

STA 371H: Statistics and Modeling (Honors)

Unique Number: 05070, 05075, 05080

Semester: Spring 2021

Essential Information

Instructor	Email	Office	Office Hours
Prof. Jared S. Murray	jared.s.murray@mcombs.utexas.edu	CBA 6.482	TBD

Teaching Assistant	Email	Office	Office Hours
Pedro Henrique Filipini dos Santos	pedro.santos@mcombs.utexas.edu	--	TBD

Course Website: <https://jaredsmurray.github.io/sta371h>

Canvas: <http://canvas.utexas.edu>

Piazza: <http://piazza.com/utexas/spring2021/sta371h>

About this course: Welcome to STA 371H! Below you will find all the “standard” syllabus information. But as preamble I want to acknowledge the difficulties and challenges related to learning online during a global pandemic. This course is not the same one I would have designed if we could be together in person, but I firmly believe that it is not uniformly *worse*, and on some dimensions it may even be better.

I have designed the course to maximize flexibility for you as you navigate the pandemic – for example, by excluding attendance as a component of your grade, granting dropped assignments, and instituting untimed, open-notes/book/etc exams. However, I had to balance that flexibility against what is fair to everyone. For example, as a rule I can’t accept late homework assignments because then I can’t immediately post solutions or discuss them in class without giving that person an edge, and withholding solutions would deny their classmates timely feedback. So I allow a reasonable number of dropped assignments instead.

I have also designed the course to maximize interactive components of our synchronous sessions. This both fosters an effective learning environment and injects additional human contact into all of our lives. There is a tradeoff here – to make this work, I need each of you to attend synchronous sessions if at all possible, to complete all the required preparatory material outside class, and to participate fully in class

activities. I have carefully chosen activities, readings, videos, and assignments to balance the total time you spend on this course – more preparation before class means less work to do after class.

This syllabus lays out what you can expect from me and what I will expect from you. I am, however, committed to making reasonable accommodations for difficult circumstances now more than ever. If you experience any hardships such as illness, accident, or a family crisis please know that these policies may be amended and therefore you should communicate with me as soon as you feel comfortable doing so. If for any reason you do not feel comfortable discussing these with me, please visit [Student Emergency Services](#).

Course Overview

COURSE DESCRIPTION AND LEARNING OBJECTIVES

This course will teach you how to effectively use probability, statistics, and data science to learn about the world and make decisions in the presence of uncertainty. After successfully completing this course you will be equipped with the necessary knowledge and skills to solve real-world problems in business and beyond using statistics and data science. Specifically:

- You will learn to translate abstract business, economic, and scientific problems into the language of statistics and models.
- You will learn how to use data to learn about populations, infer the parameters of models, and make predictions and forecasts
- You will learn how to use modern statistical software – R – to do exploratory data analysis and produce visual and quantitative evidence for evaluating hypothesis, making predictions, and making decisions in the face of uncertainty.

How will I learn? I have designed this course to maximize active learning and participation in class. Rather than deliver lengthy passive lectures in our synchronous sessions I will support your learning by providing you with materials to review and exercises to complete before class. We will spend most of our time in synchronous sessions in Q&A sessions about these materials, doing group activities to reinforce key concepts, and using statistics and data science to solve authentic, real-world problems. *These group activities will comprise the bulk of your “home”work grade.* Essentially I’m asking you to trade some pre-class preparation for fewer post-class homework assignments, which will make our time in synchronous sessions more interactive and more productive.

HOW TO SUCCEED IN THIS COURSE

- 1) Attend our synchronous sessions regularly and be prepared. I will ask you to do readings, watch videos, and complete software walkthroughs/tutorials before class. Being prepared does **not** necessarily mean mastering all of these. It means making a good-faith effort to complete what I assign and to understand the material, which may include coming to class with specific questions or points of confusion. Mastery will come with practice.
- 2) Be an active participant in class and in your groups. This course has a significant group work component, and you will maximize learning for you and your group by being a full and active participant at all times. I don’t expect everyone to participate in every discussion, but you should

be engaged and alert and, in your group work, looking for ways to contribute. Note that if you are not prepared for class you will not be able to participate fully, and your groups will suffer – and you will be less prepared for your exams.

- 3) Ask questions, of me and of your classmates. I especially love questions during our synchronous sessions. I can count on one hand the number of times a student asked a question and was the only one wondering about that topic, even using a hand with a below-average number of fingers. It might not always be the right time, and I might not always have the answer immediately, so I may ask to defer your question to office hours or later in our class period. But that doesn't mean I value it less.
- 4) Attend office hours. I am there staring into the Zoom void whether or not you attend! You may watch this video that corrects some common misconceptions about office hours:
<https://vimeo.com/270014784>
- 5) Don't wait until it's too late. If you feel you are falling behind for **any reason**, please contact me as soon as possible. I want each and every one of you to be successful, and I know you can be. Especially in these trying times I will make every reasonable accommodation to help you get and stay on track, but it is much easier to address any issues prospectively or as early as possible.

PREREQUISITES

Management Information Systems 301, 301H, or 310; Mathematics 408D, 408L, 408M or 408S; Statistics 309 or 309H; and credit or registration for Business Administration 324

COURSE FORMAT

This class meets online (via Zoom) on Mondays and Wednesdays at the following times:

Unique Number	Time
<u>05070</u>	12:30 p.m.-2:00 p.m.
<u>05075</u>	2:00 p.m.-3:30 p.m.
<u>05080</u>	3:30 p.m.-5:00 p.m.

Unless I have given you permission to do otherwise, *please attend the session for which you are registered*. Join the Zoom room for your section by clicking the links in Canvas.

COURSE COMMUNICATION

The course website (linked above) will have a post each week that collects links to lecture notes, additional readings, exercises, important deadlines, and other materials. If you need it, you can find it there (or a link to it there).

Announcements to the class: I will make announcements to the class via Canvas. Please make sure that you check the Canvas announcements regularly, and/or receive them via email (and read them!).

Questions about course materials (readings, exams, homework, etc.): General questions about course material should be posted to Piazza. You may remain anonymous to your peers if you choose. The

TA or I will typically respond to these (or endorse other responses) within one business day of their posting.

Questions about course policies, grading, or other concerns/feedback: Please feel free to email me any time. Occasionally I may ask you to post an emailed question to Piazza so that everyone can see my answer and possibly chime in themselves. Note that your TA cannot grant any extensions or exceptions to any course policy. I typically respond to emails within one business day. If it's been longer than two, please don't hesitate to remind me.

Course Requirements

REQUIRED MATERIALS

Textbook: There is no required textbook for this class. Most of your readings will come from “Data Science: A Gentle Introduction” by Prof. James Scott. These will be freely available on the course website. Other readings, short videos, and software tutorials will also be posted to the course website.

Software: R and RStudio (free software). R/RStudio are freely available for Mac, Windows, and Linux. R is the real deal—a software package used by organizations as diverse as Google, J.P. Morgan, Whole Foods, Facebook, and the New York Times to analyze their data. You will come away from the course knowing how to use a legitimate, industrial-strength platform for data analysis. You will download and install these the first week of class, if you don't already have them.

ASSIGNMENTS AND GRADING

Your grade has five main components:

1. “Home”work assignments: 20%
2. Knowledge check quizzes: 10%
3. Midterm: 20%
4. Final Project: 20%
5. Final Exam: 30%

All assignments are recorded as percentages. I will use the cutoffs below to translate your final grade percentage into a letter grade. I do not round these, so for example a final grade of 87% is a B+, while a final grade of 86.99% is a B. I reserve the right to curve your final grades *up*, and it is not uncommon for me to apply a modest curve based on the distribution of final grades. However, I will never curve grades *down* – a final weighted average percentage over the cutoff in the table will guarantee you that letter grade. Scores on individual assessments do not map to final letter grades – an exam score of 88% isn't a “B”.

Grade	A	A-	B+	B	B-	C+	C	C-	D	F
Cutoff	94%	90%	87%	84%	80%	77%	70%	65%	60%	<60%

Below I detail the nature of each component of your grade.

“Home”work assignments: “Home” is in quotes since, as noted above, we will spend significant class time working through these assignments in groups during synchronous sessions. You will submit these assignments via Canvas weekly. You are encouraged but not required to work in groups of up to four students on your homework assignments. You are free to form your own groups. These may or may not be the students you work with during our breakout sessions, which will usually be randomly determined at the beginning of each session. If you elect to work in groups you should be working together, rather than “dividing and conquering” the assignment. **You will struggle on the exams if you don’t understand all parts of each assignment independently of your group members, including how to use R.** Each group should submit one PDF of the assignment to Canvas, along with other materials I specify (e.g. R scripts). Parts of some homework assignments may be entered directly into Canvas itself.

Late assignments are not accepted for any reason. This is not intended to be punitive – it lets me immediately discuss problems in class and share solutions without putting anyone at an unfair advantage. However, I will drop your two lowest homework grades. These drops are intended to give you a buffer for illness, unexpected events, and other conflicts.

Knowledge check quizzes: These are pre-announced, untimed, short (<15 minute) assessments of important concepts and skills. I use these sporadically as a quick gauge of your understanding of the material, to assess your participation, or to prime in-class discussions. Knowledge checks may cover readings, videos, R walkthroughs, homework solutions, class discussions, or anything else I ask you to read or participate in. They are credit/no-credit; provided you complete them on time and make a serious attempt, you will receive 100% for each quiz you complete. The TA and I will use our discretion to determine whether you’ve made a serious attempt, but our intent is only to dissuade random guessing and nonsense responses to open questions, not penalize honest confusion.

If you successfully complete >80% of the knowledge checks on time, you will receive *full* credit (i.e., a 100% average for this portion of your grade). Again, this is intended to give you a buffer for illness, unexpected events, and other conflicts. I will not accept late knowledge checks or allow for makeups.

Midterm and final exams: Your midterm and final exams will be untimed, take-home, open book, and open notes. They will be available for you to work on for at least two full days before they are due (due dates are Fri March 12 for the midterm and Sat May 15 for the final). During that period all course materials will remain available to you. However, you may not discuss an exam with anyone other than me or your TA from the time I post it to Canvas until the final due date. *Discussing an exam with anyone other than me/the TA during this period is an honor code violation that I will aggressively enforce.* I have chosen this format to minimize exam stress during COVID and to ensure that students with poor access to technology, difficult living situations, or other adverse circumstances are at less of a disadvantage. Please don’t abuse that trust.

You will not be allowed a make-up for a missed exam without a documented and verifiable medical excuse, or documentation that a family emergency prevented you from completing the exam. The only documentation I will accept for this purpose is an electronic or written letter from Student Emergency Services in the Office of the Dean of Students notifying me of your absence. The Dean of Students will, in turn, require supporting documentation from you (e.g. a doctor’s note or letter from primary care provider) in order to verify your illness, injury, or emergency. While this policy may seem strict, it is the only way we can be fair to everyone.

If you will be unavailable due to representing the University on an academic, athletic, or student-organization trip, you must speak with me and provide me with appropriate documentation at least two weeks in advance so alternative accommodations can be made. If you must miss an exam for the observance of a religious holy day, inform me at least two weeks before the exam, so that alternative arrangements can be made in conjunction with the Dean and the relevant university offices.

Final project: In groups of 3-5 you will complete a self-directed final project at the end of class. This will involve finding or collecting your own data set on a question that interests you, running an appropriate statistical analysis, and writing up your conclusions. Details will be discussed in class (and posted on the course website). The project is due on Friday, May 7.

Regrade requests: On occasion you may find we have made errors in computing or recording your grades. If you let us know we will check our work and fix those mistakes without examining the rest of the assignment or exam

At other times you may disagree with the point value we have given a particular response. If you would like your assignment regraded as a result you should provide a short written explanation of why you think regrading is necessary within 7 days of receiving the graded exam or assignment. Note that when you submit this request the entire exam or assignment will be subject to regrading and your final point total may increase, decrease, or stay the same as a result.

This policy is not intended to discourage you from getting additional feedback about your performance or how it is evaluated. If after reviewing solutions you are still unclear about how grades were assigned or why you lost points, please arrange to ask about it in office hours with me or the TA – this is different than asking us to *change* the grade assigned.

CLASSROOM EXPECTATIONS

Attendance: I expect all students who are able to attend each synchronous class session. Recordings of class sessions will be available, but this course includes significant group work and activities that are difficult to replicate asynchronously. However, given the pandemic I understand regular attendance is more challenging for some than others through no fault of their own, so in the interest of fairness attendance in synchronous sessions will not factor into your final grade. Instead I will assess your participation and engagement through completion of knowledge checks and homework assignments.

Behavior in class: You should think about this online class the same way you would think about an in-person class. The same rules of courteousness and professionalism apply here. To the best of your ability, try to avoid outside distractions and keep your focus on what's happening in class. You may ask questions by unmuting yourself or through Zoom chat. Please keep comments and questions in the Zoom chat relevant to what's happening in class, both in public and private chats (note that private chats have a tendency to accidentally become public).

I have a zero-tolerance policy for racist, sexist, xenophobic, homophobic, or any sort of disrespectful language or behavior towards anyone in this class, including other students, TAs, or the instructor. Any student violating this policy will be referred to the Dean's office for disciplinary proceedings.

Some finer points of Zoom etiquette:

1. Mute yourself unless you are speaking. This will cut down on background noise and limit any distractions.



2. Be mindful of your surroundings when on camera.
3. Please add a professional photo of yourself for your Zoom profile picture. This photo will be visible during class sessions when your camera is off.
4. Turn your camera off if you are leaving temporarily and use the away feedback icon. You do not need to ask permission.
5. If the video or audio is choppy, try turning off your video. Otherwise try to leave your video on. It's very useful for me and others who are speaking to have some visual feedback from those listening.
6. Please try to use the most reliable WIFI you can access.

Names and Personal Pronouns: I will gladly honor your request to address you by a name that is different from what appears on the official roster, and by the gender pronouns you use (she/he/they/ze, etc). The best way to express your preference is through your name in Zoom and your Canvas settings. For instructions on how to add your pronouns to Canvas, visit <https://utexas.instructure.com/courses/633028/pages/profile-pronouns>.

Student Rights & Responsibilities

- You have a right to a learning environment that supports mental and physical wellness.
- You have a right to respect.
- You have a right to be assessed and graded fairly.
- You have a right to freedom of opinion and expression.
- You have a right to privacy and confidentiality.
- You have a right to meaningful and equal participation, to self-organize groups to improve your learning environment.
- You have a right to learn in an environment that is welcoming to all people. No student shall be isolated, excluded or diminished in any way.

With these rights come responsibilities:

- You are responsible for taking care of yourself, managing your time, and communicating with the teaching team and with others if things start to feel out of control or overwhelming.
- You are responsible for acting in a way that is worthy of respect and always respectful of others.
- Your experience with this course is directly related to the quality of the energy that you bring to it, and your energy shapes the quality of your peers' experiences.
- You are responsible for creating an inclusive environment and for speaking up when someone is excluded.
- You are responsible for holding yourself accountable to these standards, holding each other to these standards, and holding the teaching team accountable as well.

Course Outline

The schedule below schedule represents my current plans and objectives. This course covers a lot of ground, and at times it may be necessary to adjust the time spent on any particular topic to make sure we adequately cover others. Such changes are not unusual and should be expected. However, due dates for the exams and final project will not be adjusted except under the most extenuating circumstances. Even in those cases I will do everything in my power to move dates back, not forward.

Week	Topics	Notable deadlines
1	Review of basic probability rules. Introducing simulation in R.	
2	Joint, marginal, and conditional probability. The law of total probability and aggregation paradoxes.	
3	Independence and compounding. Bayes Rule.	
4	Expected value, variance, standard deviation, standardization, and the normal distribution. Anomaly detection, hypothesis testing, and quantifying evidence <i>against</i> a hypothesis or model with p-values.	
5	Exploratory data analysis in R. Computing summary statistics and creating plots.	
6	Regression with a single variable: Linear trends and differences between groups. R^2 , correlation, and statistical "explanations" of variation.	
7	Quantifying uncertainty through resampling: Learning about populations from samples, or about the future from the past.	
8	Isolating the effects of causes: The role of randomized controlled trials	Midterm, Mar 12
9	Spring Break	
10	Compared to what? Matching for statistical adjustment.	
11	Multiple regression for statistical adjustment: Partial and overall effects. When to include or exclude covariates when the goal is adjustment. Model checking.	
12	Inference in multiple regression models. Interaction terms in regression models. Quasi-experimental design 1: Difference-in differences through regression.	
13	Polynomial terms in regression models. Quasi-experimental design 2: Regression discontinuity through regression.	
14	Prediction and forecasting: The bias/variance tradeoff, overfitting, and cross-validation. Prediction and prediction intervals with regression models.	
15	Constructing and selecting inputs to predictive models.	
16	Advanced topics in prediction.	Final project, May 7
	Final exam due	Saturday, May 15

University Policies

ACADEMIC INTEGRITY

Each student in the course is expected to abide by the University of Texas Honor Code: “As a student of The University of Texas at Austin, I shall abide by the core values of the University and uphold academic integrity.” **Academic dishonesty and plagiarism are taken very seriously at UT.** If you use words or ideas that are not your own (or that you have used in previous class) in your homework write-ups, you must cite your sources. Otherwise you will be guilty of plagiarism and subject to academic disciplinary action, including failure of the course. You are responsible for understanding UT’s Academic Honesty and the University Honor Code which can be found at the following web address:

deanofstudents.utexas.edu/conduct

Q DROP POLICY

If you want to drop a class after the 12th class day, you’ll need to execute a Q drop before the Q-drop deadline, which typically occurs near the middle of the semester, but has been extended for the spring 2021 semester to May 11. Under Texas law, you are only allowed six Q drops while you are in college at any public Texas institution—however, for the fall 2020 and spring 2021 semesters, all Q-drops will be considered “non-academic,” which allows students to drop a class without counting toward the six-class limit. For more information about Q drops in general, see:

<http://www.utexas.edu/ugs/csacc/academic/adddrop/qdrop>. For information about fall 2020 and spring 2021 updates to the Q Drop Policy, see: <https://t.e2ma.net/message/r3htee/j51jbo>.

PASS/FAIL OR CREDIT/NO CREDIT GRADING POLICY

For the spring 2021 semester, undergraduate students may choose to have a total of three (3) classes graded on a Pass/Fail or Credit/No Credit basis without penalty. *These exceptions are new and apply only to the fall 2020 and spring 2021 semesters.* For more information please visit [UT's policy on the Extended deadline for Q-drops and P/F Flexibility](#).

SHARING OF COURSE MATERIALS IS PROHIBITED

No materials used in this class, including, but not limited to, lecture hand-outs, videos, assessments (quizzes, exams, papers, projects, homework assignments), in-class materials, review sheets, and additional problem sets, may be shared online or with anyone outside of the class unless you have my explicit, written permission. Unauthorized sharing of materials promotes cheating. It is a violation of the University’s Student Honor Code and an act of academic dishonesty. We are well aware of the sites used for sharing materials, and any materials found online that are associated with you, or any suspected unauthorized sharing of materials, will be reported to Student Conduct and Academic Integrity in the Office of the Dean of Students. These reports can result in sanctions, including failure in the course.

CLASS RECORDINGS

Class recordings are reserved only for students in this class for educational purposes and are protected under FERPA. The recordings should not be shared outside the class in any form. Violation of this restriction by a student could lead to Student Misconduct proceedings.

QUANTITATIVE REASONING FLAG

This course carries the Quantitative Reasoning flag. Quantitative Reasoning courses are designed to equip you with skills that are necessary for understanding the types of quantitative arguments you will regularly encounter in your adult and professional life. You should therefore expect a substantial portion of your grade to come from your use of quantitative skills to analyze real-world problems.

RELIGIOUS HOLY DAYS

By UT Austin policy, you must notify me of your pending absence at least fourteen days prior to the date of observance of a religious holy day. If you must miss a class, an examination, a work assignment, or a project in order to observe a religious holy day, you will be given an opportunity to complete the missed work within a reasonable time after the absence.

UNIVERSITY RESOURCES FOR STUDENTS

“KEEP LEARNING” RESOURCES

This course may be offered in a format to which you are unaccustomed. If you are looking for ideas and strategies to help you feel more comfortable participating in our class, please explore the resources available here: <https://onestop.utexas.edu/keep-learning/>

SERVICES FOR STUDENTS WITH DISABILITIES

The university is committed to creating an accessible and inclusive learning environment consistent with university policy and federal and state law. Please let me know if you experience any barriers to learning so I can work with you to ensure you have equal opportunity to participate fully in this course. If you are a student with a disability, or think you may have a disability, and need accommodations please contact Services for Students with Disabilities (SSD). Please refer to SSD's website for contact and more information: <http://diversity.utexas.edu/disability/>. If you are already registered with SSD, please deliver your Accommodation Letter to me as early as possible in the semester so we can discuss your approved accommodations and needs in this course.

COUNSELING AND MENTAL HEALTH CENTER

Do your best to maintain a healthy lifestyle this semester by eating well, exercising, avoiding drugs and alcohol, getting enough sleep and taking some time to relax. This will help you achieve your goals and cope with stress.

All of us benefit from support during times of struggle. You are not alone. There are many helpful resources available on campus and an important part of the college experience is learning how to ask for help. Asking for support sooner rather than later is often helpful.

If you or anyone you know experiences any academic stress, difficult life events, or feelings like anxiety or depression, we strongly encourage you to seek support. cmhc.utexas.edu/individualcounseling.html

THE SANGER LEARNING CENTER

Did you know that more than one-third of UT undergraduate students use the Sanger Learning Center each year to improve their academic performance? All students are welcome to take advantage of Sanger Center's classes and workshops, private learning specialist appointments, peer academic coaching, and tutoring for more than 70 courses in 15 different subject areas. For more information, please visit ugs.utexas.edu/slc or call 512-471-3614 (JES A332).

UNDERGRADUATE WRITING CENTER: uwc.utexas.edu

LIBRARIES: lib.utexas.edu

ITS: it.utexas.edu

STUDENT EMERGENCY SERVICES: deanofstudents.utexas.edu/emergency

IMPORTANT SAFETY INFORMATION

If you have concerns about the safety or behavior of fellow students, TAs or Professors, call BCAL (the Behavior Concerns Advice Line): 512-232-5050. Your call can be anonymous. If something doesn't feel right – it probably isn't. Trust your instincts and share your concerns.

TITLE IX REPORTING

Title IX is a federal law that protects against sex and gender-based discrimination, sexual harassment, sexual assault, sexual misconduct, dating/domestic violence and stalking at federally funded educational institutions. UT Austin is committed to fostering a learning and working environment free from discrimination in all its forms. When sexual misconduct occurs in our community, the university can:

1. Intervene to prevent harmful behavior from continuing or escalating.
2. Provide support and remedies to students and employees who have experienced harm or have become involved in a Title IX investigation.
3. Investigate and discipline violations of the university's [relevant policies](#).

Faculty members and certain staff members are considered "Responsible Employees" or "Mandatory Reporters," which means that they are required to report violations of Title IX to the Title IX Coordinator. **All instructors and TAs in this course are Responsible Employees and must report any Title IX related incidents** that are disclosed in writing, discussion, or one-on-one. Before talking with any faculty or staff member about a Title IX related incident, be sure to ask whether they are a responsible

employee. If you want to speak with someone for support or remedies without making an official report to the university, email advocate@austin.utexas.edu. For more information about reporting options and resources, visit titleix.utexas.edu or contact the Title IX Office at titleix@austin.utexas.edu.

EVACUATION

The following recommendations regarding emergency evacuation are from the Office of Campus Safety and Security, 512-471-5767, operations.utexas.edu/units/csas. If you are attending class virtually from an on-campus location, these guidelines may help you in case of emergency.

Occupants of buildings on The University of Texas at Austin campus are required to evacuate buildings when a fire alarm is activated. Alarm activation or announcement requires exiting and assembling outside.

- Familiarize yourself with all exit doors of each classroom and building you may occupy. Remember that the nearest exit door may not be the one you used when entering the building.
- Students requiring assistance in evacuation shall inform their instructor in writing during the first week of class.
- In the event of an evacuation, follow the instruction of faculty or class instructors. Do not re-enter a building unless given instructions by the following: Austin Fire Department, The University of Texas at Austin Police Department, or Fire Prevention Services office.
- Information regarding emergency evacuation routes and emergency procedures can be found at this link: emergency.utexas.edu