Southern Connecticut State University

Mathematics 320 – Probability

I. Catalog Description.

Post-calculus introduction to mathematical probability theory. Topics include Probability Axioms, Conditional Probability, Probability Distributions, Random Variables, Probability Densities, Multivariate Distributions and Densities, Markov Chains, Sampling Distributions, Central Limit Theorem

II. Credit.

MAT 320 carries three (3) semester-hours of University credit.
MAT 320 is an elective any mathematics major.

III Prerequisite

The student must have passed MAT 250 and MAT 252 with a C- or better in each.

IV. Format

MAT 320 is primarily a lecture-based course.

V. Outline

- Sample spaces and events
- Counting principles
- Axioms of probability
- Conditional probability
- Theorem of Total Probability
- Bayes Theorem
- Discrete Random variables
- Properties of Discrete Random Variables
- Important Discrete Random Variables
- Continuous Random variables
- Properties of Continuous Random Variables
- Important Continuous Random Variables
- Expectation of Random Variables
- Theorem of Total Expectation
- Jointly Distributed Random Variables
- Limit Theorems
- Markov Chains

VI. Proposed Text

Dimitri P. Bertsekas and John N. Tsitsiklis, Introduction to Probability, Second Edition, Ahtena Scientific, 2006

VII. Other Recommended Text

Sheldon Ross, A First Course in Probability, Seventh Edition, Pearson, 2006

VIII. Outcomes

Upon completion of MAT 320 students should be able to demonstrate satisfactory knowledge of the major concepts of probability, they should be able to construct correct proofs of basic probability concepts and solve problems using concepts of probability. In particular students should:

1. To use the axioms of probability and the rules of algebra to formally prove mathematical statements.
2. To understand and apply conditional probability including Bayes Theorem.
3. To identify, comprehend, and apply the laws and properties of probability theory, probability functions, and random variables, especially the Binomial, Poisson, Hyper-geometric, Normal, Gamma and Exponential distributions.
4. To identify, comprehend, and apply the laws and properties of probability theory, probability functions, and random variables to joint distributions.
5. To understand the concepts of expected value and variance and apply them.
6. To understand and apply the concepts of sampling distributions, especially the sample mean.
7. To understand and apply Markov chains

IX. Course Outline

Probability (3 weeks 20%)

1. Axioms of Probability
2. Conditional Probability
3. Theorem of Total Probability
4. Bayes Theorem
5. Independence
6. Counting

Discrete Random Variable (3 weeks 20%)

1. Probability Mass Functions
2. Expectation and Variance
3. The Binomial Distribution
4. The Poisson Distribution
5. The Negative Binomial Distribution
6. The Hypergeometric Distribution

Continuous Rand Variables (3 weeks 20%)

1. Probability Density Functions
2. Expectation and Variance
3. Uniform Random Variables

4. Normal Random Variables
5. Exponential Random Variables
6. Gamma Random Variables
7. Beta Random Variables

Jointly Distributed Random Variables (3 weeks 20%)

1. Independent Random Variables
2. Functions of Random Variables
3. Conditional Distributions (Discrete)
4. Conditional Distributions (Continuous)
5. Order Statistics (Optional)

Limit Theorems (1 week 7%)

1. Chebyshev's Inequality
2. The Central Limit Theorem
3. Law of Large Numbers

Markov Chains (2 weeks 14%)

1. Discrete Time Marko Chains
2. Random Walks

X. Assessment

Individual instructors may vary assessment modes, but typically grades will be based on a combination of homework assignments, quizzes, and exams.

XI. Waiver Policy

MAT 320 may not be waived.

XI. Preparer

Raymond Mugno

XII. Prepared and Approved

Prepared November 2016
Approved by the Mathematics DCC on 10/9/2018.

XIII. Bibliography.

D. Bertsekas, J. Tsitsiklis, Introduction to Probability, Second Edition, Ahtena Scientific, 2006.
G. Casella, R. Berger, Statistical Inference, Duxbury Press, 1999.
J. Devore, Probability and Statistics for Engineers, Thompson, Toronto 2004.
J. McClave, T. Sincich, Statistics, Prentice Hall, New Jersey, 2012.
S. Ross, A First Course in Probability, Seventh Edition, Pearson, 2006.