

University of Arkansas – Fort Smith
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General Syllabus

STAT 3503 Mathematical Statistics I

Credit Hours: 3

Lecture Hours: 3

Laboratory Hours: 0

Prerequisite: MATH 2854 Calculus II and STAT 2503 Probability and Statistics I or STAT 2503H Probability and Statistics (Honors)

Effective Catalog: 2020~2021

I. Course Information

A. Catalog Description

Introduction to the theory of probability and statistics using concepts and methods of calculus.

II. Student Learning Outcomes

A. Subject Matter

Upon completion of this course, the student should be able to:

1. Generate numerical and graphical statistics using statistical packages.
2. Apply basic definitions associated with the study of probability and statistics.
3. Perform and apply tests of hypothesis, including analysis of variance, regression model, chi-square tests, non-parametric analysis, and time series model.
4. Compute and understand test statistics in each application.
5. Describe and apply characteristics of various common probability distributions including Binomial, Poisson, Normal, t, F, Chi-square, etc.
6. Describe and interpret the various assumptions in each hypothesis test.
7. Describe and apply the central limit theorem.
8. Understand least square and maximum likelihood estimators, and mean square error.
9. Generalize the inference of hypothesis tests from various experiments, observational studies, and survey.

B. University Learning Outcomes

Mathematical Statistics I enhances student abilities in the following areas:

Analytical Skills

Critical Thinking Skills: Students will draw conclusions and/or solve problems. Students will access and evaluate appropriate information through written and electronic means. Students will think critically to reach viable solutions to a problem and be able to justify those solutions.

Communication Skills (written and oral)

Students will communicate effectively with a variety of audiences in any setting. Students will compose coherent documents appropriate to the intended audience. Students will be able to effectively communicate orally in a public setting.

Ethical Decision Making

Students will recognize and analyze ethical dilemmas. Students will apply ethical concepts and rules to determine viable alternatives in any given situation.

Global & Cultural Perspectives

Students will understand the general concept of theory of statistics and perform a variety of statistical analyses. Students will communicate findings with others in a global environment using appropriate statistical and non-statistical language.

III. Major Course Topics

- A. Analysis of variance to compare means from three or more groups
 - 1. One- and two-way ANOVA
 - 2. Interaction term
 - 3. Assumptions
 - 4. Multiple comparisons
- B. Regression analysis for numerical variables
 - 1. Simple and multiple regression models
 - 2. Assumptions
 - 3. Regression model with Qualitative variable
 - 4. Residual analysis
- C. Chi-square tests for categorical variables
 - 1. Goodness-of-fit test
 - 2. Test for homogeneity
 - 3. Test for independence
- D. Non-parametric tests with small sample sizes
 - 1. Wilcoxon's Signed-rank
 - 2. Rank-sum test
 - 3. Kruskal-Wallace test
- E. Time series analysis