

Statistics 4198:
Statistical Thinking and Its History
Fall, **2022**

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Course Description: Data (information) arises from both experimental and observational studies and in a wide range of applications e.g. biomedical, pharmaceutical, social sciences, business, reliability etc. Statistical thinking plays a more and more important role in collecting, understanding and analysis of these information. In this course, we will provide a journal of some great statistical ideas and methods from historical point of view. We also provide the theoretical supports of these great statistical ideas.

Course Outline:

- Statistics in 17th and 18th centuries, from games of chance (gambling) to probability. Normal distribution: the history, main properties, and the importance.
- The method of least squares: the history, main idea, theoretical supports, and the importance.
- The idea of likelihood: the history, the applications, theoretical properties, and the importance.
- Hypothesis and P-value: the history, main idea, theoretical properties, and the importance.
- The design of experiments: the history, main idea, theoretical properties, and the importance. Design of clinical trials and modern drug developments.
- Bayesian statistics: the history, main idea, theoretical properties, and the importance.

Prerequisite(s): Math 1231 (Calc I) and 2232 (Calc II), Introduction of Statistics (STAT2118 and STAT3119) or equivalent. Previous experience with statistical computing is a plus but not required.

Reference Books: (1) The history of Statistics, By Stephen M. Stigler, ISBN 9780674403413;
(2) Statistics on the Table: The History of Statistical Concepts and Methods. By Stephen M. Stigler, ISBN-13: 978-0674009790

Learning Outcomes

1. Understand main statistical ideas (normal distribution, the method of least squares, The idea of likelihood, the P-value, design of experiments and Bayesian statistics) and their history;
2. Demonstrate basic knowledge of statistical thinking;

3. Demonstrate the mathematical supports of the statistical ideas (such as least square estimator, likelihood estimators, designs of experiments).
4. Apply knowledge of statistical thinking in real world problems;

Weekly schedule (tentatively):

- **Week 1:** Statistics in 17th and 18th centuries, from games of chance (gambling) to probability.
- Week 2: Normal distribution: the history, main properties and the applications.
- Week 3: The method of least squares: the history, main idea, and examples.
- Week 4: Estimation, moments, mean and variance, examples.
- Week 5: The idea of likelihood: the history, the applications, and examples.
- Week 6: Hypothesis Testing: the history, main idea, and examples.
- Week 7: P-value: the history, main idea, and examples.
- Week 8: Experimental data and observational data: the difference and examples
- Week 9: The design of experiments: the history, main idea, and examples.
- Week 10: Design of clinical trials and modern drug developments: history and examples.
- Week 11: Adaptive Designs of Clinical Trials: The idea and advantages.
- Week 12 and 13: Bayesian statistics: the history, main idea, and examples.

Grading: HW Assignments 20%; Classroom Participation 20%; Midterm Exam 25%; Final Project 35%.

- *Midterm Exam:* The exam will be given during class time. The date of the midterm is on the class schedule.
- *Final Project:* Students will complete a data analysis project using the statistical methods discussed in class. Students will locate their own data to analyze and will give a project proposal, present in-class and submit the final report.
- Biweekly HW assignments.

Class Attendance

It is important that you attend the class. You are responsible for any materials covered or any announcements made in class, even if you are not present.

The class will not be recorded. I will send the class materials to those students who have a legitimate reason for missing class.

Amount of Time on Direct and Independent Learning: It is expected that students spend 150 minutes in classroom on lecture plus 300 minutes of independent learning per week.

Homework: Late homework will not be accepted.

Computing

Statistical Packages: You will need to use a statistical package in order to perform most of the statistical analyses covered in this course. [R](#) is a freeware that we will use extensively in this course. Please google “download R” to download R 4.0.1 and install it to your computer. Please read the Appendix of the textbook for more information about downloading R.

University policies:

University policy on observance of religious holidays

In accordance with University policy, students should notify faculty during the first week of the semester of their intention to be absent from class on their day(s) of religious observance. For details and policy, see: students.gwu.edu/accommodations-religious-holidays.

Academic integrity code

Academic dishonesty is defined as cheating of any kind, including misrepresenting one's own work, taking credit for the work of others without crediting them and without appropriate authorization, and the fabrication of information. For details and complete code, see: studentconduct.gwu.edu/code-academic-integrity

Safety and security

In the case of an emergency, if at all possible, the class should shelter in place. If the building that the class is in is affected, follow the evacuation procedures for the building. After evacuation, seek shelter at a predetermined rendezvous location.

Support for students outside the classroom

Disability Support Services (DSS)

Any student who may need an accommodation based on the potential impact of a disability should contact the Disability Support Services office at 202-994-8250 in the Rome Hall, Suite 102, to establish eligibility and to coordinate reasonable accommodations. For additional information see: disabilitysupport.gwu.edu/

Mental Health Services 202-994-5300

The University's Mental Health Services offers 24/7 assistance and referral to address students' personal, social, career, and study skills problems. Services for students include: crisis and

emergency mental health consultations confidential assessment, counseling services (individual and small group), and referrals. For additional information see: counselingcenter.gwu.edu/

Please note:

1. Please go to blackboard to find various course components.
2. You need to meet minimum technology requirements for participation in the course.
3. Please visit the following website to get support (e.g., technical requirements and support, student services, obtaining a GWorld card, and state contact information) at online.gwu.edu/student-support

Copy-Right and Privacy:

Students are prohibited from recording/distributing any Class Activity without permission from the instructor, except as necessary as part of approved accommodations for students with disabilities. Any approved recordings may only be used for the student's own private use.