

STAT 420: Statistical Modeling in R Syllabus

Course Description

In Statistical Modeling in R you will learn both **theoretical** and **practical** techniques for applying models to data. Focus will be placed on regression models, which are used to model a variable of interest as a function of explanatory variables. For example, which variables are significant predictors for the success of a restaurant? What factors make for a fuel efficient car? Can you make accurate predictions of the opening weekend gross of a new film?

You will learn the mathematical fundamentals of linear models, a broad range of models that are the first line of defense in numerous application areas. By the end of the course, you will be able to critique and distinguish variables and models that are useful for predicting and explaining the behavior of a response variable of interest. Additionally, you will work with the **R** programming language to perform analyses and generate reproducible reports.

Course Goals and Objectives

Upon successful completion of this course, you will be able to:

- Interact with data using **R** and RStudio.
- Create reproducible reports with RMarkdown to communicate results.
- Use regression models to make predictions and explain relationships.
- Interpret modeling results in the context of real-world problems.
- Utilize simulation to explore statistical properties of models.
- Interpret regression models that use categorical predictors and interactions.
- Identify and diagnose violations of the assumptions of linear models.
- Add complexity to regression models using transformations and interactions.
- Use variable selection techniques to select a model.
- Perform regression analyses for a binary response.

Prerequisites

Before taking this course, you should be familiar with probability and statistics at a level that requires calculus as a prerequisite. In particular, you should know how to:

- Perform basic probability calculations for discrete and continuous distributions, especially the normal distribution.
- Given data, calculate various summary statistics.
- Perform a one-sample **t**-test.

We will recap the most important concepts needed for this course, but some familiarity will be helpful. You should also have some prior exposure to programming. Previous experience with **R** is not necessary.

Textbook

The **required text** for this course is *Applied Statistics with R* by David Dalpiaz. It has been specifically designed for this course, and there is both an [html version](#) and a [PDF version of the text](#). It is a living document. It is highly recommended that the html version be utilized whenever possible. If you have questions about its contents or see room for improvement, please contact the instructor.

Additionally, [a short list of recommended resources](#) for improving your understanding of and skills in R is provided in the required text.

Software

R is required software for this course. R is a freely available language and environment for statistical computing and graphics. **You must have access to a computer with R to be able to complete this course.** [Installing both R and RStudio on your own computer](#) is the best option. RStudio is not strictly required, but several R concepts will be introduced with RStudio in mind, thus it is highly recommended. To complete the course without using RStudio would require additional effort to learn alternative techniques.

- [R, a statistical programming language](#)
- [RStudio, a user interface for R](#)

Course Outline

Week	Topic	Duration
Week 1	Data, Statistics, and R	5/15–5/21
Week 2	Simple Linear Regression	5/22–5/28
Week 3	Inference for Simple Linear Regression	5/29–6/4
Week 4	Multiple Linear Regression	6/5–6/11
Week 5	Exam Week	6/12–6/18
Week 6	Project Week	6/19–6/25
Week 7	Categorical Predictors and Interactions	6/26–7/2
Week 8	Diagnostics and Transformations	7/3–7/9
Week 9	Collinearity and Model Selection	7/10–7/16
Week 10	Regression for a Binary Response	7/17–7/23
Week 11	Exam Week	7/24– 7/30
Week 12	Project Week	7/31–8/5

Assignment Deadlines

For all assignment deadlines, please refer to the [Course Assignment Deadlines, Late Policy, and Academic Calendar](#) page.

Elements of This Course

Please note, in order to access course materials and assignments, you will need to pay the Coursera fee (\$158) for this course in addition to the University of Illinois tuition.

Lecture Videos

Each week some concepts will be presented through a collection of short video lectures. You may stream these videos for playback within the browser by clicking on their titles, or you may download the videos.

Readings

Each week will have assigned readings from the textbook listed above. These readings will provide details about all of the concepts for the week, as well as examples.

Orientation Quiz

The purpose of the Orientation Quiz is to ensure that you have gone through the orientation module and acquired necessary information about the course before you start it. The Orientation Quiz is a required activity, but it will not be part of the final course grade. You have unlimited attempts on the Orientation Quiz. You need to answer all questions correctly in order to pass it.

Quizzes and Practice Quizzes

All weeks of the course that are not an exam or project week will include a quiz and practice quiz. You will be allowed unlimited attempts for each practice quiz. Practice quizzes will not be used when calculating your final score in the class, but instead should be used for your own personal review before you attempt the graded assignments for the week. You will be allowed 3 attempts per every 8 hours for each graded quiz, with your highest attempt score before the deadline used toward your final grade. There is no time limit on how long you take to complete each attempt at the quizzes.

Homework Assignments

Eight weekly homework assignments will be given as we cover the corresponding material. Be sure to budget enough time to upload your submission to Coursera. Homework assignments are meant to be learning experiences. Therefore, exceptional work will be commented on and points will be deducted for any part of a submission that does not lead to the solution. Do not take deductions personally. This course and these assignments are meant to help you realize how you can improve your work.

You are encouraged to work together on homework using the discussion forums. However, sharing, copying, or providing any part of a homework solution or code is an infraction of the University's rules on academic integrity. Any violation will be punished as severely as possible. **Keep every typed word and piece of code your own and you will not have any issues.** When posting on the forums, we understand that it is helpful to post code to describe your question. Please attempt to post a minimal example that does not completely solve a question. The instructor reserves the right to edit out any code that reveals too much of the solution.

If you would like to change a previously submitted assignment, please email mcsds-support@illinois.edu and we'll manually remove your previous submission. If the deadline has not yet passed, we'll remove your existing submission so you can replace it.

Exams

This course will have two proctored exams, one in Week 5 covering topics from Weeks 1-4 of the course, and one in Week 11 covering topics from Weeks 7-10. The exams will be very similar to the graded quizzes, but they will be timed.

The exams will be proctored via a proctoring service called ProctorU. For further information about the proctored exams, see the [ProctorU Exams](#) page.

Projects

This course will also have two culminating projects; one due in Week 6 and due at the end of the course, in Week 12.

The first project will be individual, but for the second project, you will work in groups. The first project will focus on simulation, while the second project will use methods from the course to perform data analysis and generate a written report.

Grading Distribution and Scale

Your final grade will be calculated based on the activities listed in the table below. Your official final course grade will be listed in Enterprise. The course grade you see displayed in Coursera may not match your official final course grade.

Activity	Occurrence	Percent of Final Grade
Graded Quizzes	Weeks 1-4; 7-10	5%
Homework Assignments	Weeks 1-4; 7-10	40%
Exams	Weeks 5, 11	10%
Individual Simulation Project	Week 6	20%
Group Data Analysis Project	Week 12	25%

Grading Scale

Letter Grade	Percent Needed						
A+	TBD	B+	87%	C+	77%	D+	67%
A	93%	B	83%	C	73%	D	63%
A-	90%	B-	80%	C-	70%	D-	60%

Additional Policies

Student Code and Policies

A student at the University of Illinois at the Urbana-Champaign campus is a member of a University community of which all members have at least the rights and responsibilities common to all citizens, free from institutional censorship; affiliation with the University as a student does not diminish the rights or responsibilities held by a student or any other community member as a citizen of larger communities of the state, the nation, and the world. See the [University of Illinois Student Code](#) for more information.

Academic Integrity

All students are expected to abide by [the campus regulations on academic integrity found in the Student Code of Conduct](#). These standards will be enforced and infractions of these rules will not be tolerated in this course. Sharing, copying, or providing any part of a homework solution or code is an infraction of the University's rules on academic integrity. We will be actively looking for violations of this policy in homework and project submissions. Any violation will be punished as severely as possible with sanctions and penalties typically ranging from a failing grade on the assignment up to a failing grade in the course, including a letter of the offending infraction kept in the student's permanent university record.

Again, a good rule of thumb: *Keep every typed word and piece of code your own*. If you think you are operating in a gray area, you probably are. If you would like clarification on specifics, please contact the course staff.

Disability Accommodations

Students with learning, physical, or other disabilities requiring assistance should contact the instructor as soon as possible. If you're unsure if this applies to you or think it may, please contact the instructor and [Disability Resources and Educational Services \(DRES\)](#) as soon as possible. You can contact DRES at 1207 S. Oak Street, Champaign, via phone at (217) 333-1970, or via email at disability@illinois.edu.