
 - 3.3. Cumulative Distributions
 - 3.4. Variance
 - 3.5. Histograms
 - 3.6. Related formulas for Expected Values and Variance
4. Probabilities
 - 4.1. Calculating Probability
 - 4.2. Union and Intersection and Probability
 - 4.3. Conditional Probability Formula
 - 4.4. Independence
 - 4.5. Indicator functions
 - 4.6. Bayes' Theorem

5. More Data Analysis
 - 5.1. Markov's Inequality
 - 5.2. Chebyshev's Theorem
 - 5.3. Laws of Large Numbers
 - 5.4. One-Sided Chebyshev Theorem

6. Normal and Exponential Distributions
 - 6.1. Approximately Normally Distributed Sets
 - 6.2. Normal Distribution
 - 6.3. Approximately Exponentially Distributed Sets
 - 6.4. Exponential Distribution
 - 6.5. Memoryless Property of Exponential Distributions

7. Random Variables
 - 7.1. "Random Variables"
 - 7.2. Discrete Random Variables
 - 7.3. Continuous Random Variables
 - 7.4. Probability Density Functions
 - 7.5. Cumulative Distribution Functions
 - 7.6. Expected Values and Variance
 - 7.7. Markov, Chebyshev, and Law of Large Numbers Revisited
 - 7.8. Mean, Median, and Mode

8. Joint Distributions
 - 8.1. Joint Probability Calculations
 - 8.2. Discrete & Continuous
 - 8.3. Expected Values, Covariance, and Correlation.
 - 8.4. Conditional Probability Calculations
 - 8.5. Conditional Expectations
 - 8.6. The Law of Total Probability

9. Central Limit Theorem
 - 9.1. Generating Functions for Discrete Random Variables
 - 9.2. Generating Functions for Continuous Random Variables
 - 9.3. Generating Functions and Independence
 - 9.4. Central Limit Theorem
 - 9.5. Chi-squared and Gamma random variables

10. Classic Statistics
 - 10.1. Sampling
 - 10.2. Confidence Intervals
 - 10.3. Hypothesis testing