

Math 474 – Probability and Statistics

Course Description (Bulletin): Elementary probability theory and elementary statistical inference, including discrete and continuous distributions, sampling, estimation, confidence intervals, hypothesis testing, and linear regression. (3-0-3)

Enrollment: Not applicable for AM majors. Credit not granted for both MATH 474 and MATH 475

Textbook(s): Walpole, Meyers, Meyers, Ye, Probability and Statistics for Engineers and Scientists, Prentice Hall

OR

Douglas Montgomery, George Runger: Applied Statistics and Probability for Engineers, zyVersion, zyBook.

Other required material: None

Prerequisites: MATH 251

Objectives:

1. Students will be able to apply basic probability rules to compute and interpret probabilities of events and experiment outcomes.
2. Students will be able to solve problems involving basic random variables, such as binomial, Poisson, uniform, and normal.
3. Students will be able to compute mathematical expectation and variance, and evaluate and interpret probability mass functions, probability density functions, and cumulative distribution functions.
4. Students will be able to compute basic sample statistics and use them to estimate population parameters and interpret the variability of estimators from sample to sample.
5. Students will be able to identify types of random variables in a given application and choose the statistical estimation procedure most appropriate for an application.
6. Students will be able to construct elementary point estimators and evaluate them.
7. Students will be able to construct basic confidence intervals and state the confidence levels.
8. Students will be able to compute Type I and Type II errors.
9. Students will be able to conduct basic hypothesis tests.
10. Students will be able to make conclusions based on the results of a hypothesis test.

Lecture schedule: 3 50 minute (or 2 75 minute) lectures per week

Course Outline:

Topic	Hours
Introduction to basics: population and samples, data collection, sample spaces, and types of data	4
Exploratory data analysis (EDA): summarizing quantitative data graphically (boxplots and histograms), measures of center and spread.	2
Probability: sample spaces, events, equally likely outcomes, basic rules of probability, conditional probability, independence, total probability and Bayes rule.	6
Random variables: discrete and continuous; the binomial experiment, the Poisson process, hypergeometric, multinomial, normal, and uniform distributions	6
Distributions, mathematical expectations, functions of random variables. Central Limit Theorem.	2
Statistical inference: properties of sample mean and proportions, large sample distributions, distributions of estimators for population parameters, including: population proportion, population mean, population variance, difference of means.	8
Point estimation and bias. Interval estimation for a single population: means and proportions. Hypothesis testing for a single population.	6
(optional) Inference for relationships: two independent samples and matched pairs.	6

Assessment:

Homework 15-30%

Quizzes/discussion/participation 0-10%

Mid-term exam(s) 20-35%

Final Exam 20-35%

Syllabus prepared by: Andre Adler & Art Lubin 12/17/05

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