STAT 040: Mathematical Statistics

Term: 2020 Winter Session Instructor: Staff Language of Instruction: English Classroom: TBA Office Hours: TBA
Class Sessions Per Week: 6 Total Weeks: 4 Total Class Sessions: 25 Class Session Length (minutes): 145 Credit Hours: 4

Course Description:

The main purpose of this course is to help students obtain knowledge and use of theories of estimation and hypothesis testing procedures, together with some of their more important applications. Focus will be put on deriving estimators, compare and evaluate methods like moment methods and maximum likelihood estimators, hypothesis tests and confidence intervals based on interpretation of statistical properties. Topics on Chi-Square, power of a hypothesis test, Neyman-Pearson theory and likelihood ratio tests, ANOVA and hypothesis testing for linear models will also be covered. Students will be prepared with basic statistical inference methods, practice under computational framework using software and apply them to real-world problems.

Course Materials:

Textbook:
Mathematical Statistics with Applications by Dennis Wackerly, William Mendenhall, Richard L. Scheaffer, Publisher: Thomson Brooks/Cole; 7 edition (2008)

Software Suggestions:
EXCEL is highly recommended to be familiar with. MATLAB and R will be useful statistical software for these course

Course Format and Requirements:

The primary format of this course is lecture, problem solving and discussion. Familiarizing with the course material before class, you will gain a better understanding the information presented during lecture. Each student will be responsible for learning as much as possible. Students are strongly encouraged to ask questions on things you did not understand.

Attendance

Attendance will not be taken but all quizzes will be the taken at the beginning in class. Arriving late may cause you to miss a quiz, impacting your performance assessment. There is no made-up quiz.

Grading Scale:

A+: 98%-100%
A: 93%-97%
A-: 90%-92%
B+: 88%-89%
B: 83%-87%
B-: 80%-82%
C+: 78%-79%
C: 73%-77%
C-: 70%-72%
D+: 68%-69%
D: 63%-67%
D-: 60%-62%
F: Below 60%

Course Assignments:

Homework and Quizzes:

Quiz questions include calculation and short answer tests. There will be six quizzes in total, of which the lowest score will not be taken into account. No make-up quiz will be given.

Midterm Exams:

There will be two midterm exams throughout the session. Each exam accounts for 20% of the final grade. Midterm exam 1 will take place in week 2 while midterm 2 in week 3. Midterm 2 is non-cumulative and the materials learned before midterm 1 will not be tested.

Final Exam:

The final exam is cumulative. Students are advised to review thoroughly before the final exam for it covers the materials learned through the whole session. It accounts for 40% of the final grade.

Course Assessment:

Homework and Quizzes	20%
Midterm Exams 1	20%
Midterm Exams 2	20%
Final Exam	40%
Total	**100%**

Course Schedule:

Week	Topics	Activities
1.	Go through syllabus Course overview Review on probability; Functions of random variables; Bias and Mean Square Error of Point Estimators; More on Estimators and their properties; Evaluating the Goodness of a Point Estimator; Confidence intervals, sample size calculations;	Quiz 1 Quiz 2

2.	Relative efficiency; Consistency; The concepts of sufficiency; The Rao–Blackwell Theorem and minimum variance; Unbiased estimation; The Method of moments; Maximum likelihood estimation; Examples on MLE and their properties;	Midterm 1 Quiz 3
3.	More Examples on MLE and their properties under different situations; improving an estimator; Sampling distribution of a statistic; Concepts of hypothesis testing; Elementary examples; Large sample test; Z-test procedure; Type I and II errors and examples; Interpreting confidence and credible intervals from hypothesis testing results. P-value, significance level, more examples on two-sided hypothesis testing;	Quiz 4 Midterm 2 Quiz 5
4.	P-value, significance level, more examples on two-sided hypothesis testing(Cont.); Small-Sample Hypothesis Testing, the t test; The Chi-Square Test for the variance; Calculating The power of a hypothesis test, and introduction to	Quiz 6 Final Exam

Bayesian hypothesis testing; Neyman-Pearson theory and likelihood ratio tests; and their applications; ANOVA; The method of least squares and simple linear regression; Multiple, nonlinear and nonparametric regression; Hypothesis testing for linear models; Review for final	

Academic Integrity:

Students are encouraged to study together, and to discuss lecture topics with one another, but all other work should be completed independently.

Students are expected to adhere to the standards of academic honesty and integrity that are described in the Shanghai Normal University's *Academic Conduct Code*. Any work suspected of violating the standards of the *Academic Conduct Code* will be reported to the Dean's Office. Penalties for violating the *Academic Conduct Code* may include dismissal from the program. All students have an individual responsibility to know and understand the provisions of the *Academic Conduct Code*.

Special Needs or Assistance:

Please contact the Administrative Office immediately if you have a learning disability, a medical issue, or any other type of problem that prevents professors from seeing you have learned the course material. Our goal is to help you learn, not to penalize you for issues which mask your learning.