

Math 60062/70062-001: Mathematical Statistics II

Tsung-Heng Tsai

Spring 2022

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Office Hours: TR 1:00-2:00 p.m.

Office: MSB 372

Web: tsunghengtsai.github.io/mathstat1-S22

Class Hours: TR 9:15-10:30 a.m.

Class Room: MSB 376

Course Description

This is the second course of the two-semester Mathematical Statistics sequence, which covers the essential mathematics for work in statistics, the mathematical methods for statistical inference, and the approaches for evaluating the efficacy of inferential procedures. Topics of this course include: point estimation, hypothesis testing, interval estimation, and asymptotic evaluations.

Prerequisites

You should have completed Math 60061 or Math 70061 and have graduate standing. If you are enrolled in 70062, you must have doctoral standing. Students who do not have the proper prerequisites risk being deregistered from the class. Please contact instructor if you would like to take the course, but do not satisfy the prerequisite.

References

There is no required textbook. Class notes will be provided throughout the course. Useful references are:

1. George Casella and Roger L. Berger. *Statistical Inference*, Duxbury Press, 2002.
2. Larry Wasserman. *All of Statistics: A Concise Course in Statistical Inference*, Springer, 2004.

Course Policy

Important policy for this course is detailed below.

Grading

Grades will be calculated as follows:

- Homework assignments: 20%

- Midterm exam 1: 20% (Thursday February 24)
- Midterm exam 2: 20% (Thursday March 24)
- Final exam: 40% (Thursday May 5)

The final letter grades will follow the usual scale: A=90-100; B=80-89; C=70-79; D=60-69; F=0-59. Plus and minus grades will be given at discretion of the instructor.

Homework

There will be approximately 5-6 homework assignments that will be posted on Blackboard. Assignments must be uploaded to Blackboard as a **PDF** file. You can either type your homework solutions or write them on papers and upload the scanned version. In any case, please make sure your work is clearly presented.

Assignments are due at the beginning of class hour on the specified date. In general, **NO** late submissions will be accepted. In case of truly exceptional situations (e.g., family emergencies or illness), the instructor may make exceptions and allow late submission. The lowest homework score will be dropped at the end of the semester.

Exams

There will be three in-class exams: two midterm exams and one comprehensive final exam (dates mentioned above). The exams are closed-book. Each student should work on the exams independently.

Re-grades of Homeworks and Exams

All re-grading requests should be made in writing, within one week after receiving a grade. The request should state the specific question that needs to be re-graded, as well as a short explanation of why re-grading is necessary. The new grade may be lower than the original grade.

Academic Integrity

University policy 3-01.8 deals with the problem of academic dishonesty, cheating, and plagiarism. None of these will be tolerated in this class. The sanctions provided in this policy will be used to deal with any violations. If you have any questions, please read the policy at <http://www.kent.edu/policyreg/administrative-policy-regarding-student-cheating-and-plagiarism> and/or ask.

Accommodations for Students with Disabilities

Kent State University is committed to inclusive and accessible education experiences for all students. University Policy 3342-3-01.3 requires that students with disabilities be provided reasonable accommodations to ensure equal access to course content. Students with disabilities are encouraged to connect with Student Accessibility Services as early as possible to establish accommodations. If you anticipate or experience academic barriers based on a disability (including mental health, chronic medical conditions, or injuries), please let me know immediately.

Student Accessibility Services (SAS) Contact Information:

- Location: University Library, Suite 100
- Email: sas@kent.edu
- Phone: 330-672-3391; VP 330-968-0490
- Web: www.kent.edu/sas

Registration Requirement

The official registration deadline for this course is **January 24, 2022**. University policy requires all students to be officially registered in each class they are attending. Students who are not officially registered for a course by published deadlines should not be attending classes and will not receive credit or a grade for the course. Each student must confirm enrollment by checking his/her class schedule (using Student Tools in FlashLine) prior to the deadline indicated. Registration errors must be corrected prior to the deadline.

Withdrawal

The last day to drop without a grade of “W” is **January 31, 2022**. The last day to withdraw this course is **April 4, 2022**. Other important Registrar dates can be found at <http://www.kent.edu/registrar/registrar-dates-term>.

Tentative Schedule

The schedule is subject to change and will be updated at the course website (<https://tsunghengtsai.github.io/mathstat2-S22.html>), so please check it regularly.

Week 01, 01/17 - 01/21: Convergence

Topics:

- Mode of convergences
- Central Limit Theorem
- Slutsky's Theorem
- Delta Method

Kent State Campuses closed on January 18.

Week 02, 01/24 - 01/28: The Sufficiency Principle

Topics:

- Sufficient statistics and minimal sufficient statistics
- Ancillary statistics
- Complete statistics

Week 03, 01/31 - 02/04: Point Estimation

Topics:

- Method of moments
- Maximum likelihood estimators

Week 04, 02/07 - 02/11: Point Estimation

Topics:

- Bayes estimators
- Mean squared error
- Best unbiased estimators

Week 05, 02/14 - 02/18: Point Estimation

Topics:

- Cramér-Rao Theorem
- Rao-Blackwell Theorem

Week 06, 02/21 - 02/25: Midterm Exam I

Exam on February 24, 9:15-10:30 a.m.

Week 07, 02/28 - 03/04: Hypothesis Testing

Topics:

- Likelihood ratio tests
- Bayesian tests

Week 08, 03/07 - 03/11: Hypothesis Testing

Topics:

- Error probabilities and power function
- Most powerful tests

Week 09, 03/14 - 03/18: Hypothesis Testing

Topics:

- Uniformly most powerful tests
- Neyman-Pearson Lemma
- Karlin-Rubin Theorem
- p -values

Week 10, 03/21 - 03/25: Midterm Exam II

Exam on March 24, 9:15-10:30 a.m.

Week 11, 03/28 - 04/01: Spring Break

No class on March 29 and March 31

Week 12, 04/04 - 04/08: Interval Estimation

Topics:

- Inverting a test statistic
- Pivotal quantities
- Pivoting the CDF
- Bayesian intervals

Week 13, 04/11 - 04/15: Interval Estimation

Topics:

- Size and coverage probability
- Test-related optimality

Week 14, 04/18 - 04/22: Asymptotic Evaluations

Topics:

- Consistency and efficiency
- Large-sample properties of MLEs
- Large-sample properties of LRTs

Week 15, 04/25 - 04/29: Asymptotic Evaluations

Topics:

- Wald tests and score tests
- Approximate maximum likelihood intervals
- Wald intervals and score intervals

Week 16, 05/02 - 05/06: Final Exam Week

Final Exam on May 5, 9:15-10:30 a.m.