Probability and Statistics - Video course

COURSE OUTLINE

Algebra of sets, introduction to probability, random variables, probability distributions, moments, moment generating function, Markov and Chebyshev inequalities, special discrete and continuous distributions, function of a random variable, joint distributions, bivariate normal distribution, transformation of random vectors, central limit theorem, sampling distributions, point estimation, unbiasedness, consistency, method of moments and maximum likelihood estimation, confidence intervals for parameters in one sample and two sample problems from normal populations, testing of hypotheses, Neyman-Pearson lemma, tests for one sample and two sample problems for normal populations.

COURSE DETAIL

Module No.	Topic/s	Lectures
1	**Algebra of Sets:** sets and classes, limit of a sequence of sets, rings, sigma-rings, fields, sigma-fields, monotone classes.	2
2	**Probability:** Classical, relative frequency and axiomatic definitions of probability, addition rule and conditional probability, multiplication rule, total probability, Bayes' Theorem and independence, problems.	4
3	**Random Variables:** Discrete, continuous and mixed random variables, probability mass, probability density and cumulative distribution functions, mathematical expectation, moments, probability and moment generating function, median and quantiles, Markov inequality,	3

NP-TEL

NPTEL

http://nptel.iitm.ac.in

Mathematics

Pre-requisites:

- Set Theory and Calculus

Additional Reading:

1. Modern Mathematical Statistics by E.J. Dudewicz & S.N. Mishra
2. Introduction to the Theory of Statistics by A.M. Mood, F.A. Graybill and D.C. Boes

Hyperlinks:

- none

Coordinators:

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	Chebyshev's inequality, problems.	
4	**Special Distributions:** Discrete uniform, binomial, geometric, negative binomial, hypergeometric, Poisson, continuous uniform, exponential, gamma, Weibull, Pareto, beta, normal, lognormal, inverse Gaussian, Cauchy, double exponential distributions, reliability and hazard rate, reliability of series and parallel systems, problems.	7
5	Function of a random variable, problems.	1
6	**Joint Distributions:** Joint, marginal and conditional distributions, product moments, correlation and regression, independence of random variables, bivariate normal distribution, problems.	4
7	**Transformations**: functions of random vectors, distributions of order statistics, distributions of sums of random variables, problems.	1
8	**Sampling Distributions:** The Central Limit Theorem, distributions of the sample mean and the sample variance for a normal population, Chi-Square, t and F distributions, problems.	2
9	**Descriptive Statistics:** Graphical representation, measures of locations and variability.	2
10	**Estimation:** Unbiasedness, consistency, the method of moments and the method of maximum likelihood estimation, confidence intervals for parameters in one sample and two sample problems of normal populations, confidence intervals for proportions, problems.	6
11	**Testing of Hypotheses:** Null and alternative hypotheses, the critical and	8

	acceptance regions, two types of error, power of the test, the most powerful test and Neyman-Pearson Fundamental Lemma, tests for one sample and two sample problems for normal populations, tests for proportions, Chi-square goodness of fit test and its applications, problems.	

References:

1. An Introduction to Probability and Statistics by V.K. Rohatgi & A.K. Md. E. Saleh.
2. Introduction to Probability and Statistics by J.S. Milton & J.C. Arnold.
3. Introduction to Probability Theory and Statistical Inference by H.J. Larson.
4. Introduction to Probability and Statistics for Engineers and Scientists by S.M. Ross
5. A First Course in Probability by S.M. Ross
6. Probability and Statistics in Engineering by W.W. Hines, D.C. Montgomery, D.M. Gpldsman & C.M. Borror
7. Lectures in Probability by M. Kac (for example on independent events)
8. C.K. Wong (1972) A note on mutually independent events. Annals of Statistics, V. 26, 27.(for example on independent events).
9. Measure Theory by P. Halmos (for algebra of sets)