SYLLABUS FOR STAT 52800 SPRING 2024
INTRODUCTION TO MATHEMATICAL STATISTICS

Instructor Sean Peng
Class Time 4:30–5:45PM MW
Office Hours 10:30–11:30AM MW (or by appt/zoom)
Math Ph 317-274-6918
E-mail hanxpeng@iu.edu

Dept of Math Sciences
Class Room IT 162
Office LD 224B
Office Ph 317-274-8070
Zoom ID/Pass 850 0735 8567/446326

Prerequisite STAT 51900 (Introduction to Probability).

Course Description Students will learn the basic concepts of mathematical statistics including sufficiency and completeness, the exponential family of distributions, theory of point estimation, Cramer-Rao inequality, Rao-Blackwell Theorem with applications, maximum likelihood estimation, asymptotic distributions of maximum likelihood estimators, hypothesis testing, Neyman-Pearson Lemma, UMP tests, generalized likelihood ratio test, asymptotic distribution of the GLR test, and sequential probability ratio test. The prerequisite of this course is STAT 51900. It is suitable for students in mathematics, economics, business etc. who do not wish to pursue a program in statistics. However, it is a required course for statistics masters, mathematical statistics and biostatistics PhD programs, and so we will focus on concepts that are essential for statistical/bio-statistical applications. This course prepares you for advanced statistics course STAT 62800.

Textbook Hogg, McKean and Craig (2005). Introduction to Mathematical Statistics, 8th ed. Pearson Education Inc., ISBN 978-0-13-468699-8.

SoS Policy on Technology and Devices Unless stated otherwise by the instructor, cell phones, tablets, computers, smart/electronic/digital watches, or any other form of technology, are not allowed in any School of Science testing situation (tests, quizzes, exams, etc.) whether the technology is being used or not to obtain answers. Students must place all technology and devices (must be in silent mode or powered off) in their closed bags placed under their chair. Students observed with any technology device may face penalties including failure of the test/quiz/exam/course, and the incident may be formally reported to the Dean of Students. Software S-Plus, SAS and R packages (available at www.R-project.org)

Homework Daily homework is assigned in class. Homework will not be collected and graded. Completing all homework sets on time is absolutely essential in learning the material and getting ready for quizzes and exams.

Quizzes are given at the end of the quiz day for about 10 minutes (from 5:35-:45PM) and are based on homework problems due that day. The quizzes will be closed book and closed notes. Each of the 12 quizzes is worth 20 points (4%). There will be absolutely no make-up quizzes. Your lowest two quiz scores will be dropped. All quizzes together accounts for 200 points (40%).

Exams There will be three closed-book exams (one sheet of formulas permitted) in this course based on materials covered up to the previous class day. Each exam is for 75 minutes and worth 100 points (20%). There will be no make-up exams. No exam score will be dropped. The third exam is the final exam. However, MS (Applied/Bio Statistics) and PhD (Biostatistics and Mathematics) students are required to take a closed-book comprehensive exam on materials of STAT 51900 and 52800.

GRADING The percentage point distribution will be as follows: Top ten of twelve Quizzes (200 points), Three Exams (300 points). There will NOT be any make-up. Your letter grade will be determined by referring your achieved percentage score to the following absolute scale:

$$\text{A} \geq 90\% > \text{B} \geq 80\% > \text{C} \geq 70\% > \text{D} \geq 60\% > \text{F},$$

with "+" and "−" attached for scores falling in the upper and lower third of the range, respectively. I reserve the right to make adjustments to the overall grading policy, but the letter grade cutoffs will be no stricter than those advertised above. *The letter grades given on Canvas are not based on above and hence not your final grades.*

STUDENT CONDUCT Please refer to IUPUI Code of Student Rights, Responsibilities, and Conduct (http://studentcode.iu.edu/).

INCOMPLETES Grades of Incomplete will only be given in accordance with the university policy (http://www.registrar.iupui.edu/incomp.html). In particular, an incomplete cannot be given to a student who is not passing the course for whatever reason.

NO CLASS ATTENDANCE WITHOUT OFFICIAL ENROLLMENT After the conclusion of the 100% refund period (https://facultystaffcentral.iupui.edu/enrollment/index.html), all individuals attending classes on a regular basis MUST be officially enrolled in the class, attending the class based on formal arrangements to make up a prior grade of Incomplete, or enrolled as an auditor. One-time visitors to classes may be allowed only on an exception basis with prior permission of the instructor. This policy does not apply to individuals who provide assistance to a student with a documented disability, such as Adaptive Educational Services sign language interpreters, individuals who are involved in the course in an instructional role, or administrative personnel

IMPORTANT DATES

Tues Jan 08	First day of class
Mon Jan 15	Martin Luther King Jr. Holiday-No class; All offices closed
Mon Mar 11 – Sun Mar 17	Spring Break Recess. No class
Mon Mar 18	Classes resume
Mon Apr 29	Last day of class
Fri April 26– Sun May 05	Final Exams
Friday, May 10	Final grades are available on transcripts at noon and viewable through ONE (https://one.iu.edu.)

Table 1: **Tentative Schedule**

Jan 08	M	Point estimates, Moment estimates, MVUE	Lec Notes	
Jan 10	W	M- and Z- estimates	Lec Notes	Quiz 1
Jan 17	W	M- and Z- estimates	Lec Notes	
Jan 22	M	Maximum Likelihood Estimation	6.1-6.2	Quiz 2
Jan 24	W	C-R Lower Bound, Efficiency	6.2	
Jan 29	M	Asymptotic normality	6.2	Quiz 3
Jan 31	W	Multi-parameter: Estimation	6.4	
Feb 05	M	Multi-parameter: Estimation	6.4	Quiz 4
Feb 07	W	Exam 1		
Feb 12	M	Hypothesis Testing	4.5	
Feb 14	W	Hypothesis Testing and Confidence Intervals	4.5	
Feb 19	M	Chi-square test and Uni-parameter: LRT	4.7, 6.3, 8.3	Quiz 5
Feb 21	W	Likelihood Ratio Tests	6.5	
Feb 26	M	Sufficient statistics	7.2-7.3	Quiz 6
Feb 28	W	Sufficient statistics and its properties	7.2-7.4	
Mar 04	M	Property of Sufficiency Statistics	7.3-7.4	Quiz 7
Mar 06	W	Completeness, Uniqueness and Exponential Family	7.4-7.8	
Mar 18	M	Exponential Family	7.5-7.6	Quiz 8
Mar 20	W	Comp-Uniq-Independence and Optimal Tests	7.9, 8.1	
Mar 25	M	Exam 2		
Mar 27	W	Most powerful tests	8.1	
Apr 01	M	Best critical regions	8.1	Quiz 9
Apr 03	W	Uniformly most powerful tests	8.1	
Apr 08	M	Monotone likelihood ratio	8.2	Quiz 10
Apr 10	W	One-way ANOVA	9.1-2	
Apr 15	M	General estimating equations	Lec Notes	Quiz 11
Apr 17	W	ASN for GEE	Lec Notes	
Apr 22	M	ASN for LSE	Lec Notes	Quiz 12
Apr 24	W	ASN for LSE	Lec Notes	
Apr 29	M	Exam 3		