

Fall 2016

Math 372 – Elementary Probability and Statistics (3)

This course is a problem oriented introduction to the basic concepts of probability and statistics, providing a foundation for applications and further study.

Pre: 216 or 242 or 252A or consent.

Basics of probability (2 weeks). Experiments, events, sets, probabilities, and random variables. Equally likely outcomes, counting techniques. Conditional probability, independence, Bayes' theorem.

Discrete random variables (1.5 weeks). Expected values, mean, variance, binomial, geometric, and Poisson distributions. Moment generating functions.

Continuous random variables (1.5 weeks). Uniform, exponential, gamma, and normal distributions. Intuitive treatment of the Poisson process and development of the relationship with the gamma distributions.

Multivariate distributions (2 weeks). Calculation of probability, covariance, correlation, marginals, conditions. Distributions of sums of random variables and sampling distributions. Central limit theorem.

Estimation (1 week). Point and confidence interval estimation. Maximum likelihood, optimal, and unbiased estimators, examples.

Large Sample Estimation (1.5 weeks). Types and comparison of estimators; sampling distributions for means/proportions, and their use in large sample estimation; sample size.

Large Sample Testing (1.5 weeks). Components of a test; significance and power; p -values; large-sample tests for means/proportions.

Small Sample Inference (1 week). t distribution, with applications to small sample estimation and testing; χ^2 and F distributions, with applications to inference about variances.

Regression (1.5 weeks). Least squares; correlation coefficient; inference.

χ^2 tests (1 week). Multinomial distributions; contingency tables, goodness-of-fit.

Suggested texts. At the level of

R. Hogg and E. Tanis, *Probability and Statistical Inference*, Pearson.

W. Mendenhall, R. J. Beaver and B. M. Beaver, *Introduction to Probability and Statistics*, Brooks/Cole.

Course Objectives and Student Learning Outcomes. Upon successful completion, the student will have a foundation in the basic topics of the theories of Probability and Statistics listed above in the syllabus. Students will learn basic probability principles, conditional probability, discrete random variables (including the Binomial distribution) and continuous random variables (with emphasis on the normal distribution). They will learn the logic as well as the technical side of the main forms of inference: point estimation, interval estimation and hypothesis testing. The course covers inferential methods for the population mean and population proportion, inferential methods for comparing the means of two groups, linear regression, and the Chi-Square test for goodness-of-fit. Students will learn at a beginning level how probability and statistics are applied to the sciences.

Program Objectives. Math 372 is a junior level course in Probability and Statistics, an important subject with many applications in all scientific fields. This course promotes our goal that our students learn, understand, and be able to apply several mathematical topics at the junior and senior level, and that our students acquire the ability and skills to apply mathematics to other fields.