

IE 3521: Statistics, Quality and Reliability

Syllabus

Fall 2019

Course description:

In the last decade, the tools of machine learning, data science and analytics have been used to make tremendous progress in a variety of areas, from virtual assistant technology like Google Assistant and Alexa to platform markets like Uber and AirBnb. More than ever, this has made the mastery of basic probability and statistical concepts indispensable. Additionally, there is great value attached to the ability to work with data and to summarize and draw inferences from it. The goal of this course is to create a foundation in probability and statistics, and highlight the applications in quality and reliability.

Catalog description: Random variables/probability distributions, statistical sampling/measurement, statistical inferencing, confidence intervals, hypothesis testing, single/multivariate regression, design of experiments, statistical quality control, quality management, reliability, maintainability.

Learning outcomes:

After taking this course, you should be able to achieve the following objectives:

1. Use probability theory to identify and analyze distributions of various summary statistics.
2. Use standard statistical tools to build models, test hypotheses, and make inferences.
3. Use computational tools like R to perform exploratory data analysis, summarize the data and provide error bounds for summary statistics.
4. Apply the tools you learn to make judgments about quality and reliability in basic engineering contexts.

Prerequisites:

The official prerequisites is MATH 1372 or equivalent. Familiarity with basic combinatorial probability theory will be useful.

Instructor:

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Teaching assistants:

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These timings (and locations) are tentative and may change over the next week. Any change will be announced on Canvas.

Course information:

Section 001:

Class time: Tue Thu 10:10am—11:55pm

Class location: Amundson Hall B75

Section 002 + UNITE:

Class time: Tue Thu 3:35pm—5:20pm

Class location: Keller Hall 3-230

Course Website: <https://canvas.umn.edu/courses/136469>

Piazza: <https://piazza.com/class/jzuinkqeeba1w9>

Gradescope: <https://www.gradescope.com/courses/59605> (Entry code: 9B5R24)

Class websites:

1. **Canvas:** We will be using Canvas for announcements and lecture materials. You should be enrolled automatically into Canvas, but if not, please visit <https://canvas.umn.edu/> and search for IE 3521. All announcements for the class will be through Canvas, so it is your responsibility to ensure that you are enrolled and receiving the announcements. Please contact the instructor or the TAs if you have any issues.
2. **Piazza:** We will primarily use Piazza for class discussions, where you should direct your questions related to homework, exams, or the course content. You will be able to access the Piazza forum through the Canvas sidebar. The link to the forum is <https://piazza.com/class/jzuinkqeeba1w9>.

The goal for such a forum is to encourage learning through peers; knowing how your peers are struggling with a problem can be useful in your learning. Or answering your peers' questions can help identify any gaps in your understanding.

However, this will not be achieved if the questions/comments are only seen by the instructor or the TAs (you have our office hours for that). If you believe your question or a comment will be

useful to the entire class, please make it public. This should generally be the default position; only rarely would the private note option be appropriate. An example where a private note would make sense is in a situation where you are far along answering an assignment question and are unsure about some aspect of your approach.

You can keep yourself anonymous from your peers if you want; I will still see your identity.

Hope you make good use of this forum, both by asking and answering questions.

3. **Gradescope:** We will experiment with using Gradescope for grading assignments and exams. Please visit the Gradescope website for our class <https://www.gradescope.com/courses/59605> and use the entry code 9B5R24 to join the course.

You will be uploading your homework (pdf/word document, scanned copies or photos) to Gradescope, and once the TAs have graded them, you will receive your graded sheets back also through the website. We will provide more instructions on using the tool when the time comes, but there are online tutorials available on the Gradescope website, and we would encourage you to get familiar with it.

Text:

We will follow closely the book “**Probability and Statistics for Engineers and Scientists**” by Anthony J. Hayter (Cengage Learning, 4th Edition). Specifically, we will cover parts of Chapters 1-5,7-10,12,16,17. In addition, we will cover topics of personal/mutual interests (such as Bayesian statistics), for which notes will be shared.

Other good reference books on probability and/or statistics include the following:

1. **Probability Theory: The Logic of Science**, by E. T. Jaynes, Cambridge University Press, 2003. (The definitive source on probability and the Bayesian philosophy; a necessary read if you are interested in Bayesian statistics.)
2. **All of Statistics: A Concise Course in Statistical Inference**, by Larry Wasserman, Springer. (Good source for in-depth coverage of the topics we cover in class.)

Computational software and TA:

The course involves working with data, and students will be required to use the statistical package R for their coursework. Students are encouraged to use the graphical interface RStudio Desktop, available freely for academic use.

To help students with computational software including R, the ISyE department has a new Computational Software TA, Zhenhuan Zhang (email: zhan4490@umn.edu). Zhenhuan will have weekly office hours in Shepherd Labs 406 as follows:

Mondays 3:30 pm to 5:30 pm

Tuesdays 10:00 am to 12:00 noon

In his office hours, Zhenhuan will be available to answer students’ questions about R. Please note that he is **not** a replacement for course TAs, and you should not be going to him for help with solving the homework. The idea is simply to have another computing help resource for students.

Zhenhuan will also hold a few workshops throughout the semester, which will be open to all students in the course. Details will be shared as they become available.

Homework:

Homework will be due on Friday at 12pm through Gradescope. There will be weekly homework, with occasional breaks for midterm and finals. In all, there will be about 8-10 homework assignments.

You may discuss the homework with other current students of the class, but each student must write their solutions independently and individually. Showing each other written solutions is not acceptable. (Sharing written solutions, or submitting copied solutions will be considered a violation of the *Board of Regents Policy: Student Conduct Code*, and appropriate actions will be taken.)

If there is a dispute about grading, you may request regrade through Gradescope within a week of the work being returned, with a short explanation of the error. All of the work, not just the disputed question, will be regraded.

Late homework:

Late homework will incur 20% grade reduction per day, for up to 3 days late (latest by the subsequent Monday 12pm). Homework handed in after Monday 12pm will receive no points and will not be graded. Extensions will not be granted. Excuses for late homework will be evaluated on a case-by-case basis, with points deducted as described above except in rare circumstances.

Your lowest homework grade will be dropped, to accommodate non-medical reasons for missing or incomplete homework, if you provide me with proof via Gradescope that you have submitted the final course feedback. (You must not and do not have to share the feedback directly with me, just a copy of the final page saying you have submitted the feedback.)

Exams:

The midterm will be a closed book, closed notes in-class exam. The time will be confirmed, but tentatively it will be on Oct 22, 2019.

The final exam will also be closed book and closed notes, and based on the material covered during the entire course; the time and location will be confirmed later.

Grading:

Your grade will be based on homework (30%, approximately equally weighted), the midterm (30%), the final exam (40%).

As an incentive for you to provide feedback on the course and my teaching, if you fill the course evaluation form during the evaluation period and share the confirmation page with me, your lowest homework score will be dropped from consideration towards your final grade.

Academic integrity:

Each student in this course is expected to abide by the *Board of Regents Policy: Student Conduct Code*. Any work submitted by a student in this course for academic credit must be the student's own work. Complete code is available at <https://policy.umn.edu/node/7178>

Prohibition against buying and selling of course materials:

Course materials, posted on Canvas/Piazza or otherwise, are intellectual property belonging to the author/instructor. Students are prohibited against buying or selling any course materials without the express permission of the instructor. Such unauthorized behavior constitutes academic misconduct.