

# STAT 3119-10 Fall 2024

## Design and Analysis of Experiments

### Syllabus

#### COURSE AND CONTACT INFORMATION

Section	
Time	TR 11:10AM - 12:25PM
Location	

#### INSTRUCTOR

Name: Dr. Tatiyana V Apanasovich

Office: Rome Hall, 729

Phone: 202-994-9721

Email: [apanasovich@gwu.edu](mailto:apanasovich@gwu.edu)

Office hours: Tuesday, 1:00-2:00pm or by appointment, in person or over zoom

#### Textbook

Montgomery, D. C. (2019). Design and Analysis of Experiments, 10th Edition. John Wiley & Sons.

#### Prerequisites

1. Linear Algebra is required. Familiarity with notations of matrices is assumed.
2. An introductory course in Statistics is required (STAT2118 or equivalent).
3. R coding is required for computation in the lab session and homework assignments. You do not have to be proficient in R at this moment, but please be prepared to learn and use some fundamental coding techniques in this course.

## Topics

This course introduces the techniques for planning and conducting experiments and analyzing the resulting data so that valid and objective conclusions are obtained. Experimentation plays an important role in technology commercialization and product realization activities, which consist of new product design and formulation, manufacturing process development, and process improvement. There are also many applications of designed experiments in a nonmanufacturing or non-product-development setting, such as marketing, service operations, and general business operations. Designed experiments are a key technology for innovation in various disciplines. Both breakthrough innovation and incremental innovation activities can benefit from the effective use of designed experiments. Throughout this course, we will present techniques for designing experiments in different applications and turning the resulting data into a statistical model for robust prediction and interpretation.

We will cover the following topics.

Week 1. An introduction to Strategy and principles of experimentation

Week 2. Linear regression with numerical and categorical factors (matrix notations)

Week 3. Simple comparative design

Week 4. Completely randomized design

Week 5. Post hoc tests, Fisher's and Tukey's methods

Week 6. The blocking technique, randomized complete blocking design

Week 7. Latin square design, Graeco-Latin Square Design, Balanced Incomplete Block Design

Week 8. Review and midterm exam

Week 9. Factorial design,  $2^k$  factorial design

Week 10. Fractional factorial design with two levels

Week 11. Three-level factorial design and fractional factorial design

Week 12. Experiments with random effects

Week 13. Response surface methodology, steepest ascent method

## Week 14. Nested and Split Plot Designs

### Learning Outcomes

As a result of completing this course, students will be able to:

1. Learn about the objectives of experimental design and the role it plays in the knowledge discovery process.
2. Learn about different principles and strategies of experimentation.
3. Apply the experimental design strategies to collect data
4. Use linear regression and ANOVA to analyze experimental data

### Grading Policy and Exam Schedule

8-10 homework assignments	Quizzes	one midterm exam	one final exam
10% The lowest score will be dropped	30% the lowest score will be dropped	30%	30%

Quizzes will be given in class. The dates are: Sep, 5; Sep, 19; Oct, 3; Oct, 29; Nov, 7, Nov, 21. The lowest quiz score will be dropped from consideration.

Exams will be in class; the dates are: **Oct, 17 and Dec, 10.**

Quizzes and exams are open book, each student should work independently on the assigned problems.

You will receive weekly homework assignments through Blackboard. They will be due on Thursday at 11:59pm, starting September, 5. Homework assignments should show individual efforts and submitted to the portals on Blackboard.

Late homework submitted within 2 days (48 hours) of due date will receive 25% penalty for each day (24 hours) late. Any homework late by more than 2 days will not be graded and will receive zero point. The lowest homework score will be dropped from consideration.

In writing up homework, it is not sufficient to give only the answer to a problem; you must show reasonably detailed justifications/calculations.

Make-up exams/quizzes: except for cases beyond the student's control (such as medical or family emergency), there will be no make-ups.

### **Workload**

Other than the 2.5 hours of lectures, it is expected that the student would spend about 5-6 hours a week studying and preparing for the class. This time may be evenly split between writing solutions to homework problems and reading in the textbook.

### **Blackboard**

Please check Blackboard frequently, as there may be assignments, announcements, and material passed to the class via this electronic medium during the week. You can find it at

<http://blackboard.gwu.edu/webapps/portal/frameset.jsp>

You need to login, using your GW user ID and password.

Lecture recordings will appear on the Blackboard automatically as I will be using GW lecture capture.

### **Incomplete Grade Policy**

Incomplete grades may be given to undergraduate students only if for reasons beyond the student's control (such as medical or family emergency) s/he is unable to complete the final work of the course.

The student should request the Incomplete grade and the instructor should be informed about and approve the request before the date when grades must be reported. An Incomplete Contract (found on the Academic Forms page) should be signed by both the instructor and the student and submitted to the GWSB Undergraduate Advising Center, Duques 456. A student has one calendar year to finish the coursework for the class, and when completed a grade change form must be submitted to the Undergraduate Advising Center to update the grade.

### **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 “Religious Holidays” at [provost.gwu.edu/policies-procedures-and-guidelines](http://provost.gwu.edu/policies-procedures-and-guidelines)

### **Academic Integrity Code**

Academic Integrity is an integral part of the educational process, and GW takes these matters very seriously. Violations of academic integrity occur when students fail to cite research sources properly, engage in unauthorized collaboration, falsify data, and in other ways outlined in the Code of Academic Integrity. Students accused of academic integrity violations should contact the Office of Academic Integrity to learn more about their rights and options in the process. Outcomes can range from failure of assignment to expulsion from the University, including a transcript notation. The Office of Academic Integrity maintains a permanent record of the violation.

More information is available from the Office of Academic Integrity at [studentconduct.gwu.edu/academic-integrity](http://studentconduct.gwu.edu/academic-integrity). The University’s “Guide of Academic Integrity in Online Learning Environments” is available at [studentconduct.gwu.edu/guide-academic-integrity-online-learning-](http://studentconduct.gwu.edu/guide-academic-integrity-online-learning-)

[environments](#). Contact information: [rights@gwu.edu](mailto:rights@gwu.edu) or 202-994-6757.

## **Support for Students outside The Classroom**

### **Virtual academic support**

A full range of academic support is offered virtually in fall 2020. See [coronavirus.gwu.edu/top-faqs](https://coronavirus.gwu.edu/top-faqs) for updates.

Tutoring and course review sessions are offered through Academic Commons in an online format. See [academiccommons.gwu.edu/tutoring](https://academiccommons.gwu.edu/tutoring)

Writing and research consultations are available online. See [academiccommons.gwu.edu/writing-research-help](https://academiccommons.gwu.edu/writing-research-help)

Coaching, offered through the Office of Student Success, is available in a virtual format. See [studentsuccess.gwu.edu/academic-program-support](https://studentsuccess.gwu.edu/academic-program-support)

Academic Commons offers several short videos addressing different virtual learning strategies for the unique circumstances of the fall 2020 semester. See [academiccommons.gwu.edu/study-skills](https://academiccommons.gwu.edu/study-skills). They also offer a variety of live virtual workshops to equip students with the tools they need to succeed in a virtual environment. See [tinyurl.com/gw-virtual-learning](https://tinyurl.com/gw-virtual-learning)

### **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 online. See [gwu.mywconline](https://gwu.mywconline).

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 drop-in sessions. Students may schedule an

appointment, review the tutoring schedule, access other academic support resources, or obtain assistance at [academiccommons.gwu.edu](https://academiccommons.gwu.edu).

### **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 to establish eligibility and to coordinate reasonable accommodations.

[disabilitysupport.gwu.edu](https://disabilitysupport.gwu.edu)

### **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](https://healthcenter.gwu.edu/counseling-and-psychological-services)

### **Safety and Security**

- In an emergency: call GYPD 202-994-6111 or 911
- For situation-specific actions: review the Emergency Response Handbook at [safety.gwu.edu/emergency-response-handbook](https://safety.gwu.edu/emergency-response-handbook)
- In an active violence situation: Get Out, Hide Out, or Take Out. See [go.gwu.edu/shooterpret](https://go.gwu.edu/shooterpret)
- Stay informed: [safety.gwu.edu/stay-informed](https://safety.gwu.edu/stay-informed)

### **Title IX statement:**

**The George Washington University** (GW) and its faculty are committed to creating a safe and open learning environment for all students. If you or someone you know has experienced sexual harassment, including sexual assault, dating or domestic violence, and stalking, please know that help and support are available.

GW strongly encourages all members of the community to take action, seek support, and report incidents of sexual harassment to the Title IX Office. You may contact the Title IX Office at 202-994-7434 or at [titleix@gwu.edu](mailto:titleix@gwu.edu) or learn more by visiting [titleix.gwu.edu](http://titleix.gwu.edu).