Course 3: UDSC- 201 - Probability and Statistics

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Prerequisites	Differential and Integral Calculus	

Course Objectives

Probability and Statistics is the branch of mathematics that deals with modeling uncertainty. It is important because of its direct application in areas such as computer science, finance, and telecommunications. It forms the fundamental basis for many other areas in the mathematical sciences, including modern optimization methods and risk modeling. This course provides students with a formal treatment of probability and statistics.

Course Outcomes

- Develop the skill set to solve real-world problems based on axioms of probability, conditional probability, and Bayes' theorem. Understand several discrete and continuous random variables.
- Compute covariance and correlation of two or more dimensional data, and identify statistical distributions by observing real datasets. Compute the moment-generating function for a given random variable.
- Plot histograms and box plots for univariate data, and scatter diagrams for bivariate data.

Syllabus

Unit	Topic	Contents	Periods
1	**Elements of Probability**	Sample space, events, counting techniques, axioms of probability, addition rules, multiplication rules, conditional probability, independence, Bayes' formula and random variables.	12
2	**Discrete Random Variables**	Probability distributions and probability mass functions, cumulative distribution functions, mean and variance of a discrete random variable. Special discrete random variables: Uniform, Binomial, Geometric, Negative Binomial, Hypergeometric and Poisson distributions.	12
3	**Continuous Random Variables**	Probability distributions and density functions, cumulative distribution functions, mean and variance of a continuous random variable. Special continuous random variables: Uniform, Exponential, Normal, Erlang, Gamma, Weibull, Lognormal and Beta distributions. Normal approximation to the Binomial and Poisson distributions.	14
4	**Joint Probability Distributions**	Joint distribution of two and more than two random variables, conditional probability distributions and independence, covariance and correlation, common joint distributions, linear functions and general functions of random variables, moment-generating functions.	12
5	**Descriptive Statistics**	Numerical summaries of data, stem-and-leaf diagrams, frequency distributions and histograms, box plots, scatter diagrams, probability plots.	6
		Total	**56**

Key Text(s)

- Montgomery, Douglas C., and Runger, George C., Applied Statistics and Probability for Engineers, 7th Edition, Wiley, 2018. — Prescribed Chapters: 2 to 6

Suggested / Additional Readings

- Sheldon M. Ross, Introduction to Probability and Statistics for Engineers and Scientists, 6th Edition, Elsevier Academic Press, 2020.
- Irwin Miller, Marylees Miller, John E. Freund's Mathematical Statistics with Applications, 8th Edition, Pearson Publications.