Course Syllabus

ISYE 6501 Introduction to Analytics Modeling

Summer 2026

Professor: Dr. Joel Sokol

Course Description

An introduction to important and commonly used models in Analytics, as well as aspects of the modeling process.

Prerequisites

- Probability and statistics
- Basic programming proficiency
- Linear algebra
- Basic calculus
- A little background in R can be useful, but isn't necessary if you're willing to learn on the fly.

Course Goals

The most important thing you can learn from this course is not the memorization of any specific bit of material. Instead, I would like you to learn these skills:

- Given a business (or other) question, select an appropriate analytics model to answer it, specify the data you will need to solve it, and understand what the model's solution will and will not provide as an answer.
- Given someone else's use of analytics to address a specific business (or other) question, evaluate whether they have used an appropriate model (and appropriate data) and whether their conclusion is reasonable.

Another goal of this course is for you to learn how to think though descriptions and usage of new models, so you can continue to learn throughout your career; new techniques will certainly be developed after you graduate, and we want you to be able to pick them up quickly.

We will not cover the mathematics and algorithms under the hood, or deeper mastery of the modeling needed to set up the use of the technique. You can acquire those deeper levels of knowledge in elective courses. (In fact, we could spend an entire semester on many of the topics you'll see in the course.)

Course Topics

- Basic modeling
  - Overview (Lessons 1.1-1.3, 21.2)
  - Philosophy and ethics of modeling (Lessons 1.3, 6.3, 8.4, 10.3a, 11.2b, 15.4a, 19.3, 21.0m, 21.1a, 21.1)
- Analytics/data science models
  - Classification (Lessons 2.1-2.2, 2.4-2.6, 2.8)
  - Clustering (Lessons 4.1, 4.3-4.6)
  - Change detection (Lessons 6.1-6.2)
  - Time series models (Lessons 7.1-7.6)
  - Regression (Lessons 8.1, 8.3, 8.5-8.6, 10.4, 10.7)
  - Tree-based models (Lessons 10.1-10.3)
  - Variable selection (Lessons 11.1-11.3)
  - Design of experiments (Lessons 12.1-12.4)
  - Probability distributions (Lessons 13.1-13.3)
  - Probability-based models (Lessons 13.5, 13.8)
  - Simulation (Lessons 13.6-13.7a)
  - Optimization (Lessons 15.1-15.8)
  - Advanced models (Lessons 16.1-16.8a)
- Cross-cutting concepts
  - Data and data preparation (Lessons 2.3, 2.7, 5.1, 9.1-9.2)
    - Outliers (Lessons 5.2-5.3)
  - Principal component analysis (9.3-9.6)
  - Validation (Lessons 3.1-3.4)
  - Measurement of data and model quality (Lessons 4.2, 8.2, 10.5-10.6, 13.4)
  - Missing data (Lessons 14.1-14.3)
- Experiential learning
  - Using and combining models and data (Lessons 17.1, 18.1-18.4, 19.1-19.4, 20.1-20.3)
  - All homeworks (HW 1-HW14)
  - Course project

Grading Policy

1. There will be two midterm quizzes and one final quiz that will be graded by faculty. Each will be worth 25% of the course grade.
   a. The midterm quizzes will be 90 minutes, probably each around 45-50 questions.
      i. Midterm 1 covers Modules 1-10.
      ii. Midterm 2 primarily covers Modules 11-16, but requires knowledge from Modules 1-10 as well.
   b. The final quiz is 180 minutes, probably around 60 questions.
      i. The final quiz is comprehensive (it covers all modules).
2. There will be homework assignments most weeks of the semester. Your two lowest homework grades will be dropped, and the remaining ones will add up to 15% of the course grade. These will be peer-graded (based on the median score assigned by your peer graders). <u>You will also need to peer-grade others' homeworks; you will not receive credit for your homework submission if you do not complete your peer assessments</u>.

NOTE: I know that everyone has other obligations – family, work, etc. – that sometimes make it hard or impossible to meet weekly homework deadlines. That is why you are allowed to drop your lowest two homework grades: the drops allow you to not turn in the homework in whatever two week(s) the other obligations in your life might be too time-consuming. (Of course, I hope that you do the homework later to make sure you learn what you're supposed to know that week, but you can do it on your own time without the pressure of a deadline.)

3. There will be one course project worth 8% of the course grade. The project will be peer-graded (your score will be the median score assigned by your peer graders). You will also need to peer-grade others' projects; you will receive a grade of zero for your project submission if you do not complete your peer assessments.
4. There will be one quiz on the syllabus, worth 2% of the course grade.
5. For Georgia Tech degree and certificate students, quizzes will be scaled to letter grades based on their difficulty, and combined with the homeworks and project to determine an overall letter grade scale at the end of the semester. The overall scale will not be higher than 90% for an A, 80% for a B, 70% for a C, and 60% for a D (and F below 60%); however, I reserve the right to make the scale lower (i.e., easier for students to earn higher grades) based on the difficulty of the quizzes. Audit and Verified/MicroMasters learners must achieve an overall weighted average of 60% to pass the course.

Homework and Quiz Due Dates

All homework and quizzes will be due at the times in the table at the end of this syllabus. These times are subject to change so please check back often. Please convert from UTC to your local time zone using a Time Zone Converter. Only Georgia Tech degree and certificate students and Verified/MicroMasters learners will have access to quizzes; quizzes are not available to Audit learners.

Timing Policy

- The Modules follow a logical sequence that includes knowledge-building and experience-building.
- Assignments should be completed by their due dates, in order for timely peer assessment. Peer assessments should also be completed by their due dates, to give timely feedback.
- Quizzes must be completed during the time allotted on the schedule.
- You will have access to the course content for the scheduled duration of the course.

Quiz Policy

(Georgia Tech degree and certificate students and Verified/MicroMasters learners only; quizzes are not available to Audit learners.)

- Quizzes for all Georgia Tech degree and certificate students and Verified/MicroMasters learners will require remote proctoring, including a full scan of the room in which the quiz is taken. Please prepare accordingly (either cover/remove any personal items you

don't wish to be scanned before starting the quiz, or arrange to take the quiz in an alternative location that is quiet and private (e.g., a public library quiet room).

- For all quizzes, you are allowed limited notes as well as blank sheets of paper for scratch work:
  - For Midterm Quiz 1 and Midterm Quiz 2, you are allowed to use one sheet of paper, either 8.5"x11" or A4, with handwritten notes (both sides of the sheet, 2 sides total).
  - For Final Quiz, you are allowed to use two sheets of paper, either 8.5"x11" or A4, with handwritten notes (both sides of each sheet, 4 sides total).
  - All sheets of notes and scratch paper must be shown (both sides) in the pre-quiz room scan.
- Any student who misses a quiz for any reason will not be allowed to take it after the deadline; however, in appropriate situations the instructor may impute a score for the missed quiz, based on the student's other quiz scores.
- Calculators may not be used (you won't need them for any calculations).

Onboarding Process (Onboarding Quiz, Syllabus Quiz, Piazza Registration, etc.)

(Georgia Tech degree and certificate students and Verified/MicroMasters learners only; quizzes are not available to Audit learners.)

- All Georgia Tech degree and certificate students and Verified/MicroMasters students are required to complete the Onboarding Process by the deadlines shown in the table at the end of this syllabus. That includes the Onboarding Quiz, the Syllabus Quiz, and Piazza registration.
- The Onboarding Quiz is needed to help make sure that your identity is verified and that your system is set up to work with online proctoring. This is an ungraded quiz; it is just to make sure you're set up for the rest of the semester. You are required to complete this quiz early in the semester to avoid problems when taking the midterm quizzes.
- The Syllabus Quiz helps make sure everyone understands some key things (how to get help, what to do if something goes wrong, etc.) that will make the semester go more smoothly. Because the emphasis is on knowing what to do, you can keep submitting this quiz until you have all the correct answers – so everyone should be able to get the full 2% (as long as you take it before the deadline, of course). You are required to complete this quiz early in the semester to ensure that everyone understands how to navigate this course and its requirements.
- Every Georgia Tech degree and certificate student, and every Verified/MicroMasters student, is required to register for the Piazza message board associated with this course. Registration is part of the onboarding process, and it is important because all official communications in this course are done via Piazza (see the "Communication" section of the syllabus).

Attendance Policy

- This is a fully online course.

- Log in on a regular basis to complete your work, so that you do not have to spend a lot of time reviewing and refreshing yourself regarding the content.

Plagiarism Policy

- Plagiarism is considered a serious offense. You are not allowed to copy and paste or submit materials created or published by others, as if you created the materials. All materials submitted and posted must be your own. Any background materials you use should be cited.

AI Use Policy

- Any code or text created using AI for homeworks or the project must be specifically cited. Just like using online sources (e.g., Stack Overflow) for small snippets of code is allowed as long as they are cited, AI may be used for code or text snippets as long as it is cited; in all cases, you should indicate specifically which part of your submission is AI-generated. Unless otherwise specified in the homework or project, you may not use AI for more than that; even if you believe that in the future you will just prompt AI to do these tasks for you, it is important that you learn to do them yourself.

- You are responsible for any errors introduced by the AI.

Student Honor Code

All Audit and Verified/MicroMasters learners are expected and required to abide by the letter and the spirit of the edX honor code. All Georgia Tech degree and certificate students are expected and required to abide by the letter and spirit of the Georgia Tech honor code. The teaching assistants and I will also abide by these honor codes. Please feel free to contact me if there is any way that I can help you in complying with the honor code.

- I'm very serious about this. Ethical behavior is extremely important in all facets of life.
- Review the honor code that is relevant to you: Georgia Tech degree and certificate students should review the Georgia Tech Student Honor Code www.honor.gatech.edu and Audit and Verified/MicroMasters learners should review the edX Honor Code https://www.edx.org/edx-terms-service and.
- You are responsible for completing your own work.
- Any Georgia Tech degree or certificate student suspected of behavior in violation of the Georgia Tech Honor Code will be referred to Georgia Tech's Office of Student Integrity. Any Audit or Verified/MicroMasters learner found in violation of the edX Honor Code will be subject to any/all of the actions listed in the edX Honor Code.

Communication

- All Georgia Tech degree and certificate students and Verified/MicroMasters learners are responsible for knowing the content of all pinned Piazza posts. This is where instructors will be letting students know about important announcements, changes (if any), etc., so all students are required to read and know the content of all such posts. It is expected that students will check these posts at least once every 24 hours (with exceptions for national and religious holidays, emergencies, etc.).

- All learners should ask questions, and answer their fellow learners' questions, on the course discussion forums. Often, discussions with fellow learners are the sources of key pieces of learning.
- Georgia Tech degree and certificate students and Verified/MicroMasters learners can also ask questions of the instructor and teaching assistants via Piazza. For special cases such as failed submissions due to system errors, missing grades, failed file uploads, emergencies that prevent you from submitting, personal issues, etc., the Piazza discussion forum also allows you to send private messages to the entire team of instructors (professors and TAs).
- Audit learners will be able to ask questions of each other and answer each other questions, but the instructor and teaching assistants will not answer questions in the Audit learner forums.

Students with Disabilities, Unexpected Medical/Personal Issues, Etc. (Georgia Tech degree and certificate students only; edX MicroMasters students should contact edX)

- If you wish to request an accommodation due to a documented disability, please contact the Office of Disability Services (ODS) (**dsinfo@gatech.edu** or 404-894-2563 (voice) or 404-894-1664 (TDD)) as soon as possible. ODS helps students get accommodations prospectively (before the accommodation is needed), but not retroactively (i.e., they will not help if you knew you might need the accommodation beforehand but waited until after the situation arose to request it). We (professor and TAs) cannot give these accommodations ourselves; they must be requested through ODS.
- If you encounter an unexpected personal issue, medical issue, etc. you can contact the Dean of Students' office, or post on Piazza to all instructors. Depending on the situation, we might be able to handle it, or we might need you to contact the Dean of Students' office, but you are always welcome to contact the Dean of Students' office if you are not comfortable revealing the details of your situation to the professor and TAs.

Acceptable Student Conduct

- *In Georgia Tech's Master of Science in Analytics program, which this course is a part of, we expect all participants (learners, faculty, teaching assistants, staff) to interact respectfully. Learners who do not adhere to this guideline may be removed from the course.*

- Please see Georgia Tech's Student-Faculty Expectations to see other conduct requirements of both students and faculty.

Course Topics Schedule

- The tables below contain a course topic outline and assessment due dates.

Weeks	Course Topics	Release Dates

Week 1	Introduction, Classification, Validation	May 18 @ 13:00 UTC May 18 @ 9am ET May 18 @ 6am PT
Week 2	Clustering, Basic Data Preparation, Change Detection *NOTE: Registration for the course Piazza forum is required to access the material for Weeks 2 and beyond.*	May 23 @ 13:00 UTC May 23 @ 9am ET May 23 @ 6am PT
Week 3	Time Series Models, Basic Regression	May 30 @ 13:00 UTC May 30 @ 9am ET May 30 @ 6am PT
Week 4	Advanced Data Preparation, Advanced Regression, Tree-based Models	Jun 6 @ 13:00 UTC Jun 6 @ 9am ET Jun 6 @ 6am PT
Week 5	Variable Selection, Design of Experiments, Probability-based Models	Jun 13 @ 13:00 UTC Jun 13 @ 9am ET Jun 13 @ 6am PT
Week 6	Probability-based Models, Missing Data, Optimization	Jun 20 @ 13:00 UTC Jun 20 @ 9am ET Jun 20 @ 6am PT
Week 7	Optimization, Advanced Models	Jun 27 @ 13:00 UTC Jun 27 @ 9am ET Jun 27 @ 6am PT
Week 8	Discussion Cases – Case Format, Power Company Case	Jul 4 @ 13:00 UTC Jul 4 @ 9am ET Jul 4 @ 6am PT
Week 9	Discussion Cases – Retailer Case	Jul 11 @ 13:00 UTC Jul 11 @ 9am ET Jul 11 @ 6am PT
Week 10	Discussion Cases – Monetization Case	Jul 18 @ 13:00 UTC Jul 18 @ 9am ET Jul 18 @ 6am PT
Week 11	Course Summary	Jul 25 @ 13:00 UTC Jul 25 @ 9am ET Jul 25 @ 6am PT
Week 12	Final Quiz	See below

	Assignment		**Peer Assessments**	
	Release Date	**Due Date**	**Release Date**	**Due Date**
Onboarding Quiz	May 18 @ 13:00 UTC May 18 @ 9am ET May 18 @ 6am PT	Jun 1 @ 13:00 UTC Jun 1 @ 9am ET Jun 1 @ 6am PT		
Syllabus Quiz	May 18 @ 13:00 UTC May 18 @ 9am ET May 18 @ 6am PT	Jun 1 @ 13:00 UTC Jun 1 @ 9am ET Jun 1 @ 6am PT		
Week 1 Homework	May 18 @ 13:00 UTC May 18 @ 9am ET May 18 @ 6am PT	May 28 @06:00 UTC May 28 @ 2am ET May 27 @ 11pm PT	May 28 @ 06:00 UTC May 28 @ 2am ET May 27 @ 11pm PT	Jun 1 @ 06:00 UTC Jun 1 @ 2am ET May 31 @ 11pm PT

	Assignment		Peer Assessments	
	Release Date	**Due Date**	**Release Date**	**Due Date**
Week 2 Homework	May 28 @ 06:00 UTC May 28 @ 2am ET May 27 @ 11pm PT	Jun 4 @ 06:00 UTC Jun 4 @ 2am ET Jun 3 @ 11pm PT	Jun 4 @ 06:00 UTC Jun 4 @ 2am ET Jun 3 @ 11pm PT	Jun 8 @ 06:00 UTC Jun 8 @ 2am ET Jun 7 @ 11pm PT
Week 3 Homework	Jun 4 @ 06:00 UTC Jun 4 @ 2am ET Jun 3 @ 11pm PT	Jun 11 @ 06:00 UTC Jun 11 @ 2am ET Jun 10 @ 11pm PT	Jun 11 @ 06:00 UTC Jun 11 @ 2am ET Jun 10 @ 11pm PT	Jun 15 @ 06:00 UTC Jun 15 @ 2am ET Jun 14 @ 11pm PT
Week 4 Homework	Jun 11 @ 06:00 UTC Jun 11 @ 2am ET Jun 10 @ 11pm PT	Jun 18 @ 06:00 UTC Jun 18 @ 2am ET Jun 17 @ 11pm PT	Jun 18 @ 06:00 UTC Jun 18 @ 2am ET Jun 17 @ 11pm PT	Jun 22 @ 06:00 UTC Jun 22 @ 2am ET Jun 21 @ 11pm PT
Week 5 Homework	Jun 18 @ 06:00 UTC Jun 18 @ 2am ET Jun 17 @ 11pm PT	Jun 25 @ 06:00 UTC Jun 25 @ 2am ET Jun 24 @ 11pm PT	Jun 25 @ 06:00 UTC Jun 25 @ 2am ET Jun 24 @ 11pm PT	Jun 29 @ 06:00 UTC Jun 29 @ 2am ET Jun 28 @ 11pm PT
Week 6 Homework	Jun 25 @ 06:00 UTC Jun 25 @ 2am ET Jun 24 @ 11pm PT	Jul 2 @ 06:00 UTC Jul 2 @ 2am ET Jul 1 @ 11pm PT	Jul 2 @ 06:00 UTC Jul 2 @ 2am ET Jul 1 @ 11pm PT	Jul 6 @ 06:00 UTC Jul 6 @ 2am ET Jul 5 @ 11pm PT
Week 7 Homework	Jul 2 @ 06:00 UTC Jul 2 @ 2am ET Jul 1 @ 11pm PT	Jul 9 @ 06:00 UTC Jul 9 @ 2am ET Jul 8 @ 11pm PT	Jul 9 @ 06:00 UTC Jul 9 @ 2am ET Jul 8 @ 11pm PT	Jul 13 @ 06:00 UTC Jul 13 @ 2am ET Jul 12 @ 11pm PT
Week 8 Homework	Jul 9 @ 06:00 UTC Jul 9 @ 2am ET Jul 8 @ 11pm PT	Jul 16 @ 06:00 UTC Jul 16 @ 2am ET Jul 15 @ 11pm PT	Jul 16 @ 06:00 UTC Jul 16 @ 2am ET Jul 15 @ 11pm PT	Jul 20 @ 06:00 UTC Jul 20 @ 2am ET Jul 19 @ 11pm PT
Week 9 Homework	Jul 16 @ 06:00 UTC Jul 16 @ 2am ET Jul 15 @ 11pm PT	Jul 23 @ 06:00 UTC Jul 23 @ 2am ET Jul 22 @ 11pm PT	Jul 23 @ 06:00 UTC Jul 23 @ 2am ET Jul 22 @ 11pm PT	Jul 27 @ 06:00 UTC Jul 27 @ 2am ET Jul 26 @ 11pm PT
Week 10 Homework	Jul 23 @ 06:00 UTC Jul 23 @ 2am ET Jul 22 @ 11pm PT	NOT DUE -- USE FOR	GROUP DISCUSSION	AND LEARNING
Course Project	Jul 4 @ 13:00 UTC Jul 4 @ 9am ET Jul 4 @ 6am PT	Jul 23 @ 06:00 UTC Jul 23 @ 2am ET Jul 22 @ 11pm PT	Jul 23 @ 06:00 UTC Jul 23 @ 2am ET Jul 22 @ 11pm PT	Jul 27 @ 06:00 UTC Jul 27 @ 2am ET Jul 26 @ 11pm PT
Midterm Quiz 1	Jun 11 @ 06:00 UTC Jun 11 @ 2am ET Jun 10 @ 11pm PT	Jun 22 @ 06:00 UTC Jun 22 @ 2am ET Jun 21 @ 11pm PT		
Midterm Quiz 2	Jul 2 @ 06:00 UTC Jul 2 @ 2am ET Jul 1 @ 11pm PT	Jul 13 @ 06:00 UTC Jul 13 @ 2am ET Jul 12 @ 11pm PT		
Final Quiz	Jul 23 @ 06:00 UTC Jul 23 @ 2am ET Jul 22 @ 11pm PT	Aug 3 @ 06:00 UTC Aug 3 @ 2am ET Aug 2 @ 11pm PT		

Course Materials

- All content and course materials can be accessed online
- There is no textbook for this course

Technology/Software Requirements

- Internet connection (DSL, LAN, or cable connection desirable)
- R statistical software (free download; see cran.r-project.org) and R Studio (free download; see https://rstudio.com/products/rstudio/download/)
- Arena simulation software (free student download; see www.arenasimulation.com/academic/students) for Windows, *or* SimPy (free download; see https://pypi.python.org/pypi/simpy) for Windows/Mac)
- PuLP optimization software (free download; see www.coin-or.org/PuLP/ -- Windows version and (for Mac users) a Linux version)
- Python (required for PuLP and SimPy) programming language (free download; see www.python.org/)
- Adobe Acrobat PDF reader (free download; see https://get.adobe.com/reader/