STEPHEN F. AUSTIN STATE UNIVERSITY

Department of Mathematics and Statistics

MTH 360 – Statistical Inference
Course Syllabus

Course description: Covariance and correlation, sampling distributions, development and data analysis concerning: one/two/many sample location tests and confidence intervals. Analysis of variance and simple linear regression, chi-square tests for categorical data. Use of technology and/or statistical software throughout.

Credit hours: 3

Course Prerequisites and Corequisites: MTH 333 (or concurrent enrollment) and MTH 359

Course outline: Approximate time spent

- **Covariance and Correlation** **10%**
  - Introduction to multiple random variables and independence
  - Joint, marginal and conditional distributions
  - Calculation and interpretation of correlation and covariance
- **Sampling and Sampling Distributions** **10%**
  - Properties of Normal, t, chi-squared and F distributions
  - Properties of the sample mean and variance
- **The Need for Estimation and Testing: a review of scenarios in which popular discrete & continuous named distributions are used.** **5%**
  - Use of experimental conditions in order to identify a parametric family
  - Use of descriptive statistics to identify a parametric family
- **Elements of Testing Hypotheses** **10%**
  - terminology associated with testing
  - likelihood ratio tests
- **The Popular One Sample Location Tests and Confidence Intervals** **15%**
  - mathematical development of one sample t and z tests (and associated confidence intervals)
  - analysis of data and computer application for one sample t and z procedures
  - mathematical development of the sign and signed rank tests
  - analysis of data and computer application for sign and signed rank procedures
  - paired data as a one-sample problem
- **The Popular Two Sample Location Tests and Confidence Intervals** **15%**
  - mathematical development of the two-sample independent t-test (and associated confidence interval)
  - analysis of data and computer application for two-sample independent t-test procedures
  - mathematical development of the rank sum test
  - analysis of data and computer application for the rank sum test procedure
- **Tests for Variances and Associated Confidence Intervals** **5%**
  - The chi-squared test (and associted confidence intervals) for a single population variance including data analysis and computing/software usage
  - The F test for the equality of two population variances (and associated confidence interval) including data analysis and computing/software usage.
- **One Way Analysis of Variance & Simple Linear Regression** **20%**
  - mathematical development & application
  - analysis of data and computer application for ANOVA and regression procedures
  - multiple comparisons in ANOVA, residual analysis in Regression including data analysis and computing/software usage

- **Categorical Data** **10%**
  - Chi-squared goodness-of-fit test
  - Tests for Independence/Row Homogeneity for Two Categorical Variables
  - Analysis of data and computer application for categorical data procedures

Student Learning Outcomes (SLO): At the end of MTH 420, a student who has studied and learned the material should be able to:

1. Discuss the similarities and differences between the branch of mathematics known as probability and the science of statistics. [PLO: 1]
2. Describe the key components of a hypothesis test. [PLO: 2, 4]
3. Analyze one or two sample data, including the use of computing/software, in order to test a hypothesis or form a confidence interval about measures of center and spread. [PLO: 2, 4]
4. Demonstrate an understanding of the theory, assumptions and procedures of analysis of variance and analyze data suitable for ANOVA including the use of computing/software. [PLO: 1, 2, 3, 4]
5. Explain how confidence intervals and hypothesis tests in one, two and many sample problems are derived and interpreted, including knowing the proper assumptions for each procedures' application. [PLO: 1, 2, 3, 4]
6. Choose and apply an appropriate statistical tool to analyze data from one, two or many samples. Specifically, students will be able to discriminate between the proper scenarios for applying parametric and nonparametric methods. [PLO: 1, 2, 3, 4]
7. Analyze categorical data using chi-squared methods and discuss the assumptions and limitations of these procedures, including the use of computing/software. [PLO: 2, 4]
8. Describe relationships which exist among bivariate data through the use of correlation measures and simple linear regression models, including the use of computing/software. [PLO: 2, 4]

Program Learning Outcomes (PLO):

Students graduating from SFASU with a B.S. degree and a major in mathematics will:

1. Demonstrate comprehension of core mathematical concepts. [***Concepts***]
   (notion of theorem, mathematical proof, logical argument)
2. Execute mathematical procedures accurately, appropriately, and efficiently. [***Skills***]
   (calculus, algebra, routine, nonroutine, applied)
3. Apply principles of logic to develop and analyze conjectures and proofs. [***Logical Reasoning***]
   (quantifiers, breaking down mathematical statements, counterexamples)
4. Demonstrate competence in using various mathematical tools, including technology, to formulate, represent, and solve problems. [***Problem Solving***]
   (calculus tools, algebra tools, applied tools, nonstandard problem solving)

Date of document: 11/29/2010