Georgia Institute of Technology
Course Syllabus: ISYE 6420 Bayesian Statistics

Term: Spring 2026	School of Industrial and Systems Engineering
Delivery: 100% Web-Based, Asynchronous	**LMS for Content Delivery:** Canvas Only
Dates course will run: Jan 12 – May 7, 2026	

Instructor Information

Roshan Joseph, Ph.D., Professor	Brani Vidakovic, Ph.D., Professor in Videos

General Course Information

Description

An introduction to Bayesian statistical inference and applications.

Pre-requisites

- Introductory courses in probability and statistics
- Basic programming proficiency
- Calculus

Course Goals and Learning Outcomes

By the end of this course, students will be able to model and infer from the Bayesian philosophical perspective. The aim is to make you proficient in the following:

- Given a real-life data set, select an appropriate statistical model to conduct inference, formulate any prior information in terms of probability distributions (priors), and understand what the conducted inference implies.
- In addition to understanding concepts and being able to select the right methodology for the problem in hand, the course is aimed at hands-on approaches and delivering explicit results.
- Another aim of this course is for you to build a solid base for your data modeling skills, 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.
- In addition, when you accumulate more information about the problem at hand, you will be able to coherently incorporate this information and update your inference.

The core of the Bayesian approach to data modeling is the Markov Chain Monte Carlo method. Although you would be exposed to theoretical concepts of MCMC and several step-by-step examples will be discussed, we will not cover the details of mathematics and algorithms under the hood, or deeper mastery of the modeling needed to set up an efficient MCMC chain.

Students will use both a general-purpose programming language and a probabilistic programming language (PPL) called PyMC to complete assignments. PyMC will not be used for assignments until after the midterm (starting with Homework #5). Until that point, students should use Python as a general-purpose programming language.

Course Materials

- The TA course notes site contains Python code, TA-written notes, and known errata for all lectures.
- Homework and other course materials can be accessed online from Canvas.

Recommended Reading

- Vidakovic, B. (2017) Engineering Biostatistics: An Introduction using MATLAB and WinBUGS, Wiley. This is the main course textbook but covers a mix of frequentist and Bayesian statistics. It is a good reference because the lectures generally assume basic familiarity with the frequentist

concepts covered within them. If you are already very familiar with these concepts, many of these readings may be skipped.

Units	Recommended Chapters from *Engineering Biostatistics*
1–3	3–4
4	5.1–5.5, 5.7–5.10, 6.1–6.5, 8, 9.3–9.4, 9.8
5	See handouts uploaded with Homework 4.
6	19
7	10.2, 11.1–11.2, 11.4, 11.6, 14.1–14.10, 15
8	16
9	No readings.
10	No readings.

The following books were used in the creation of the course:
- Ntzoufras, I. (2009) *Bayesian Analysis Using WinBUGS*, Wiley. Georgia Tech Library e-book link.
- Peter M. Lee (2012) *Bayesian Statistics: An Introduction*, 4th Edition, Hodder Arnold. Georgia Tech Library e-book link.

See this link for some other recommended resources.

Course Requirements, Assignments & Grading

Assignment Distribution and Grading Scale

Assignment	Open	Due Date	Related Units	Weight
Homework #1	01/12 12:00AM ET	(optional)	1–3	0%
Homework #2	01/19 12:00AM ET	02/01 11:59 PM ET	4.1–4.9	6%
Homework #3	02/02 12:00AM ET	02/15 11:59 PM ET	Rest of 4	6%
Homework #4	02/16 12:00AM ET	03/01 11:59 PM ET	5	6%
Homework #5	03/16 12:00AM ET	03/29 11:59 PM ET	6–7	6%
Homework #6	03/30 12:00AM ET	04/12 11:59 PM ET	8–9	6%
Midterm	03/06 06:00PM ET	03/08 06:00 PM ET	1–5	25%
Project	03/16 12:00AM ET	04/19 11:59 PM ET	1–10	10%
Final	04/24 06:00PM ET	04/26 06:00 PM ET	1–10	35%
Total				100%

Time Zones

The above times are Eastern Time (ET), which will be EST (UTC –5) until Sunday, March 8th at 06:00 UTC. ET then switches to EDT (UTC –4) for the remainder of the semester. The midterm and following assignments will be due an hour earlier than previous assignments if you're in a place that doesn't use daylight savings time.

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EST is UTC-5 and EDT is UTC-4, so 05:00 UTC is midnight in Atlanta during standard time and 1 AM during daylight saving time. Students are responsible for converting to their local time. The exam time periods are meant to allow students in every time zone to have a full weekend to take the test.

Grading Scale

The students' course grades will be based on their performance on homework, midterm, project, and final. The overall score will be calculated as a weighted average where homework constitutes 30%, the midterm 25%, the project 10%, and the final 35% of the total. The grade will be based on the cut points specified below. There is no curve applied to the course grades.

A	90-100%
B	80-89%
C	70-79%
D	60-69%
F	0-59%

Project Description

More details will be released after the midterm, but you will write a Bayesian analysis on a topic of your choice. This will be an individual project only.

Exam Description

The exams are "open book" and un-proctored. Students may use our course materials during the exam period but may not use external resources. Outside materials of any kind, including AI tools, like ChatGPT/Copilot or similar, are not allowed for any purpose, including the use of notes generated before the exam. TAs will discuss the exam rules in more detail as we get closer. You have the full 48-hour period to complete the exam (dates listed above on the Assignment Distribution and Grading Scale table).

Submitting Assignments

Homework will remain accessible (open for late submission) 24 hours after the (Sunday, 11:59 PM ET) due date. During this 24-hour late-submission period, you may submit your homework assignment for a 25% penalty. After this 24-hour period, no submissions will be accepted. There is no late-submission period for exams or projects.

If the instructional team is **unable to open a file or if the file is not a solution, the student will not have an opportunity to submit the correct files again.** Therefore, it is important for the students to double-check their submissions and make that all the files and calculations within are correct on Canvas.

Submission Format

This applies to all assignments, including exams and the project. Students should submit one report file and any supporting code files. If you completed the assignment without using code (this may be possible for assignments 1–3), you do not need to submit a code file.

You are responsible for following these guidelines. Failure to do so **will result in penalties** for the assignment.

Reports

For each assignment, students are required to create a document that fully supports their mathematical or simulation-based solution to the questions stated. If you have not fully supported your solution, you may lose points. If you use methods from outside the course, you must cite them in your report.

- Approved filetypes: .pdf, .html, .docx
- Do not compress your files in .zip or other formats.
- Do not include screenshots of code anywhere in the report. You may insert snippets of code in to explain your processes, but no screenshots, please. If you're exporting your report from a Jupyter notebook, code cells are acceptable.
- If you have supporting code, it is not acceptable to only submit a report, even if you have pasted the code into your report. You must also submit a runnable code file (see supporting code files, below).
- Absolutely no handwritten work is accepted! Equations must be typeset. You can use Latex, Typst, the equation editor of your word processor, convert handwritten equations using OCR software like Mathpix, or any other method that works for you.
- Do not submit final answers only. You must show your work and explain your reasoning for full credit.
- You may export your Jupyter notebook to pdf or html and submit that as your report. Your answers must still be fully justified and explained outside the code cells. Code comments are not an acceptable replacement for your report. Submitting only an .ipynb file is not acceptable; you must export the file to html or pdf for your report.
- Again, absolutely no handwritten work! **You will receive a 0** on any portion of your assignment that is handwritten.

Supporting code files

- Approved file types: .py, .ipynb
- Do not compress your files in .zip or other formats.
- They can be separate code files for individual problems, or you can use one code file for the entire assignment.
- If using a Jupyter notebook, submitting only the html or pdf export is **not acceptable** at any time and does not count as submitting your code file. You must submit **both the exported report and the .ipynb file.**
- Take steps to ensure your code can be run by the graders and that it outputs the same solutions in your report. Code that doesn't work or doesn't reproduce your results may receive penalties.
    - Many of our problems involve randomly generated numbers. We account for and expect minor differences. Setting a random seed is not required but is generally good practice anyways.
    - Before submitting a Jupyter notebook, always restart and run all cells, then check the output for discrepancies or errors.

Assignment Grading, Follow-up, and Regrade Policy

Assignment submissions are evaluated and graded by course staff. Grade turnaround has generally been two weeks. Assignment solutions will be provided after the submission window has closed for all students. Please do not request solutions; we will provide them when we can for all assignments.

Grading the assignments for this class can be labor-intensive, and the amount of feedback the grading TA is able to give may vary. Students should compare their solutions to the official ones to see where they went wrong. If there's something you don't understand, you are welcome to create a post on Ed Discussion asking for clarification. Asking for clarification on Ed is not the same as a regrade request!

If you would like to dispute your grade on an assignment, please **email** your grading TA (their names may be found on Canvas) and cc the head TA (areding6@gatech.edu). **Your grades may increase,**

stay the same, or decrease based on our decision. We reserve the right to regrade the whole submission, not just the part a student has an issue with. You will have one week from the return of your grade to request a regrade. After the regrade, the score will be final and there will not be another chance to dispute the grade for that assignment.

Re-grade requests should be based on specific issues. Below are good and bad examples:

Good:
- "My answer is in a different form but mathematically equivalent to the official solution. Here's why..."
- "The grading TA said I didn't include this deliverable, but it's actually in my report on page 3."

Bad:
- "I need one more point to get over the threshold for an A, can you take another look at my homework?"
- "I think my error was minor, I should have been deducted fewer points."

Late and Make-up Work Policy

In the case of emergency, you (or the person whom you designate) should inform the instructor promptly via email. An official notification from the dean of student's office is necessary to be able to extend the due date of homework/exam/project.

Plagiarism & Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. All students enrolled at Georgia Tech, and all its campuses, are to perform their academic work according to standards set by faculty members, departments, schools and colleges of the university; and cheating and plagiarism constitute fraudulent misrepresentation for which no credit can be given and for which appropriate sanctions are warranted and will be applied. For information on Georgia Tech's Academic Honor Code, please see the honor code and the code of conduct.

Plagiarism is considered a serious offense. You are not allowed to submit materials created or published by others without explicit attributions; that is, as if you created the materials. **ChatGPT and other large language models are not allowed as valid sources for our course. Further, if you took notes using an LLM during the semester, you may not use those notes on the exam because all outside sources are banned during exams.**

Any student suspected of cheating or plagiarizing a homework, exam, or assignment will be directly reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Discussing the homework and exams with someone outside of the course student body, faculty, and staff and/or posting homework/exams/other course materials to non-GT sites are considered serious violations of the honor code. Furthermore, internet searches related to course topics and other material from outside the class are not allowed to be used during exam periods. Your work on exams must use methods/models from our course materials, with appropriate modifications for the problem at hand. Using methods from outside our course materials is considered cheating on our exams.

Student Honor Code

All course participants (the professor, teaching assistants, and learners) are expected and required to abide by the letter and the spirit of the Georgia Tech honor code. If there is any way we can help you comply with the honor code, please do not hesitate to ask. We will do the same.
- Ethical behavior is extremely important in all facets of life.
- You are responsible for completing your own work.

- Any learner found in violation of the Georgia Tech Honor Code will be subject to some/all the actions listed in the Georgia Tech Honor Code.

Technology Requirements: Computer Hardware and Software

- You will need access to a personal computer with high-speed internet.
- We are flexible with allowed software; however, students are responsible for finding a setup that works for them. We will try to help with technical issues, but the TAs cannot support all combinations of software or different versions of that software.
- You will need to be able to use one general-purpose programming language like MATLAB, Octave, Python, or R. We currently provide examples and solutions in Python. Python will be required for the second half of the course because we will start using PyMC after the midterm.
- After the midterm, you will learn to use a probabilistic programming language called PyMC. We currently only provide examples and solutions in PyMC and require it for homeworks 5, 6, and the final.

Other Course Policies, Expectations & Guidelines

Communication Policy

- Please contact your instructor, teaching assistants, and fellow learners via course forums. Often, discussions with fellow learners are the sources of key pieces of learning.
- 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., you can contact the Head TA via email or private Ed Discussion post.
- For serious personal issues, you can contact Dr. Roshan Joseph at roshan@gatech.edu.
- We will use Ed Discussion for all regular course correspondence, except for re-grade requests.

Online Student Conduct and (N)etiquette

Netiquette refers to etiquette that is used when communicating on the Internet. Review the Core Rules of Netiquette. When you are communicating via email, discussion forums or synchronously (real-time), please use correct spelling, punctuation and grammar consistent with the academic environment and scholarship[1].

1. Conner, P. (2006-2014). Ground Rules for Online Discussions, Retrieved 4/21/2014 from http://teaching.colostate.edu/tips/tip.cfm?tipid=128

In Georgia Tech's MS in Analytics program, 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.

Communicating appropriately in the online classroom can be challenging. To minimize this challenge, it is important to remember several points of "internet etiquette" that will smooth communication for both students and instructors:

1. *Read first, Write later*. Read the ENTIRE set of posts/comments on a discussion board before posting your reply, in order to prevent repeating commentary or asking questions that have already been answered.
2. *Avoid language that may come across as strong or offensive*. Language can be easily misinterpreted in written electronic communication. Review email and discussion board posts BEFORE submitting them. Humor and sarcasm may be easily misinterpreted by your readers. Try to be as matter-of-fact and professional as possible. Ed Discussion Public Posts are meant for technical discussions of course material and for helping every student to learn the course material better. Private Ed Discussion messages are a way to quickly communicate with the course staff, and as such should primarily be used in emergencies such as personal illness, injury, or other accommodation requests such as Disability Services. In some cases, such as during exam periods

or debugging code that contains your answer to a homework problem, private posts may also be appropriate. Before making a private Ed post rather than a public one, please consider whether your question could help others learn, since TAs have limited available hours to devote to one-on-one time with students.

3. *Follow the language rules of the Internet*. Do not write using all capital letters, because it will appear as shouting. Also, the use of emoticons can be helpful when used to convey nonverbal feelings. ☺
4. *Consider the privacy of others*. Ask permission prior to giving out a classmate's email address or other information.
5. *Keep attachments small*. If it is necessary to send pictures, change the size to an acceptable 250kb or less (one free, web-based tool to try is picresize.com).
6. *No inappropriate material*. Do not forward virus warnings, chain letters, jokes, etc. to classmates or instructors. The sharing of pornographic material is forbidden.

NOTE: The instructor reserves the right to remove posts that are not collegial in nature and/or do not meet the Online Student Conduct and Etiquette guidelines listed above.

University Use of Email

A university-assigned student e-mail account is the official university means of communication with all students at Georgia Institute of Technology. Students are responsible for all information sent to them via their university-assigned e-mail account. If a student chooses to forward information in their university e-mail account, he or she is responsible for all information, including attachments, sent to any other e-mail account. To stay current with university information, students are expected to check their official university e-mail account and other electronic communications on a frequent and consistent basis. Recognizing that some communications may be time-critical, the university recommends that electronic communications be checked minimally twice a week.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services at (404)894-2563 or http://disabilityservices.gatech.edu/, as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible to set up a time to discuss your learning needs.

Attendance and/or Participation

- This is a fully online course.
- Login 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.

Student-Faculty Expectations Agreement

At Georgia Tech we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. See http://www.catalog.gatech.edu/rules/22/ for an articulation of some basic expectations that you can have of the course staff and that we have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, we encourage you to remain committed to the ideals of Georgia Tech while in this class.

Subject to Change Statement

The syllabus and course schedule may be subject to change. Changes will be timely communicated via [email, Ed Discussion, the Canvas announcement tool, and/edX bulk email]. It is the responsibility of students to check email messages and course announcements to stay current in their online courses.