

Probability

Upon completion of this course, the students will be able to:

1. Define the concept of random experiments, sample space, events, and algebra of events in the context of Probability with a focus on Introduction to Probability.
2. Differentiate between classical, statistical, and axiomatic definitions of Probability.
3. Apply the Theorem of compound probability, the Theorem of total probability, and Bayes' theorem in solving problems related to Conditional Probability.
4. Analyze independent events and their implications in Probability theory.
5. Determine the probability distributions of random variables including PMF, PDF, and CDF, and understand the properties of CDF and Empirical distribution functions.
6. Calculate moments of random variables and analyze their properties.
7. Understand Joint, marginal, and conditional probability distributions, and analyze Joint PMF, PDF, and CDF along with their properties and independence of variables.
8. Apply Markov's and Chebyshev's inequalities in Probability theory.
9. Construct probability distributions of mixed random variables and analyze their properties.
10. Identify and analyze the properties and applications of standard Univariate Discrete Theoretical Distributions such as Binomial, Poisson, geometric, negative binomial, hypergeometric, and uniform distributions.
11. Identify and analyze the properties and applications of standard Univariate Continuous Theoretical Distributions including rectangular, normal, exponential, Cauchy, beta, gamma, lognormal, logistic, double exponential, and Pareto distributions.
12. Analyze the Bivariate Normal Distribution in terms of its properties and applications.
13. Understand Truncated Distributions and their significance in Probability theory.

Overall, the students will develop a comprehensive understanding of Probability theory, random variables, probability distributions, and their applications in various real-world scenarios. They will enhance their analytical and problem-solving skills through practical applications and theoretical concepts covered in this course.

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