

STAT418 Learning Objectives

This list is intended to be a minimal set of objectives. Individual instructors may add their own objectives.

1. Be able to write axioms of probability, define conditional probability.
2. Be able to write axioms of probability, derive simple consequences of these axioms; use set notation or Venn diagrams.
3. Define conditional probability and understand intuitively what the conditional probability mean.
4. State the multiplication rule of conditioning; state and use Bayes's theorem;
5. Work with two or more independent events, understand independent trials; learn to use rules of counting (multiplication rule, permutations, and combinations).
6. Work with random variables, both discrete and continuous; list properties of probability mass function and density functions; find constant multiplier for a density function.
7. Define and derive expectation, variance and standard deviation of random variables and functions of random variables.
8. Learn the properties of special distributions such as Bernoulli, binomial, Poisson, geometric, uniform, exponential, gamma, chi-square and normal/Gaussian.
9. Derive cumulative distribution function; use cumulative distribution function method to find the distribution of a function of a random variable.
10. Understand joint probability mass function, density and cumulative distributions of two or more random variables.
11. Derive marginal probabilities, conditional density and mass functions given a random variable.
12. Check when the given random variables and random vectors are independent.
13. Derive expectations of functions of random vectors; derive covariance and correlation coefficient.
14. Write down the density of bivariate Gaussian random variable; understand and become familiar with vector notation; derive covariance matrix.
15. Derive expectation and variance of sum of random variables; derive cumulative distribution function and probability density function of sum of two random variables.
16. Define and derive moment generating function of a random variable; derive moments from the moment generating function.
17. Work with random sums of independent random variables.
18. Learn to use conditional expectations to get unconditional mean and variance.
19. State and work with central limit theorem.
20. Derive and use probability inequalities such as Chernoff bound, Markov and Chebyshev's inequalities.

21. Be able to work with stochastic processes such as Poisson process and Brownian Motion.
22. Check if a given process is stationary or not; derive autocovariance function; learn about Gaussian processes.
23. Learn about discrete-time Markov Chains; derive limiting state probabilities for a finite Markov Chain; and evaluate stationary probabilities for Ergodic Markov chains.