ISYE 3232 Syllabus

Stochastic Manufacturing and Service Systems, 3.000 credits

Section

- Days: TBD
- Time: TBD
- Location: TBD

Instructor
Dr. Lauren N. Steimle (she/her/hers)

Study Session
TBD

Teaching Assistants
TBD

TBD

Study Sessions
TBD

Instructor Team Email
An instructor team email will be provided.

This email address allows the entire instructor team to view your email and respond more quickly as a team. Please use this email for any questions related to course content or logistics.

General Information

Course Description

Manufacturing & service systems typically have random components to their behavior such as the demand for products and services. We will learn quantitative methods that are useful in analyzing, designing, and operating stochastic systems, particularly manufacturing and service systems. Much of our attention will be focused on understanding, managing, and reducing variability for inventory, production, and service systems.

Prerequisites

ISYE 2027, MATH 3215, or MATH 3225 (including knowledge of conditional probability, density and distribution functions, expectation, conditional expectation, laws of large numbers, central limit theorem, and Poisson Processes)

Course Goals and Learning Outcomes

The goal of this course is to provide an overview of methods and modeling techniques used to design, analyze, and manage a manufacturing or service system with uncertainty.

- Describe the role of uncertainty in manufacturing and service systems
- Analyze and manage uncertainty in systems dealing with perishable items
- Quantify the waiting time, length of the queue, and utilization in queueing systems

- Analyze and manage uncertainty in systems using predictions of potential future outcomes
- Effectively work as a member of a team to analyze the role of uncertainty in a system and communicate the findings

Course Requirements & Grading

Graded Component	Weight
Midterm Exam 1	25%
Midterm Exam 2	25%
Final Exam	30%
Individual homework assignments	8%
Team assignments	7%
Quizzes	5%
Extra Credit	Up to 2%

Grading Scale

Your final grade will be assigned as a letter grade according to the following scale:

A	>=90%
B	80.0-89.99%
C	70.0-79.99%
D	60.0-69.99%
F	0-59.99%

According to policy, grades at Georgia Tech are interpreted as follows:

A	Excellent (4 quality points per credit hour)
B	Good (3 quality points per credit hour)
C	Satisfactory (2 quality points per credit hour)
D	Passing (1 quality point per credit hour)
F	Failure (0 quality points per credit hour)

See http://registrar.gatech.edu/info/grading-system for more information about the grading system at Georgia Tech.]

Description of Graded Components:

Exams will be in-person during our normal class time in the regular classroom.

Midterm Exams

- Midterm 1: TBD
- Midterm 2: TBD

Final Exams

- See Georgia Tech Registrar's Final Exam Matrix; Location is regular classroom

Individual homework assignments

There will be 14 graded individual homework assignments. Their due dates are given in the course schedule below and will be posted on Canvas/Gradescope.

- You may discuss your assignments with the professor, TAs, fellow students, and others. However, you are expected to write up your solutions to individual homework on your own.
- **Using solutions, in any manner, to assignments given in previous semesters to prepare solutions for current assignments is a violation of the student honor code for ISYE 3232.**
- You will submit your homework assignments as a PDF via Canvas. You are responsible for ensuring that your homework solutions are easily read by the graders, that all pages of your solution are included in the submission, and that no part of the solution was cut off during the upload to Canvas. Corrupted files will receive zero credit; again, it is your responsibility to ensure that any file uploaded to Canvas is readable to the instructor team. If you used software to generate your solutions, you must submit your code or Excel sheets. The grading team will not consider missing pages, cut off images, or illegible work when grading. To save your homework as a PDF file, you might do this by embedding several pictures into a Word file and then saving as a PDF. Alternatively, you can use a document scanner application on a smartphone to convert photos into a PDF.
- Some assignments will involve R, MATLAB or Excel. These are available through the Georgia Tech Virtual Lab.
- Assignments will be graded by the TAs. Not all assignments will be graded and selected problems will be graded on each assignment.
- You are allowed to drop your 2 lowest homework scores.
- Late assignments and extensions are not allowed. If you are unable to complete an assignment on-time, you must use your dropped homework for this purpose. There will be a short grace period for Canvas uploads after the deadline. Any submission received beyond the grace period will be considered late.

Team assignments

There will be several team assignments focused around 2 simulation games focused on "Littlefield Technologies". Several of the team assignments will involve how well your team manages a simulated factory, which will be described in "Littlefield Technologies: Overview".

- **Littlefield Preparation Assignment (0.5% of final grade):** The purpose of this assignment is to prepare your team to work together for the Littlefield Simulation Game.
- **Littlefield Simulation 1 (3% of final grade): See schedule.** You will write and submit a report based on your team's strategy and performance during the first round.
- **Littlefield Simulation 2 (3% of final grade): See schedule.** You will write and submit a report based on your team's strategy and performance during the second round.
- **Team Debrief (0.5% of final grade):** You will write a reflection about your experience working on your team. You will evaluate your contributions and your teammates' contributions to your team's performance. In turn, your contributions to your group will be evaluated by your peers and may be used to adjust the group's grade to reflect the contributions of individuals.

Quizzes

- After each lecture that covers new content, a short quiz will be posted on Canvas. You have until midnight the day after the lecture to complete the quiz. The lowest 4 quizzes will be dropped.

Extra Credit Opportunities

Throughout the semester, there will be opportunities to gain extra credit. These extra credit opportunities will be posted on Canvas as assignments. Some examples of extra credit opportunities include making videos on topics related to the course, finding and summarizing current events and how they related to the topics in class, and creating problem sets and solution sets. I may use these materials in future offerings of the class. Students may accumulate up to 2% of extra credit throughout the course of the semester.

Required Course Text and Materials

Goldratt, Eliyahu M., and Jeff Cox. "The Goal: A Process of Ongoing Improvement. Third Revised Edn." (2014).

There will be an assignment related to this book.

You should buy a course packet from the bookstore to allow you to play the Littlefield Technologies games. The packet contains your individual Littlefield access code. Do not discard the access code after your first game. More information about Littlefield Technologies will be posted on the Canvas.

You should have a calculator capable of doing matrix calculations (e.g., TI-83, TI-84) for exams.

Course Schedule

This is the tentative schedule for the course and is subject to change based on the Spring 2026 schedule that will be updated for Fall 2026. Please check Canvas for assignments and due dates. Quizzes occur after every lecture unless otherwise noted.

Date	Lecture #	Module and Topics	Related Readings	Due dates and notes
1/13	1	**Introduction & Probability Review**	FVF Chapter 1 HL Chapter 24 Ross Chapter 1&2.1-2.5	Homework 1 released Read "The Goal" Chapters 1-8
1/15	2	**Newsvendor Problem** Introduction - Definition	FVF Chapter 10.1	
1/20	3	**Newsvendor Problem** Deriving an equation for expected profit	FVF Chapter 10	**Homework 1 due 1/20, 11:59pm ET** Homework 2 released
1/22	4	**Newsvendor Problem** Deriving an optimal order quantity	FVF Chapter 10	Read "The Goal" Chapters 9-16
1/27	5	**Newsvendor Problem** Minimizing Expected Cost	FVF Chapter 10	**Homework 2 due 1/27, 11:59pm ET** **Register for Littlefield Technologies**
1/29	6	**Queueing Theory** Introduction to queuing systems; Performance metrics in queuing systems,	FVF Chapter 7.1, 7.4 Ross Chapter 8 FVF Chapter 7.1, 7.4 Ross Chapter 8	Homework 3 released Read "The Goal" Chapters 17-25
2/3	7	**Queueing Theory** G/G/1 Queue, Lindley Equation,		**Homework 3 due 2/3, 11:59pm ET** Homework 4 released
2/5	8	**Queueing Theory**		Read "The Goal" Chapters 26-31

Date	Lecture #	Module and Topics	Related Readings	Due dates and notes
		Traffic Intensity, Utilization, Kingman's Approximation Formula		
2/10	9	**The Goal Discussion** **Queueing Theory** Little's Law, Throughput, Bottlenecks in Production (Tandem Queues)		**Littlefield Preparation Assignment due 2/9, 11:59 ET** **Littlefield Simulation 1 begins on 2/10** **Homework 4 due 2/10, 11:59pm ET**
2/12	10	**Discrete Time Markov Chains (DTMCs)** Motivating example of DTMC – Inventory Introduction to (s,S) policy State space, transition matrix, Transitions over multiple periods Initial distribution & Unconditional Probabilities	Ross 4.1, 4.2 FVF 5.1, 5.2	Homework 5 released
2/17	11	**Midterm Review**	Ross 4.1,4.2 FVF 5.3-5.5	**Homework 5 due 2/17, 11:59pm ET** Homework 6 released (Not to be turned in) **Littlefield Simulation 1 ends 2/17**
2/19		**---------- MIDTERM EXAM 1; In class on 2/19 ----------**		
2/24	12	**Discrete Time Markov Chains (DTMCs)** Importance of state definitions; Inventory example (state @ beginning of week vs end of week) Formal definition of DTMC; Markov Property Definition & Example	Ross 4.4	**Littlefield Simulation Report 1 due 2/23 11:59 PM ET** **Homework 6 (Not to be turned in)** Homework 7 released

Date	Lecture #	Module and Topics	Related Readings	Due dates and notes
2/26	13	**Discrete Time Markov Chains (DTMCs)** Other examples, including infinite state spaces Stationary distribution: Definition, how to calculate, interpretation		
3/3	14	**Discrete Time Markov Chains (DTMCs)** Long-run average profit using stationary distribution Irreducibility: Accessibility, Communication & Uniqueness of stationary distribution	Ross 4.3, 4.4 FVF 5.3-5.	**Homework 7 due 3/3, 11:59 ET** Homework 8 released
3/5	15	**Discrete Time Markov Chains (DTMCs)** Limiting distribution; Periodicity; Solidary property	Ross 4.4	
3/10	16	**Discrete Time Markov Chains (DTMCs)** Limits for periodic chains Recurrence & Transience Definitions	Ross 4.4	**Homework 8 due 3/10, 11:59pm** Homework 9 released
3/12	17	**Discrete Time Markov Chains (DTMCs)** Recurrence & Transience in Infinite State chains Cut method for determining the stationary distribution	Ross 5.2,5.3	
3/17	18	**Discrete Time Markov Chains (DTMCs)** Cut method for determining the stationary distribution	Ross 5.2,5.3	**Homework 9 due 3/17, 11:59pm** Homework 10 released

Date	Lecture #	Module and Topics	Related Readings	Due dates and notes
3/19	19	**Poisson Process** Introduction to Arrival Processes Exponential Random Variables & Memoryless Property Distribution of minimum of two exponentials Comparing exponentials	Ross 5.3, 5.4, 6.2, 6.3	
3/24; 3/26		---------- **Spring Break - No Class** ----------		
3/31	20	**Poisson Process** Example using exponential random variables Introduction to homogenous Poisson processes Key properties: Arrivals in given time period, Independent Increment	Ross 5.3, 5.4, 6.2, 6.3	**Homework 10 due 3/31, 11:59pm** Homework 11 released **Littlefield Simulation 2 begins 3/31**
4/2		---------- **MIDTERM EXAM 2; In class on 4/2** ----------		
4/7	21	**Poisson Process** Calculating probabilities using Poisson Processes Independent increments analysis example Duality relationship between arrival times & number of arrivals Other important random variables for Poisson Processes	See Canvas	
4/9	22	**Poisson Process** Probabilities conditioned on # of arrivals Thinning & Merging Poisson Process	See Canvas	**Homework 11 due 4/9, 11:59pm** Homework 12 released

Date	Lecture #	Module and Topics	Related Readings	Due dates and notes
4/14	23	**Continuous Time Markov Chains** Introduction to CTMC; examples to show state space, holding times, roadmap matrix, generator matrix, transition rate diagram	See Canvas	**Homework 12 due 4/14, 11:59pm** Homework 13 released **Littlefield Simulation Ends 4/14**
4/16	24	**Continuous Time Markov Chains** Example of CTMC to model 2 operators with different processing times; Markov property for CTMC	See Canvas	**Littlefield Technologies Report due 4/20, 11:59 ET**
4/21	25	**Continuous Time Markov Chains** Stationary distribution & interpretation, effective arrival rate in systems with capacity, throughput M/M/1 and M/M/∞ diagrams	See Canvas	**Homework 13 due 4/21, 11:59pm** Homework 14 release
4/23	26	**Open Jackson Networks**	See Canvas	
4/28	27	**Class Summary & Wrap Up**		**Homework 14, due 4/28 11:59pm**
		Final Exam ---------- **FINAL EXAM** ---------- The final exam is in the same classroom at the time indicated in the Registrar's Final Exam Matrix		

More Information

Course Website and Other Classroom Management Tools

We will use Canvas as our course website. On Canvas, you will find the material related to the class, discussions, and any announcements.

Additional Materials/Resources

The following are optional textbooks that may be useful for this course:

[**FVF**] Feldman, Richard M., and Ciriaco Valdez-Flores. *Applied probability and stochastic processes*. Springer Science & Business Media, 2009. [Available online through the Georgia Tech Library]

[HL] F.S. Hillier, Introduction to Operations Research, 10th Ed., McGraw Hill, 2014. (ISBN: 9781259162985)

[**Ross**] Ross, S.M., Introduction to Probability Models, 11th Ed, Elsevier, 2014.

More Support for Course Texts and Materials:

Throughout the semester, we may be using software such as MATLAB and/or R. Any commercial software required for the course will be available through the computer labs on campus.

https://www.isye.gatech.edu/about/school/computing/computer-labs

Course Website and Other Classroom Management Tools

We will use Canvas as our course website. You will submit all assignments via Canvas (or Gradescope within Canvas).

Course Expectations & Guidelines

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. For information on Georgia Tech's Academic Honor Code, please visit http://www.catalog.gatech.edu/policies/honor-code/ or http://www.catalog.gatech.edu/rules/18/

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

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 in order to set up a time to discuss your learning needs.

Participation

You are encouraged to actively participate in this class by asking questions and contributing during “in-class activities” which are small group activities.

Collaboration, Group Work, and Acceptable Resources

Homework assignments are designed to develop your ability to understand, formulate, and solve problems. You are encouraged to work together when conceptualizing and analyzing the homework assignments. However, you are required to prepare your own solutions and perform the calculations yourself, and turn in (for grading) your own analysis and write-up. Copying or rephrasing someone else's work is unacceptable. Further, copying someone else's work is a disservice to your own understanding of the material. There is a big difference between the ability to read and understand a solution and the ability to create and write one. You are allowed to use the materials listed in the syllabus in preparation of your homework responses. If you use material outside those listed in the syllabus, you should cite the material used.

The team assignments are a collaborative effort. Your group will submit one report for each assignment. Your contributions to your group will be evaluated by your peers and may be used to adjust the group's grade to reflect the contributions of individuals.

Collaboration and group work is encouraged for in-class activities. If you are unable to attend a live lecture, you may consult with classmates who did not attend the synchronous lecture and submit a solution that indicates which students you worked with. This solution must be generated independently of anyone that attended the synchronous lecture. Consulting with someone who attended the lecture to complete the solution is a violation of the honor code.

Collaboration is not allowed on midterm or final exams. Any collaboration on these graded components is a violation of the honor code.

Use of Artificial Intelligence (e.g., ChatGPT, BARD, etc.)

You may use generative AI programs, e.g. ChatGPT, to help generate ideas and brainstorm for homework. You should be aware that the material generated by these programs may be inaccurate, incomplete, biased, or otherwise problematic. Also, the use of these tools may stifle your own independent thinking and creativity, which could hurt your performance on exams.

Just as though you were working with a classmate, you may use AI to generate ideas but you *must* prepare your own solutions and write-up. Per GaTech's Honor Code, you may not submit any work generated by an AI program as your own. If you use AI, you **must** provide the prompts you used.

AI is not permitted during exams or quizzes as these are meant to test your mastery of the material without the aid of AI tools. AI is also not permitted in the writing of Littlefield reports.

Late Assignments and Corrupted Files

Late assignments will not be accepted. You are responsible to check that your assignment is downloadable by the instructor team; corrupted files will not be accepted. You will be able to drop two homework assignments and four quizzes. If you are unable to complete an assignment on-time, you should use a dropped homework/quiz for this purpose.

We only accept notifications from Dean's office or institute Approved Absences with the links to the on- line request forms below.

https://gatech-advocate.symplicity.com/care_report/index.php/pid167160

https://registrar.gatech.edu/info/institute-approved-absence-form-for-students

Please inform the instructor of your approved absences timely. If the notification from Dean's office is for instructor's discretion and your absence prevents you from completing assignments or tests, please discuss the accommodations with the instructor as soon as possible. Since it is difficult to create a different but fair test, and solutions to assignments may have already been published, the accommodation might not be a makeup test or assignment.

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 expectation that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

Student Use of Mobile Devices in the Classroom

Research on learning shows that unexpected noises and movement automatically divert and capture people's attention, which means that one student's use of a mobile devices (laptops, cell phones, tablets, etc.) can distract another student and disrupt their ability to learn. In addition, students using mobile devices often become engaged in matters that are not related to the class they are attending. Further, research indicates that students taking notes on laptops tend to process less as they take notes, and the depth of their learning suffers.

Although students may use laptop and tablet devices, these devices should be used only for matters related to our class. For the reasons listed above, I encourage students to be mindful in terms of how using laptop and tablet devices may be impacting their own learning. Cell phones should be silenced and stored during classroom time. In the synchronized sessions, cell phone, tablet and laptop can be used to follow the class, not to become a distraction.

Email

When sending emails to **isye3232spring2026-t15@groups.gatech.edu**, please use your Georgia Tech email address and include "ISYE 3232" in the subject line. This will make sure that your email gets properly filtered in my inbox and allow the instructor team to provide a more timely response.

Re-grade requests

If you think there has been an error in the grading of your assignment or exam, you have 3 days from the day it was returned to the class to submit it for a re-grade. When you submit a regrade request, you must provide a *written* explanation of the suspected grading mistake. Re-grading entails re-grading the entire assignment or exam; therefore, the re-grade process may result in your submission receiving a higher or a lower score after all of the problems have been reconsidered.

Recordings of Class Sessions and Required Permissions

Classes may not be recorded by students without the express consent of the instructor unless it is pursuant to an accommodation granted by the Office of Disability services. Class recordings, lectures, presentations, and other materials posted on Canvas are for the sole purpose of educating the students currently enrolled in the course.

Students may not record or share the materials or recordings, including screen capturing or automated bots, unless the instructor gives permission. Digitally proctored exams may require students to engage the video camera, but those recordings will not be shared with or disclosed to others without consent unless legally permitted.

Because class participation is a component of the course grade, if students are identifiable by their names, facial images, voices, and/ or comments, written consent must be obtained before sharing the recording with persons outside of currently enrolled students in the class.

Campus Resources for Students

These are resources on campus that are available to students:

- **Free tutoring for this class** is provided by the **ISyE Tutoring Center**, Monday through Thursday, 6pm to 9pm, in the studio in ISyE Main. Please find the tutoring schedule at https://www.gtiise.org/tutoring.
- **Free 1-to-1 tutoring** for this class is also provided by the Georgia Tech Center for Academic Success. Appointments can be made on success.gatech.edu.
- **The Counseling Center:** https://counseling.gatech.edu/ The Counseling Center educates students for life by providing a variety of services and programs that are consistent and consonant with the strategic plan goals of the Institution and the Division of Student Life. Services include short-term individual counseling, group counseling, couples counseling, testing and assessment, crisis intervention, referral services, as well as outreach programming, and consultation for faculty and staff, family and friends of Georgia Tech students. All counseling services are confidential and free of charge for eligible students. The Counseling Center provides brief or short-term therapy for a variety of presenting issues.
- **The Center for Assessment, Referral, and Education (CARE):** https://care.gatech.edu/ CARE is the primary resource for mental health support at Georgia Tech.
- **The Division of Student Life**: https://studentlife.gatech.edu/content/get-help-now The Office of the Vice President for Student Life and Dean of Students provides a number of services to assist students with medical and personal emergencies.