College of Sciences & Mathematics Class Syllabus / Policy Sheet

Fall 2023
MATH 5351
Mathematical Statistics II

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Text and Materials:

Course Requirements:

Course Objectives: To present the student with a mathematical introduction to probability and the science of statistics. This theory will then provide a foundation for the application of statistical techniques that are often required to solve problems in engineering, medicine, industry and other disciplines. Specifically, we seek to provide the student with a basic, working knowledge of estimation and hypothesis tests.

Exams: There will be four exams all of which are closed notes & text. All exams will be given outside of class time and will be timed at four hours maximum. The exams are not necessarily written to last for four hours, but occasionally a student encounters a problem that takes a decent amount of time to work through and develop a solution through various attempts. This creation process can take time.

Refer to the course calendar (separate document) for scheduling of all exams.

The fourth exam will be given during Finals Week and is not cumulative.

A Note About Lectures vs. Textbook: The primary source of information for material in this course will be my notes given in class. The text’s purpose is to accent the lectures. Sometimes, we will closely parallel a particular section in Casella & Berger. At other times, we will discuss ideas that are disjoint from the text.

Be aware: This semester’s material DOES NOT parallel the text as much as the notes did in Mathematical Statistics I. For all of the above reasons, your first source in studying for exams should always be the notes. However, reading/studying the text will serve to enhance the ideas presented in class. Therefore, I will frequently assign you to (& expect you to) read the appropriate sections in the text.
Homework: I will assign homework during the majority of the lectures. The homework’s purpose is to prepare you for exams and to promote discussion with me and your classmates. Homework is not graded. Solutions to the homework problems are posted on D2L approximately 10 days after the problems are assigned. You should check there regularly. Occasionally, the keys to these assignments will be printed out and handed to you in class.

Course Calendar:
Roughly speaking, we will focus attention on the material in Chapters 5-9 in the text with the following thoughts:

Chapter 5: Section 5.6 is omitted and this is one chapter where I tend to parallel the books’ coverage.

Chapter 6: Some terms from this chapter and introduced similar to Casella and Berger but I deviate a tremendous amount from the presentation in this Chapter. Virtually none of the text will parallel the notes during this part of the course. Casella and Berger’s presentation is basically replaced by my own here.

Chapter 7: Sections 7.2.4 and 7.3.4 are not covered, otherwise all of Casella and Berger’s presentation shows up in the notes at some point. This chapter is “enhanced” a bit by additional notes that I have. This might be the “core” chapter of MTH 5351.

Chapter 8: Sections 8.2.3, 8.3.3 and 8.3.5 are omitted. This chapter is paralleled in notes less than Chapter 7 is, but more than Chapter 6. Again, my own supplemental spin is placed in notes here (and with more frequency than Chapter 7)

Chapter 9: Material from this chapter is introduced periodically throughout the course. Section 9.3 is minimized almost to the point of omission.

A few ideas from Chapter 10 sneak in from time to time but only in five and ten minute interludes. The most important section is 10.3.1. Chapters 11 and 12 are not referred to at all.

Grading Policy:
Each exam counts ¼ of your grade.

I assign letter grades with the possible additions of pluses (+), minuses (-) and slashes (/). At the end of the semester, these letter grades are then translated to the 0.0 – 4.0 grade point scale and averaged. Slashes (/) represent falling on the border of two grades and the corresponding grade points are averaged. Pluses (+) correspond to x.3 and Minuses (-) correspond to x.7.

Often (not always), the assigned grades per test correspond to approximately 15-point grade blocks (85 is roughly the cut for A, 70 roughly the cut for B, etc…). However, I do
not rigidly use these as cutoffs, instead, the cutoffs are flexible from exam to exam based on overall course performance and patterns in point deductions that I see while grading. The 15-point block scale ought to be thought of as an “average” scale.

For instance, the cutoff for an “A” on an exam in which the class did particularly well might be 87 whereas the cutoff for an “A” on an exam in which the class struggled might be 83. So, in a sense, these changes reflect my attempt at a class “curve” on an exam by exam basis.

Example of grade calculation:

Exam 1: B+ (3.3) Exam 2: A (4.0) Exam 3: A/A- (3.85) Final: A- (3.7)

The average of 3.3, 4.0, 3.85 and 3.7 is 3.7125. This is closest to “A-“, so the student earns an A in the course. Note: The slash grade A-/B+ equates to a 3.5 and serves as the cutoff between A’s and B’s.

**Attendance Policy:**
None.
Academic Integrity

Please copy and paste the following information regarding Academic Integrity into your syllabus. In addition, you may include your guidelines for academic integrity as appropriate.

The Code of Student Conduct and Academic Integrity outlines the prohibited conduct by any student enrolled in a course at SFA. It is the responsibility of all members of all faculty, staff, and students to adhere to and uphold this policy.

Articles IV, VI, and VII of the new Code of Student Conduct and Academic Integrity outline the violations and procedures concerning academic conduct, including cheating, plagiarism, collusion, and misrepresentation. Cheating includes, but is not limited to: (1) Copying from the test paper (or other assignment) of another student, (2) Possession and/or use during a test of materials that are not authorized by the person giving the test, (3) Using, obtaining, or attempting to obtain by any means the whole or any part of a non-administered test, test key, homework solution, or computer program, or using a test that has been administered in prior classes or semesters without permission of the Faculty member, (4) Substituting for another person, or permitting another person to substitute for one’s self, to take a test, (5) Falsifying research data, laboratory reports, and/or other records or academic work offered for credit, (6) Using any sort of unauthorized resources or technology in completion of educational activities.

Plagiarism is the appropriation of material that is attributable in whole or in part to another source or the use of one’s own previous work in another context without citing that it was used previously, without any indication of the original source, including words, ideas, illustrations, structure, computer code, and other expression or media, and presenting that material as one’s own academic work being offered for credit or in conjunction with a program course or degree requirements.

Collusion is the unauthorized collaboration with another person in preparing academic assignments offered for credit or collaboration with another person to commit a violation of any provision of the rules on academic dishonesty, including disclosing and/or distributing the contents of an exam.

Misrepresentation is providing false grades or résumés; providing false or misleading information in an effort to receive a postponement or an extension on a test, quiz, or other assignment for the purpose of obtaining an academic or financial benefit for oneself or another individual or to injure another student academically or financially.

Withheld Grades Semester Grades Policy (5.5)

Please copy and paste the following information regarding Withheld Grades into your syllabus. Add additional information as needed to meet your departmental or course needs.

Ordinarily, at the discretion of the instructor of record and with the approval of the academic chair/director, a grade of WH will be assigned only if the student cannot complete the coursework because of unavoidable circumstances. Students must complete the work within one calendar year from the end of the semester in which they receive a WH, or the grade automatically becomes an F. If students register for the same course in future terms the WH will automatically become an F and will be counted as a repeated course to compute the grade point average. For additional information, go to https://www.sfasu.edu/policies/course-grades-5.5.pdf.

Students with Disabilities

Please copy the following statement and paste it into your course syllabus.

To obtain disability-related accommodations, alternate formats, and/or auxiliary aids, students with disabilities must contact the Office of Disability Services (ODS), Human Services Building, and Room 325, 468-3004 / 468-1004 (TDD) as early as possible in the semester. Once verified, ODS will notify the course instructor and outline the accommodation and/or auxiliary aids to be provided. Failure to request services promptly may delay your accommodations. For additional information, go to http://www.sfasu.edu/disabilityservices/.

Please copy everything below and paste it into your course syllabus.

Student Wellness and Well-Being

SFA values students’ overall well-being, mental health and the role it plays in academic and overall student success. Students may experience stressors that can impact both their academic experience and their personal well-being. These may include academic pressure and challenges associated with relationships, emotional well-being, alcohol and other drugs, identities, finances, etc.

If you are experiencing concerns, seeking help, SFA provides a variety of resources to support students’ mental health and wellness. Many of these resources are free, and all of them are confidential.
On-campus Resources:
The Dean of Students Office (Rusk Building, 3rd floor lobby)
www.sfasu.edu/deanofstudents
936.468.7249
dos@sfasu.edu

SFA Human Services Counseling Clinic Human Services, Room 202
www.sfasu.edu/humanservices/139.asp
936.468.1041

The Health and Wellness Hub “The Hub”
Location: corner of E. College and Raguet St.
To support the health and well-being of every Lumberjack, the Health and Wellness Hub offers comprehensive services that treat the whole person – mind, body and spirit. Services include:
• Health Services
• Counseling Services
• Student Outreach and Support
• Food Pantry
• Wellness Coaching
• Alcohol and Other Drug Education
www.sfasu.edu/thehub
936.468.4008
thehub@sfasu.edu

Crisis Resources:
• Burke 24-hour crisis line: 1.800.392.8343
• National Suicide Crisis Prevention: 9-8-8
• Suicide Prevention Lifeline: 1.800.273.TALK (8255)
• johCrisis Text Line: Text HELLO to 741-741
MATH 5351–Mathematical Statistics II
Course Syllabus

Course description: Sufficient and complete statistics, likelihood and moment estimation, properties of estimators, interval estimation and hypothesis tests.

Credit hours: 3

The following is an excerpt from SFA Policy 5.4:

The federal definition of a credit hour is an amount of work represented in intended learning outcomes and verified by evidence of student achievement that is an institutionally established equivalency that reasonably approximates:

1. Not less than one hour of classroom or direct faculty instruction and a minimum of two hours out-of-class student work each week for approximately fifteen weeks for one semester or trimester hour of credit, or 10 to 12 weeks for one quarter hour of credit, or the equivalent amount of work over a different amount of time, or;

2. At least an equivalent amount of work as outlined in item 1 above for other academic activities as established by the institution including laboratory work, internships, practica, studio work, and other academic work leading to the award of credit hours.

To this end, all students in courses offered by the Department of Mathematics and Statistics that wish to be successful should plan to spend a minimum of two hours outside of class for every credit hour associated with this course. Expected activities to be completed in the time outside of class include reviewing notes from previous class meetings, reading assigned course resources, completing all assigned exercises and projects, and performing periodic assessment preparation.

Course Prerequisites and Corequisites: MATH 5350

Course outline:

- Sampling Distributions
  - Properties of the Sample Mean and Sample Variance
  - Convergence Concepts
  - Central Limit Theorem
  - Approximate time spent: 10%

- The t and F sampling distributions
  - Properties of t and F random variables
  - The role of t-statistics and F-ratios in statistics
  - Approximate time spent: 5%

- Order Statistics
  - Approximate time spent: 5%

- Methods of Point Estimation for Parameters
  - Method of Moments
  - Maximum Likelihood Estimation
    - Utilizing calculus
    - Utilizing graphical methods
  - Bayes' Estimation
    - Bayesian v. Frequentist Philosophy
    - Prior and Posterior Distributions
  - Approximate time spent: 25%

- Properties of Estimators
  - Mean Squared Error and Unbiasedness
  - "Best" Estimation
    - UMVUE via Cramer-Rao Inequality
    - Sufficiency and Completeness
  - Approximate time spent: 20%
- Rao-Blackwell Theorem
- UMVUE via Lehmann-Scheffe Theorem
- Best Invariant Estimation

**Theory of Tests of Hypotheses** 25%
- Simple v. Composite Hypotheses
- Simple Likelihood Ratio Tests
  - Neyman-Pearson Results
- General Likelihood Ratio Tests
- Monotone Likelihood Ratios
- Karlin-Rubin Theorem
- Bayes’ Tests
- Properties of Hypothesis Tests
  - Unbiasedness and Consistency
  - Type I and II errors, Power

**Confidence Intervals** 10%
- Relationship to Hypothesis Tests
- Pivotal Quantities
- Test Statistic Inversion
- Coverage and Assessing/Interpreting Confidence Intervals

**Student Learning Outcomes (SLO):** At the end of MATH 5351, a student who has studied and learned the material should be able to:
1. State and apply the Central Limit Theorem and discuss its importance in statistical inference techniques. [PLO 1,2,3]
2. Estimate parameters of probability models via several methods and compare and contrast the properties of each method. [PLO 1,2,3]
3. Assess the quality of an estimator for a parameter, specifically addressing the issue of mean-squared error. [PLO 1,2,3]
4. Explain and consider both a frequentist and Bayesian approach to statistical inference. [PLO 1,2,3]
5. Carry out a test of hypotheses for the parameters of a probability model, specifically being familiar with likelihood ratio methodology. [PLO 1,2,3]
6. Explain the dual relationship between hypothesis tests and confidence intervals. [PLO 1,2,3]
7. Calculate and properly interpret an interval estimate for parameters from a specified probability model. [PLO 1,2,3]
8. Apply the major theorems related to hypothesis tests and discuss the overall philosophy of testing. [PLO 1,2,3]
9. Explain the meaning of Type I and II errors along with have a firm understanding of the role of power as it pertains to hypothesis tests. [PLO 1,2,3]

**Program Learning Outcomes (PLO):** Students graduating from SFA with a M.S. Mathematical Sciences Degree will:

1. Written Communication - SFA Mathematics majors communicate mathematical ideas effectively in written form, integrating mathematical notation correctly and consistently.
2. Verbal Communication - SFA Mathematics majors communicate mathematics effectively to diverse audiences.
3. Mathematical Maturation - SFA Mathematics majors grow from a computational understanding of mathematics to an integrated approach which includes critical thinking proficiency, computational facility, conceptual understanding, and problem-solving persistence.

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dos@sfasu.edu

SFA Human Services Counseling Clinic Human Services, Room 202
[www.sfasu.edu/humanservices/139.asp](http://www.sfasu.edu/humanservices/139.asp)
The Health and Wellness Hub “The Hub”
Location: corner of E. College and Raguet St.

To support the health and well-being of every Lumberjack, the Health and Wellness Hub offers comprehensive services that treat the whole person – mind, body and spirit. Services include:

- Health Services
- Counseling Services
- Student Outreach and Support
- Food Pantry
- Wellness Coaching
- Alcohol and Other Drug Education

[www.sfasu.edu/thehub](http://www.sfasu.edu/thehub)
936.468.4008
thehub@sfasu.edu

Crisis Resources:
- Burke 24-hour crisis line: 1.800.392.8343
- National Suicide Crisis Prevention: 9-8-8
- Suicide Prevention Lifeline: 1.800.273.TALK (8255)
- Crisis Text Line: Text HELLO to 741-741

Acceptable Student Behavior
Classroom behavior should not interfere with the instructor’s ability to conduct the class or the ability of other students to learn from the instructional program (see the Student Conduct Code, policy 10.4). Unacceptable or disruptive behavior will not be tolerated. Students who disrupt the learning environment may be asked to leave class and may be subject to judicial, academic or other penalties. This prohibition applies to all instructional forums, including electronic, classroom, labs, discussion groups, field trips, etc. The instructor shall have full discretion over what behavior is appropriate/inappropriate in the classroom.

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