

University of Trieste
Undergraduate Degree in Computer and Electronic Engineering
Academic Year 2016/2017
Name of the Course: Probability and Statistics (code 112IN)
Teachers: Prof. Claudio Ascì, Prof. Daniele Del Santo

Probability

• Finite and countable sample spaces. Events. Sure event, impossible event, incompatible events, jointly exhaustive events. Discrete uniformly probability theory.

• Independent events. Conditional probability under an event. Bayes theorem. Alternatively Bayes's law.

• Basic combinatorics, permutations and combinations. Pascal triangle. Binomial expansion.

• Discrete random variables. Distribution functions of discrete random variables. Discrete random vectors. Joint distribution and marginal distributions of a discrete random vector. Expected value and variance of a discrete random variable.

• Independent discrete random variables.

• Discrete random variables: uniform distribution, Bernoulli distribution, binomial distribution, geometric distribution, Poisson distribution, hypergeometric distribution. Connection between binomial and Poisson distribution.

• Sigma-algebras. Kolmogorov axioms of probability theory. Borel sets. Random variables. Definition and main properties of the cumulative distribution function of a real valued random variable.

• Continuous random variables. Properties of the density function of a continuous random variable. Continuous random vectors. Joint distribution and marginal distributions of a continuous random vector. Expected value and variance of a continuous random variable.

• Independent continuous random variables.

• Moment-generating function.

• Continuous random variables: uniform continuous distribution, gamma distribution, exponential distribution, normal distribution, Chi-squared distribution, Student's t-distribution.

• Convergence of random variables. Almost sure convergence, convergence in probability, convergence in distribution. Strong law of large numbers. Central limit theorem. Approximate normality.

• Markov chains. Positive and null recurrent states. Transient states. Reducibility, irreducibility, periodicity of a Markov chain. Invariant measures. Convergence theorems for Markov chains.

Statistics

• Population and sampling. Unknown parameters. Statistics. Sample mean, sample variance. Populations moments. Order statistics. Empirical distribution function.

•Statistical inference. Likelihood function. Parameters of a statistical model. Method of estimating parameters. Point estimators. Maximum likelihood estimate. Method of moments. Point estimators properties. Correctness, consistency, efficiency. Bias of an estimator. Mean square error.

•Confidence interval and interval estimate. Sampling of a normal random variable: confidence interval for the mean and the variance.

Reference book: Paolo Baldi, Calcolo delle Probabilità e Statistica 2/ed, McGraw Hill, 1998.