COURSE SYLLABUS

Course: Probability and Statistics
Number: Math 315
Credit-Hours: 3 credits [semester credit hours]

Course Description: Emphasizes probability, probability density functions, distributions, statistical inferences and estimation, correlation, and regression.

Prerequisites: Successful completion (C- or higher) of MATH 214 (Calculus II) or equivalent.

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 final examination must be passed at 60% or higher to earn passing grade in course. "B" and "A" grade paths have additional examinations. See http://www.distancecalculus.com/grades/ for more information.

Course Professor: Robert R. Curtis, Ph.D. <robert@distancecalculus.com>

University Information: Roger Williams University, University College, 1 Empire Plaza, Providence, RI, USA 02903. Accredited by New England Commission of Higher Education (NECHE). See https://www.rwu.edu/academics/accreditations for more information.

E-Textbook: "Probability, Statistics & LiveMath" by Davis/Porta/Uhl et al
Mathematics Software: LiveMath™ Computer Algebra & Graphing System
and/or Mathematica™ Computer Algebra & Graphing System

Detailed Syllabus

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

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. Fourier Transforms
    - 9.6. Chi-squared and Gamma random variables

Additional Optional Modules:

10. Counting
    - 10.1. Binomial and Poisson counting
    - 10.2. Binomial and Poisson Distributions

11. Statistics
    - 11.1. Sampling
    - 11.2. Confidence Intervals
    - 11.3. Hypothesis testing