

# STAT 51400: Design of Experiments

Department of Statistics  
College of Science, Purdue University  
Course Syllabus, Summer 2025  
Department of Statistics

## Course Information

- Course number and title: STAT 51400 Design of Experiments
- Meeting time: Online, Asynchronous
- Course credit hours: 3 credits
- Course web page: <https://purdue.brightspace.com/>
- Prerequisites (if any): Graduate status

## Instructor Contact Information

**Instructor:** Dr. Frank (Chenzhong) Wu  
**Email:** wu1108@purdue.edu

## Course Help and Office Hours

There are three main ways to receive help or answers to questions in this course: Discussion boards, office hours with Teaching Assistants (TAs), and office hours with me.

### Discussion Boards

Within Brightspace, there will be a discussion board for each assignment or exam as well as a discussion board for general questions about the course. These discussion boards will serve as the first resource for receiving help. If you have a question, please consider posting it first on an appropriate discussion board. These boards will be monitored daily, and someone will attempt to provide an answer as soon as possible, generally within 24 hours after it has been posted. In some cases, other students in the course might also be able to provide an adequate answer, in which case the instructor or a TA will indicate their answer as the correct answer.

If you do not feel your question can be adequately addressed by posting it on a discussion board, you may then reach out to a TA or me.

## Teaching Assistants

TAs are a second resource when looking for help in this course. TAs will be available via regularly scheduled office hours to answer questions that cannot be adequately addressed on a discussion board. The TAs for the course along with information about their office hours can be found below:

Name	Office Hours	Office Hour Link
Lucy Kuhl	MW, 10–11 AM EDT	Link: <a href="https://purdue-edu.zoom.us/j/7984775927?pwd=1wH6znErymxkXnoPaJicupVujFywbG.1">https://purdue-edu.zoom.us/j/7984775927?pwd=1wH6znErymxkXnoPaJicupVujFywbG.1</a>
Hara Koo	Tu, 9–11 AM EDT	Link: <a href="https://purdue-edu.zoom.us/j/8964727919?omn=93647245891">https://purdue-edu.zoom.us/j/8964727919?omn=93647245891</a>

Table 1: TA Office Hours

## Instructor

I will serve as a third resource for help in this course. If you have any questions that cannot be addressed on a discussion board or by a TA, please feel free to reach out to me and I am happy to find a time to meet that works for both of our schedules. Office hours will be held on my personal Zoom room:

<https://purdue-edu.zoom.us/j/5247319054>

I will be available via email daily and try to respond as soon as possible (generally within 24-48 hours). However, please keep in mind that if you email me at 5pm on Friday, there is a chance I will not get back to you until Monday morning. When emailing me, please place the course number/section and the topic in the subject line of the email (e.g., Stat 514: Contrasts). This will help me tremendously in locating and responding to your emails quickly.

## Time Zone

Be aware that all times stated in this class are for the Eastern time zone (W. Lafayette local time).

# Course Description

The course introduces the principles of experimental design and the appropriate analysis for experimental design data. Tentative coverage of designs includes completely randomized designs, complete block designs, incomplete block designs, row-column (Latin square and Youden) designs, nested designs, split-plot designs, repeated measures design. For each design, appropriate statistical models, estimates and sample size issues will be discussed, and SAS programs demonstrated.

## Prerequisites

A course in general statistical methods that has calculus as a prerequisite (e.g., STAT 350, STAT 503, STAT 511) and a course on regression analysis (e.g., STAT 512). A self-check quiz will be given during the first week of the course to assess your understanding of some important concepts prior to taking this course. The quiz was designed to test your knowledge with respect to a wide variety of prerequisites that one may have taken in preparation for this course. Some of the material may not have been adequately covered in courses you have taken previously. For this reason, you will receive full credit for completing the quiz.

The quiz is meant to allow me to understand where students are in their preparation for the course and to help you to be aware of gaps that might need to be filled. If you feel that you did not perform well, please take time to review the questions you missed and to make sure you understand why you missed them. If after doing this, you still have concerns or questions, please feel free to reach out to me.

## Learning Outcomes

By the end of the course, you will be able to:

1. Design an appropriate experiment for research hypotheses or research objectives.
2. Choose an appropriate statistical model for the experiment.
3. Analyze and visualize data from common experiment designs.
4. Correctly interpret statistical results and draw meaningful conclusions.

# Learning Resources, Technology, & Texts

All course materials are available on Brightspace. Here you will find lectures, assignments, important announcements, grades, and everything else related to this course. The course website is also a commonly used repository of course information.

## Required Textbook

- *Design and Analysis of Experiments* (2nd Edition) by A. Dean, D. Voss and D. Draguljic. Springer International Publishing AG 2017. Free online access is available through Purdue library. All data in the book can be downloaded in different format at: <http://deanvosssdraguljic.ietsandbox.net>.
- Additional readings may be assigned in class.

## Required Software

- Computer language - SAS is required but previous knowledge of SAS is not necessary. All students have access to SAS through Purdue. More information will be provided in class.

## Course Lectures and Format

The course is organized around seven learning modules. Each module will teach you different experimental designs. Within each module are a series of pre-recorded lecture videos for you to watch that walk you through the different experimental designs and statistical analysis. You should plan to read the course textbook, watch the associated lecture video(s), and then complete the associated assessment for each module. Each module should take about 1 week to complete.

Your learning will be assessed through a combination of homework and two exams. Details can be found on the course website and here in Brightspace. Homework shall be submitted electronically through Brightspace.

## Other helpful considerations

- You are encouraged to “mentally enroll” in this course as if it occurred on Monday mornings. In other words, our weeks will run from Monday to Sunday.

- I will use the announcements tool in Brightspace to provide regular updates to the whole class. These updates will often be provided weekly.
- You are allowed to “work ahead” on content as fits your personal schedule. However, at a minimum you should plan to complete the course as described in the course schedule.
- All assignments should be submitted as a PDF file and are due by 11:59 pm EST (Midnight) on the due date listed in the course schedule.
- There will be two exams, one midterm exam and one final exam. Each exam will be open during a 48- to 72-hour window. Once an exam is started, you will have 1.5 hours to complete that exam. Make sure to note the dates of exams from Brightspace so you budget enough time on those days to complete the exams.
- An assignment file should be appended by your username, such as “homework1-kim53.pdf”. This will make it easier for me to manage assignment files.

## Assignments Summary

Assignments	Due	Percent
Self-Check Quiz	First week of class	5%
Homework	Approximately 1 per week	45%
Midterm Exam	Beginning of week 5	20%
Final Exam	End of week 8 (finals week)	30%

## Self-Check Quiz

The self-check quiz has the following purpose:

- Allow the instructor an opportunity to assess the background knowledge of students taking the course with respect to a variety of topics that may have been covered in prerequisite courses.
- Allow students an opportunity to identify any possible gaps in their preparation so they can review these topics before continuing the course.

The self-check quiz must be completed by the end of Friday, 6/14. Once you start the quiz, you will have 90 minutes to complete it. You will receive full credit for the quiz upon its completion. If you still have concerns about the course after you complete the quiz and review the topics covered in it, feel free to reach out to the instructor to discuss your concerns.

## Homework

There are seven homework assignments in the course. Homework should be completed after you have completed the specified lesson. Homework should be typed and where appropriate you should show your work or show your SAS code. Only one PDF file can be submitted for one assignment and other file formats are not acceptable. However, you can submit multiple times. Only the last submitted version is graded.

## Exams

There are two exams in the course, the first of which will be completed at the beginning of week 5 and the second of which will be completed at the end of week 8 (finals week). The exams are timed events. You will have a 48- to 72-hour availability window in which to complete an exam. This window opens at 8 am on the first day and closes at 8 am on the last day. During this availability window you must complete the exam. Once you start the exam you will have 1.5 hours (90 minutes) to complete it and only one opportunity. All exams are multi-version. Your exam will be unique to you.

You must independently complete the exam and should not discuss it with anyone until your score is available in Brightspace. Absence without the permission of the instructor will result in no grade and no make-up exam will be available.

## Missed or Late Work

For **one** homework assignment this semester, *you may* be allowed **three additional days** to complete the assignment. However, there will be a 10% deduction for each day it is late, and it will not be accepted after the third day it is late.

This policy is designed to account for situations that might arise throughout the semester that don't qualify as true emergencies, but that may still create legitimate difficulties when it comes to completing an assignment. Examples of true emergencies may include funerals, extreme illness, etc. If you feel that you are in such a situation as this, you may contact me. After this, you will not be allowed to turn in any assignment after the due date has passed, no matter the reason (barring true emergencies or university-approved accommodations).

## Grading Scale

Your final grade will be based on the following scale:

- A+: 97% or above
- A: 93% - 97%
- A-: 90% - 93%
- B+: 87% - 90%
- B: 83% - 87%
- B-: 80% - 83%
- C+: 77% - 80%
- C: 73% - 77%
- C-: 70% - 73%
- D+: 67% - 70%
- D: 63% - 67%
- D-: 60% - 63%
- F: < 60%

If your score falls on the boundary, say, 87%, your grade will be in the higher bracket, i.e., B+. Any adjustment to the cutoffs will be done at the end of the semester. I will generally strive to grade work within at least two weeks of submission (and often much quicker than that); however, there are times during the semester that may require a longer turnaround time on graded work.

## Incompletes

A grade of incomplete (I) will be given only in unusual circumstances. To receive an “I” grade, a written request must be submitted prior to the end of the semester and approved by the instructor. The request must describe the circumstances, along with a proposed timeline for completing the course work. Submitting a request does not ensure that an incomplete grade will be granted. If granted, you will be required to fill out and sign an “Incomplete Contract” form that will be turned in with the course grades. Any requests made after the course is completed will not be considered for an incomplete grade.

# How to Succeed in this Course

If you want to be a successful student:

- Be self-motivated and self-disciplined.
- Be willing and able to commit to 8 to 15 hours per week per course.
- Be able to communicate through writing.
- Be able to meet the minimum requirements for the course.
- Watch the videos, study the lecture notes, and read the textbook and any supplementary materials.
- Accept critical thinking and decision making as part of the learning process.

In contrast, here are some common behaviors that lead to failing the course:

- Don't read until the night before the discussion.
- Wait until the last day to begin assignments.
- Forget about deadlines.
- Ignore emails from the instructor and/or your peers regarding course activities.
- Don't get familiar with the grade book and syllabus.

## Attendance Policy

Given the nature of this online class, there is no mandatory physical or virtual requirement to attend on specific dates. However, taking an online class requires that you be available throughout the semester to participate in asynchronous course content. When conflicts or absences can be anticipated, such as for many University-sponsored activities and religious observations, the student should inform the instructor of the situation as far in advance as possible.

For unanticipated or emergency absences when advance notification to an instructor is not possible, the student should contact the instructor as soon as possible by email or phone. When the student is unable to make direct contact with the instructor and is unable to leave word with the instructor's department because of circumstances beyond the student's control, and in cases of bereavement, the student or the student's representative should contact the Office of the Dean of Students via email or phone at **765-494-1747**.



## Academic Integrity

Academic integrity is one of the highest values that Purdue University holds. Individuals are encouraged to alert university officials to potential breaches of this value by either emailing or by calling 765-494-8778. While information may be submitted anonymously, the more information that is submitted provides the greatest opportunity for the university to investigate the concern.

**The Purdue Honor Pledge:** “As a Boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together — we are Purdue.”

## Nondiscrimination Statement

Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life.

## Students with Disabilities

Purdue University strives to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at: [drc@purdue.edu](mailto:drc@purdue.edu) or by phone: 765-494-1247.

Please reach out to your instructor if you utilize a screen reader or other adaptive technologies and need documents in a different format. Also, the DRC offers services that can make documents accessible if they are needed.

## Basic Needs Security

Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact the Dean of Students for support. There is no appointment needed and Student Support Services is available to serve students 8 a.m.–5 p.m., Monday through Friday.

Considering the significant disruptions caused by the current global crisis as it related to COVID-19, students may submit requests for emergency assistance from the Critical Needs Fund.

## Emergency Preparation

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor's control. Relevant changes to this course will be posted onto the course website or can be obtained by contacting the instructors or TAs via email or phone. You are expected to read your @purdue.edu email on a frequent basis.

## Mental Health Statement

- If you find yourself beginning to feel some stress, anxiety and/or feeling slightly overwhelmed, try WellTrack. Sign in and find information and tools at your fingertips, available to you at any time.
- If you need support and information about options and resources, please see the Office of the Dean of Students for drop-in hours (M–F, 8 a.m.–5 p.m.).
- If you're struggling and need mental health services: Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of mental health support, services are available. For help, such individuals should contact Counseling and Psychological Services (CAPS) at 765-494-6995 during and after hours, on weekends and holidays, or by going to the CAPS office on the second floor of the Purdue University Student Health Center (PUSH) during business hours.

## Netiquette

Your instructor and fellow students wish to foster a safe online learning environment. All opinions and experiences, no matter how different or controversial they may be perceived, must be respected in the tolerant spirit of academic discourse. You are encouraged to comment, question, or critique an idea, but you are not to attack an individual.

Our differences, some of which are outlined in the University's nondiscrimination statement above, will add richness to this learning experience. Please consider that sarcasm

and humor can be misconstrued in online interactions and generate unintended disruptions. Working as a community of learners, we can build a polite and respectful course ambiance. Please read the Netiquette rules for this course:

- Do not dominate any discussion. Give other students the opportunity to join in the discussion.
- Do not use offensive language. Present ideas appropriately.
- Be cautious in using Internet language. For example, do not capitalize all letters since this suggests shouting.
- Avoid using vernacular and/or slang language. This could possibly lead to misinterpretation.
- Keep an “open mind” and be willing to express even your minority opinion.
- Think and edit before you push the “Send” button.
- Do not hesitate to ask for feedback.

## **Violent Behavior Policy**

Purdue University is committed to providing a safe and secure campus environment for members of the university community. Purdue strives to create an educational environment for students and a work environment for employees that promote educational and career goals. Violent Behavior impedes such goals. Therefore, Violent Behavior is prohibited in or on any University Facility or while participating in any university activity. See the University’s full violent behavior policy for more detail.

## **Diversity and Inclusion Statement**

In our discussions, structured and unstructured, we will explore a variety of challenging issues, which can help us enhance our understanding of different experiences and perspectives. This can be challenging, but in overcoming these challenges we find the greatest rewards. While we will design guidelines as a group, everyone should remember the following points:

- We are all in the process of learning about others and their experiences. Please speak with me, anonymously if needed, if something has made you uncomfortable.

- Intention and impact are not always aligned, and we should respect the impact something may have on someone even if it was not the speaker's intention.
- We all come to the class with a variety of experiences and a range of expertise, we should respect these in others while critically examining them in ourselves.

## Use of Artificial Intelligence

Artificial intelligence (AI), particularly generative AI tools such as ChatGPT, can be used as a helpful learning tool or can significantly hinder the learning process. In this course, it is expected that students will only use such tools in a way that facilitates learning and skill mastery. Some examples of ways in which these tools might be used are found below:

- Summarizing information found within the textbook or course lecture notes.
- Producing R code with the intent to better understand how to use R.
- Testing your knowledge and understanding of concepts with additional examples or practice problems.
- Reviewing materials in preparation for exams.
- Providing additional explanations or perspectives on concepts presented in the course.

Some examples of how these tools should not be used are as follows:

- Producing R code for homework without double checking the code and confirming you understand how the code works.
- Providing answers to exam problems during an exam.

## Disclaimer

This syllabus is subject to change. The instructor has the right to make any revisions regarding course contents, grading scale and course policies that he deems academically advisable. Changes will be announced through the announcements tool in Brightspace and/or emailed to students.

## Course Schedule and Pacing

Module	Lecture and Topic	Readings	Assignment
<b>Module 1:</b> Principles, Techniques, and Planning Experiments	Lecture 1 - Principles Lecture 2 - Planning Review of Probability Review of Statistics Lecture 3 - Standard Designs	Ch 1 Ch 2  Ch 2	Homework 1 (Due 6/22/25 @ 12:59 pm)
<b>Module 2:</b> One-Way ANOVA	Lecture 4 - Designs with One Source of Variation Lecture 5 - One Way Analysis of Variance SAS Lab 1 Lecture 6 - Inferences for Contrasts and Treatment Means, Part 1 Lecture 6 - Inferences for Contrasts and Treatment Means, Part 2 Lecture 7 - Checking Model As- sumptions Lecture 8 - Determining Sample Size	Ch 3.1–3.4  Ch 3.5  Ch 4.1–4.3 Ch 4.4 Ch. 5 Ch 4.5	Homework 2 (Due 6/29/25 @ 12:59 pm)
<b>Module 3:</b> Experiments with Two or More Crossed Factors	Lecture 9 - Experiment with Two Crossed Treatment Factors Lecture 10 - ANOVA for Two-Way Complete Model Lecture 11 - Analysis of the Two- Way Main Effects Model SAS Lab 2 Lecture 12 - Some More Topics on Two-Way Models	Ch 6.1–6.3 Ch 6.4 Ch 6.5 Ch 6.6–6.7	

	Lecture 13 - Experiments with Several Crossed Factors	Ch 7	Homework 3 (Due 7/6/25 @ 12:59 pm)
<b>Module 4:</b> Block Designs	Lecture 14 - Complete Block Designs Lecture 15 - Complete Block Designs Sample Size Determination Lecture 16 - Incomplete Block Designs Lecture 17 - Analysis of Incomplete Block Designs	Ch 10.1–10.4 Ch 10.5–10.9  Ch 11.1–11.3  Ch 11.4–11.8	Homework 4 (Due 7/13/25 @ 12:59 pm)
<b>Midterm Exam</b>	Modules 1–3	Ch 1–7	Midterm Exam (7/13/25–7/16/25 8AM)
<b>Module 5:</b> Random Effects Model	Lecture 18 - Random Effects Models, Part 1 Lecture 18 - Random Effects Models, Part 2	Ch 17  Ch 17	Homework 5 (Due 7/20/25 @ 12:59 pm)
<b>Module 6:</b> Nested Models and Split-Plot Designs	Lecture 19 - Nested Models Lecture 20 - Split-Plot Designs	Ch 18 Ch 19	Homework 6 (Due 7/27/25 @ 12:59 pm)
<b>Module 7:</b> Additional Topics	Lecture 21 - Analysis of Covariance Lecture 22 - Repeated Measures  Lecture 23 - Row-Column Designs	Ch 9 Not covered in book  Ch 15	Homework 7 (Due 8/03/25 @ 12:59 pm)
<b>Final Exam</b>	Modules 1–7		Final Exam (8/06/25–8/08/25)

*\*Schedule and assignments subject to change. Any changes will be posted in the learning management system.*