

MA 511 Applied Statistics for Engineers and Scientists F20

Instructors:

Adam C. Sales, PhD (Assistant Professor, Math Department)

Email: asales@wpi.edu

TA: Ashley Lockwood

Email:

Please feel free to email us with questions about the course, and to bug Adam if it seems to be taking too long for him to respond.

Office Hours:

- Online Office hours
 - Adam: [Zoom] or other media if you prefer
 - Monday 11am-12pm Worcester time
 - Tuesday 5-6pm
 - By appointment (email me)
 - Ashley: ([Zoom])
 - 3-4pm Wednesdays
 - 2-3pm Thursdays

Class Meetings (Zoom)

Mondays, 5:30-8:20pm Worcester time

Meeting ID:

OR: use Zoom link from Canvas

Textbook (and other Suggested Materials):

Applied Statistics for Engineers and Scientists (2014); Petruccelli, Nandram, and Chen

ISBN 0-13-565953-1 (*Electronic link to free book available on Canvas*)

Introduction to Statistics: A Modeling Approach (2020); CourseKata Online Interactive Textbook. Access through Canvas.

Prerequisite Courses: There is no presumption of statistical knowledge prior to the class. Material covered is similar to WPI's undergraduate Applied Statistics I & II (MA 2611 and MA 2612) with additional depth in topics such as probability mass and density functions, logic and tradeoffs of Type I and II errors, and calculation of Type II error. Some basic differential and integral calculus may be applied.

Learning Outcomes:

- Summarize data with summary statistics (e.g. 5-number summary), contingency tables, and plots (histogram, boxplot, scatterplot)
- Use common probability distributions (normal, Bernoulli/binomial, categorical/multinomial) to model data, and use a given distribution and the laws of probability for basic probability calculations
- Select and use confidence intervals and hypothesis tests for mean and proportion in one and two population cases. Distinguish trade-offs for types of errors made in statistics and weigh their potential consequences when conclusions are made. Identify potential problems with published p-values.
- Construct, fit, and interpret the results of linear regression models for multivariate data analysis and 1-way analysis of variance.
- Identify potential sources of selection bias and confounding, and propose random samples, , randomized experiments, or regression models to avoid or ameliorate these biases.

Software:

- CourseKata Textbook, access via Canvas
- R ([LINK \(Links to an external site.\)](#)) & RStudio ([LINK \(Links to an external site.\)](#)) , open-source data analysis software

Weekly Zoom Classes:

- Classes will be interactive—have a computer with RStudio ready to use
- The class will be broken up into two parts (roughly 5:30-6:50 and 7:00-8:20) with a 10 minute break in between
- Class attendance will not be factored into the grade, but is highly encouraged.
- I plan on trying to record class meetings and post them on Canvas, if feasible
- Zoom etiquette:

- Please ensure that your display name is the name you wish me to use
- Putting video on is strongly encouraged, but I understand that it's not always possible or a good idea.
- Participants will be muted except when asking a question, etc.
- Please feel free to ask questions whenever you want, by unmuting and asking or using the chat feature
- I plan to use polls and other features—please participate!

Course Requirements:

1. CourseKata class preparation (10% of grade)

We will use the online interactive textbook *Introduction to Statistics: A Modeling Approach* for class preparation. You will be expected to complete the exercises in the specified section before the start of each week's class (i.e. by Monday 5:30pm Eastern Time). This will be graded based on completion, not on correctness; however, CourseKata gives you the opportunity to fix incorrect answers, so I strongly encourage you to get all the questions right.

2. Problem Sets (30% of grade)

There will be problem sets assigned on most weeks. These will be submitted via Canvas by Monday (due by the end of the day, 11:59pm Eastern Time), and be based on material covered in previous classes. Computational problems will be completed in knitr (via RStudio, with the provided template), while math problems may be completed however you want. The problem set with the lowest score will be dropped from the final grade.

3. Midterm Exams (15% of grade each)

These will be administered remotely in the *first half* of the class period:

- - 12 October, 5:30-6:50
 - 16 November, 5:30-6:50 (tentative)

They will be followed by a regular class meeting in the second half, i.e. 7:00-8:20. **Please contact me if either of these times poses a problem for you.**

4. Final Project (30% of grade)

This will be completed in groups or pairs. Details will be discussed in class November 16th (after the midterm).

Grade Determination Breakdown

A score greater than 90 earns an A, a score greater than 80 earns at least a B and above 70 is at least a C. Scaling can occur depending on the difficulty of exams. Our goal is that every student earns an A (but grades will honestly reflect student work).

POLICIES

Late Work Policy

Late work is eligible for 75% of original points. I must receive completed assignment before solutions are posted for the assignment. Please start assignments early and communicate with me to discuss questions. If you need more time for an assignment, please email me and tell me what's up. We can probably figure things out. My concern will always be for your progress and well-being.

Diversity: I would like to create a learning environment that supports a diversity of thoughts, perspectives and experiences, and honors your identities (including race, gender, class, sexuality, religion, ability, etc.) To help accomplish this:

- If you have a name and/or set of pronouns that differ from those that appear in your official WPI records, please let me know!
- If you feel like your performance in the class is being impacted by your experiences outside of class, please don't hesitate to come and talk with me, submit anonymous feedback (via "Quizzes" on Canvas), and/or contacting [Diversity and Inclusion. Links to an external site.](#)
- I (like many people) am still in the process of learning about diverse perspectives and identities. If something was said in class (by anyone) that made you feel uncomfortable, please talk to me about it. (Again, anonymous feedback is always an option).

Academic Integrity: See school's policy: www.wpi.edu/offices/policies/honesty/studentguide.html

Working together is permissible except during exams. When working together you must show individual thought and writing in each problem assigned. Direct copying (and allowing someone to copy directly from you) is not acceptable.

Consequences for violating the Academic Honest Policy range from earning a zero on the assignment, failing the course, or being suspended or expulsion from WPI. The Dean of Students Office maintains judicial records for any act of academic dishonesty.

Academic Accommodations: We strive to create an inclusive environment where all students are valued members of the class community. If you need course adaptations or accommodations because of a disability, or if you have medical information to share with us that may affect your performance or participation in this course, please make an appointment with us as soon as possible. *Students with approved academic accommodations should plan to submit their accommodation letters through the [Office of Accessibility Services Student Portal \(Links to an external site.\)](#). Should you have any questions about how accommodations can be implemented in this particular course, please contact me as soon as possible. Students who are not currently registered with the Office of Accessibility Services (OAS) but who would like to find out more information regarding requesting accommodations and what that entails should plan to contact them via*

email: AccessibilityServices@wpi.edu and/or via

phone: (508) 831-4908.

Take Care of Yourself: Your overall well-being is important to us, and should be to you too. If you would like to talk to me about personal struggles I will do my best to support you. If you or anyone you know experiences any academic stress, difficult life events, or feelings like anxiety or depression, I strongly encourage you to seek support. [Student Development and Counseling Center \(SDCC\)Links to an external site.](#) is here to help.

Phone: 508-831-5540

Email: sdcc@wpi.edu.

Consider reaching out to a friend, faculty or family member you trust for help getting connected to the support that can help.

Please know it is important to me that you feel you are in the best position to succeed in the course. If you need accommodations and there is anything, I can do to help, I will be happy to assist to the best of my abilities.

(Tentative) Course Schedule:

Week	Date	Petruccelli, et al. Chapter	Main Topics	Notes
1	8/31	1	Introduction	
2	9/7	2	Summarizing data	
3	9/14	4	Probability	
4	9/21	4	Distribution theory	
5	9/28	5	Estimation	No lecture—this week will be asynchronous
6	10/5	5	Estimation, cont., selection bias, random sampling	
7	10/12	6+Exam	Exam+ Hypothesis tests	Exam followed by class
8	10/19	No Class		
9	10/26	6, 3	Hypothesis tests, cont.	
10	11/2	7	The relationship between two variables	
11	11/9	8	Multiple regression	
12	11/16	8+Exam	Exam, then more multiple regression	
13	11/23	8	Multiple regression and causal inference	
14	11/30	9	1-way ANOVA (just more regression)	

15 12/7

Wrap-up