Course Syllabus

STAT 581:
Advanced Theory of Statistical Inference
Fall 2021

Instructor:
Fang Han (fanghan@uw.edu)

Teaching Assistant:
Gang Cheng (gangc@uw.edu)

Course Website:
https://www.stat.washington.edu/people/fanghan/teaching/STAT581

Class Schedule: There will be three lectures a week:

• (Lecture) MWF, 10:30-11:20 PM in https://washington.zoom.us/j/92858015882 (pwd: 581185).

This year STAT581 will be offered in a hybrid mode; all lectures will be live on zoom, while each Wednesday the instructor will zoom-lecture physically in CMU230.

Course Overview: This is a 10-week lecture-based course focused on introducing some core topics in mathematical statistics, including the elementary decision theory, basic large sample theory, maximum likelihood estimators and M-estimators, hypothesis testing, and efficiency lower bounds.

Prerequisites: This course requires either MATH 424-6, or MATH 559, and is appropriate for a graduate student of a mathematics/probability/statistics background, and requires a certain level of mathematical maturity. Please do not hesitate to approach the instructor if you have any concern.

Grades: There will be eight HWs (40%), one midterm (25%), and one final exam (35%). The final grade will be curved.

Format of HWs: There will be 8 homework assignments (each worth 5%):

Homework 1: Assigned 10/01, Due 10/08 (23:59:59PM);
Homework 2: Assigned 10/08, Due 10/15 (23:59:59PM);
Homework 3: Assigned 10/15, Due 10/22 (23:59:59PM);
Homework 4: Assigned 10/22, Due 10/29 (23:59:59PM);
Homework 5: Assigned 10/29, Due 11/05 (23:59:59PM);
Homework 6: Assigned 11/05, Due 11/19 (23:59:59PM);
Homework 7: Assigned 11/19, Due 12/03 (23:59:59PM);
Homework 8: Assigned 12/03, Due 12/10 (23:59:59PM).

Late HWs will be penalized 20% per day (for instance, a homework turned in two days late will receive only 60% credit). Exceptions to these rules will of course be made for serious illness or other emergency circumstances; in these cases, please contact me as soon as you are aware of the problem. You need to upload your answers to the Canvas. Teamwork is allowed, but it is encouraged to think by yourself first; plagiarism is strictly forbidden. Technical correctness, clarity, and completeness are equally important.

Format of the exam: There will be a midterm and a final exam, both take-home and intended to be done in any 2-hour window, on Nov 12 and Dec 10. You will need to upload your answers to canvas. The exams will be open book, though neither access to the internet nor teamwork is allowed; they will be considered as cheating.

Course Textbook: This course is built on the lecture notes provided on canvas and the following textbook
Professor Jon Wellner’s lecture notes shall also be referenced from time to time


COVID-related expectations: Per UW policy, this class will be conducted in person. Therefore, unless you meet the criteria for an accommodation from Disability Resources for Students (DRS) or a special arrangement approved by a respective office that allows you to take the course remotely, you should only register for this class if you can attend in-person.

- Please contact UW Disability Resources for Students (DRS) directly if you feel you may be eligible for an accommodation based on your status as an immunocompromised individual or based on other diagnosed physical or mental health conditions that might prevent you from being able to take classes in-person.
- If you are a student enrolled in a program in SPH, and you are either living with an individual who is immunocompromised, OR you are unable to obtain a visa to travel to the US, you may be eligible for a “special arrangement” that will allow you to take this course remotely. Requests for special arrangements to take the class remotely should have been submitted to and approved by the Students and Academic Services team in the Office of the Dean before the beginning of the quarter. If you have questions about this type of arrangement, please reach out to Student and Academic Services by email at sphsas@uw.edu.

All UW students are expected to complete their vaccine attestation before arriving on campus and to follow the campus-wide face-covering policy at all times. You are expected to follow state, local, and UW COVID-19 policies and recommendations. If you feel ill or exhibit possible COVID symptoms, you should not come to class. If you need to temporarily quarantine or isolate per CDC guidance and/or campus policy, you are responsible for notifying your instructors as soon as possible by email. If you receive a positive COVID-19 test result, you must report to campus Environmental Health & Safety (EH&S) by emailing covidehc@uw.edu or calling 206-626-3344.

Food is not allowed in the classroom. Drinks may be sipped with lifting or removal of your facemask for a brief moment, and immediate re-masking after drinking.

Religious accommodations: “Washington state law requires that UW develop a policy for accommodation of student absences or significant hardship due to reasons of faith or conscience, or for organized religious activities. The UW’s policy, including more information about how to request an accommodation, is available at Religious Accommodations Policy ([https://registrar.washington.edu/staffandfaculty/religious-accommodations-policy/](https://registrar.washington.edu/staffandfaculty/religious-accommodations-policy/)). Accommodations must be requested within the first two weeks of this course using the Religious Accommodations Request form ([https://registrar.washington.edu/students/religious-accommodations-request/](https://registrar.washington.edu/students/religious-accommodations-request/)).”

Academic integrity: The University takes academic integrity very seriously. Behaving with integrity is part of our responsibility to our shared learning community. If you’re uncertain about if something is academic misconduct, ask me. I am willing to discuss questions you might have.

Acts of academic misconduct may include but are not limited to:

- Cheating (working collaboratively on quizzes/exams and discussion submissions, sharing answers and previewing quizzes/exams)
- Plagiarism (representing the work of others as your own without giving appropriate credit to the original author(s))

Concerns about these or other behaviors prohibited by the Student Conduct Code will be referred for investigation and adjudication by (include information for specific campus office).

Students found to have engaged in academic misconduct may receive a zero on the assignment (or other possible outcome).

Course Schedule:
<table>
<thead>
<tr>
<th>Date (M)</th>
<th>virtual</th>
<th>Date (W)</th>
<th>in-person</th>
<th>Date (F)</th>
<th>virtual</th>
</tr>
</thead>
<tbody>
<tr>
<td>09/29</td>
<td></td>
<td>10/01</td>
<td>Intro to decision theory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10/04</td>
<td>Posterior dist. and Bayes rules</td>
<td>10/06</td>
<td>Bayes rules</td>
<td>10/08</td>
<td>Minimax rules</td>
</tr>
<tr>
<td>10/11</td>
<td>Minimax rules</td>
<td>10/13</td>
<td>Admissibility</td>
<td>10/15</td>
<td>Admissibility</td>
</tr>
<tr>
<td>10/18</td>
<td>Modes of convergence</td>
<td>10/20</td>
<td>Modes of convergence</td>
<td>10/22</td>
<td>Stochastic order</td>
</tr>
<tr>
<td>10/25</td>
<td>CLTs</td>
<td>10/27</td>
<td>Multivariate Delta method</td>
<td>10/29</td>
<td>Intro to M-estimation</td>
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<tr>
<td>11/01</td>
<td>Intro to M-estimation</td>
<td>11/03</td>
<td>Consistency of M-estimators</td>
<td>11/05</td>
<td>Uniform consistency</td>
</tr>
<tr>
<td>11/08</td>
<td>Uniform consistency</td>
<td>11/10</td>
<td>ASN of M-estimators</td>
<td>11/12</td>
<td>Midterm</td>
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<tr>
<td>11/15</td>
<td>ASN of MLEs</td>
<td>11/17</td>
<td>QMD</td>
<td>11/19</td>
<td>MLE: Wald</td>
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<tr>
<td>11/22</td>
<td>Wald, score, and LRTs</td>
<td>11/24</td>
<td>Local power analysis</td>
<td>11/26</td>
<td>Thxgiving Friday: no class</td>
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<tr>
<td>11/29</td>
<td>Local power analysis</td>
<td>12/01</td>
<td>Relative efficiency</td>
<td>12/03</td>
<td>Relative efficiency</td>
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<tr>
<td>12/06</td>
<td>Efficiency lower bounds</td>
<td>12/08</td>
<td>Efficiency lower bounds</td>
<td>12/10</td>
<td>Final</td>
</tr>
</tbody>
</table>

CLT: central limit theorem  
ASN.: asymptotic normality  
MLE: maximum likelihood estimator  
QMD: quadratic mean differentiability  
LRT: likelihood ratio tests  

Figure 1: Course schedule (tentative).