The George Washington University
Department of Statistics
STAT 6250-10
Fall, 2024

Course and contact information

Course: STAT 6250, A/B Testing
Meeting time: 6:10-8:40pm on Monday

Instructor

Name: Feifang Hu
Campus Address: Phillips Hall 727
Phone: 804-310-0383
E-mail: feifang@gwu.edu
Office hours: Monday, 3:30pm-5:00pm

Grader: Zixuan Zhao, zixuan.zhao@gwu.edu

Textbook

No Text book. Some references will be available.

Course description

A/B testing is becoming more and more popular in industries. For examples, Microsoft, Amazon, Facebook and Google conduct more than 10,000 online A/B testings (controlled experiments) annually, with many tests engaging millions of users. In this course we focus on the following themes: (i) introducing the basic concepts of A/B testing procedures; (ii) introducing some basic designs of A/B testing in online experiments; (iii) introducing some advanced designs (adaptive designs) of A/B testing in medical studies; (iv) introducing network data and adaptive designs of A/B testing under network structures; (v) discussing statistical inferences of A/B testing under different situations (in medical studies and online experiments); and (vi) Some further topics of A/B testing.

Course prerequisites

The course is designed for MS students and PhD students who have completed STAT 6201-2 (Mathematical Statistics I and II), 6214 (Applied Linear Models).

Learning outcomes

As a result of completing this course, students will be able to
1. Manage the basic concepts of A/B testing procedures;
2. Demonstrate their skills of designing online experiments;
3. Manage their skills of statistical analysis of both online and medical experiments.
4. Demonstrate their skills of finding and solving interesting research problems of A/B testing;
5. Apply to the diverse range of statistical problems,
6. Demonstrate their skills to tackle real-life A/B testing problems by using appropriate statistical methods, and interpret their results in meaningful ways.

Topics by weeks

1. Week 1: Discussion of some basic concepts of A/B testing, some real world A/B testing examples (Amazon example, Covid-19 clinical trials, etc.)
2. Week 2: The procedure and statistical framework of A/B testing.
3. Week 3: Randomized Control studies and their properties.
4. Week 4: Design issues of A/B testing for online experiments.
5. Week 5: Adaptive designs for medical experiments.
6. Week 6: Statistical Inference of A/B testing, control type I error and adjustments.
7. Week 7: Exam I and some examples.
8. Week 8: Balance important factors of A/B testing; Covariate-adaptive designs.
9. Week 9: Adaptive designs for online experiments with network structures, some examples
10. Week 10: Classical statistical Inference, bootstrap, asymptotical normality and others.
11. Week 11: A/B testing with network data.
12. Week 12: Two real world examples of A/B testing: from A to Z (from beginning to end).
13. Week 13: Some further research and practical problems of A/B testing.
14. Week 14 and 15: Presentation of the final projects.

Credit hour policy

This is a a 3-credit course. This would include 2.5 hours of direct instruction and a minimum of 5 hours of independent learning per week for a combined minimum total of 7.5 hours per week or 112.5 hours per semester. See Assignment of Credit Hour Policy for more information.

Assignments:

There will be about 7 bi-weekly homework assignments. Each assignment will be worth 100 points. The assignments will be on:
(i) Standard homework with around 5 problems
(ii)some small projects on A/B testing
(iii) Analysis of some real-world data

Grading

The course grade will be based on
• Homework Assignments (30%)
• One Midterm exam I (25%)
• Classroom participation (10%)
• Final project and presentation (35%).

Class Attendance

It is important that you attend the class. Everyone should attend the class. If you cannot attend, please let me know the reason. You are responsible for any materials covered or any announcements made in class.

University policies

Academic Integrity Code:
Academic integrity is an essential part of the educational process,
and all members of the GW community take these matters very seriously. As the instructor of record for this course, my role is to provide clear expectations and uphold them in all assessments. Violations of academic integrity occur when students fail to cite research sources properly, engage in unauthorized collaboration, falsify data, and otherwise violate the Code of Academic Integrity. If you have any questions about whether particular academic practices or resources are permitted, you should ask me for clarification. If you are reported for an academic integrity violation, you should contact the Office of Student Rights and Responsibilities (SRR) to learn more about your rights and options in the process. Consequences can range from failure of assignment to expulsion from the university and may include a transcript notation. For more information, please refer to the SRR website (https://studentconduct.gwu.edu/academic-integrity), email rights@gwu.edu, or call 202-994-6757.

University policy on observance of religious holidays
Students must notify faculty during the first week of the semester in which they are enrolled in the course, or as early as possible, but no later than three weeks prior to the absence, of their intention to be absent from class on their day(s) of religious observance. If the holiday falls within the first three weeks of class, the student must inform faculty in the first week of the semester. For details and policy, see “Religious Holidays” at provost.gwu.edu/policiesprocedures-
and-guidelines.

Use of Electronic Course Materials and Class Recordings
Students are encouraged to use electronic course materials, including recorded class sessions, for private
personal use in connection with their academic program of study. Electronic course materials and recorded class sessions should not be shared or used for non-course related purposes unless express permission has been granted by the instructor. Students who impermissibly share any electronic course materials are subject to discipline under the Student Code of Conduct. Please contact the instructor if you have questions regarding what constitutes permissible or impermissible use of electronic course materials and/or recorded class sessions. Please contact Disability Support Services at disabilitysupport.gwu.edu if you have questions or need assistance in accessing electronic course materials.

Academic support

Writing Center
GW’s Writing Center cultivates confident writers in the University community by facilitating collaborative,
critical, and inclusive conversations at all stages of the writing process. Working alongside peer mentors, writers develop strategies to write independently in academic and public settings. Appointments can be booked onlinenat gwu.mywconline.com

Academic Planning and Assessment
Academic Commons
Academic Commons provides tutoring and other academic support resources to students in many courses. Students can schedule virtual one-on-one appointments or attend virtual dropin sessions. Students may schedule an appointment, review the tutoring schedule, access other academic support resources, or obtain assistance at academiccommons.gwu.edu

Support for students outside the classroom

Disability Support Services (DSS) 202-994-8250
Any student who may need an accommodation based on the potential impact of a disability should contact Disability Support Services at disabilitysupport.gwu.edu to establish eligibility and to coordinate reasonable accommodations.

Counseling and Psychological Services 202-994-5300
GW's Colonial Health Center offers counseling and psychological services, supporting mental health and
personal development by collaborating directly with students to overcome challenges and difficulties that may interfere with academic, emotional, and personal success. healthcenter.gwu.edu/counseling-and-psychological-services.

Safety and Security
Monitor GW Alerts and Campus Advisories to Stay Informed before and during an emergency event or
Situation. In an emergency: call GWPD/EMeRG 202-994-6111 or 911. For situation-specific actions: refer to GWU's Emergency Response Handbook and Emergency Operations Plan. In the
event of an armed Intruder: Run. Hide. Fight.