

CS305 ADVANCED COMPUTING

Spring 2026

Instructor:	Weihaio Qu	Time:	T: 1:15-2:35, Thur 11:40 - 1:00
Email:	wqu@monmouth.edu	Place:	HH 135
Office:	HH 227	Office phone:	(732) 263-5396

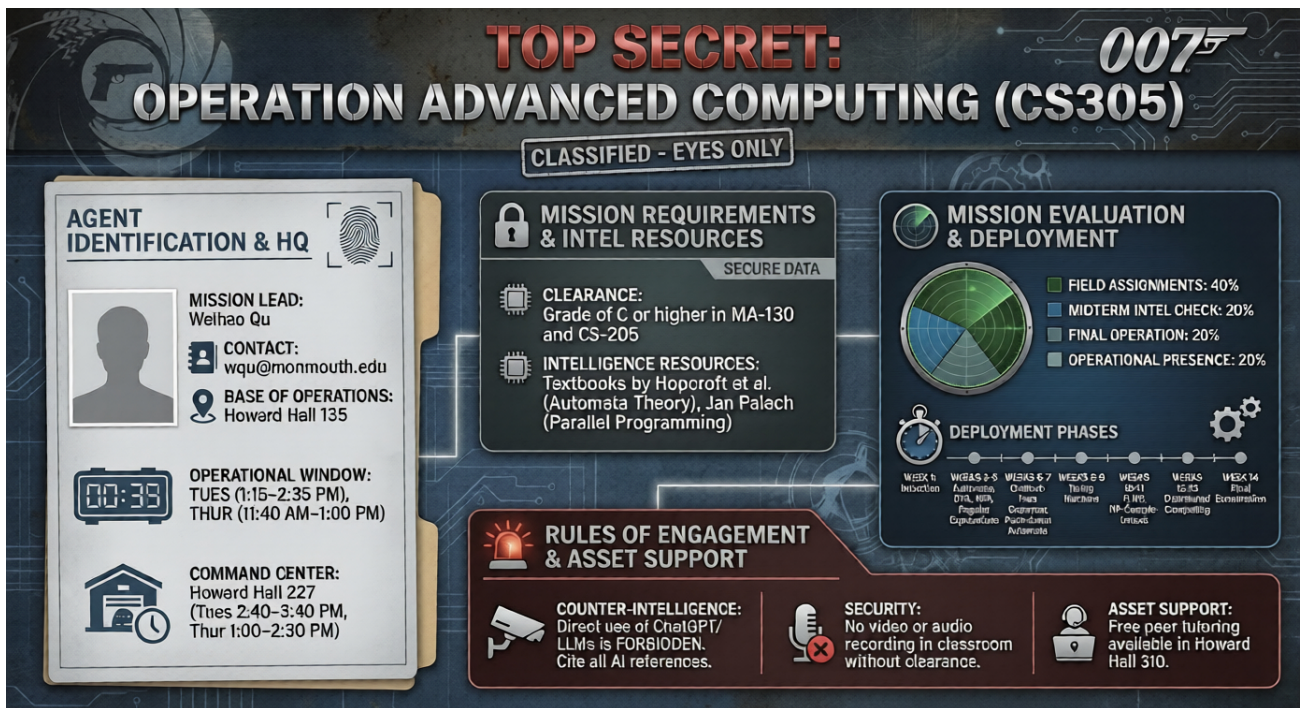


Figure 1: Take Away

Communication via Email: wqu@monmouth.edu

Instructor email may be expected within 16 business hours from receipt of the message. Business hours are from 9 am to 5 pm when classes are in session. For example, a message sent on Friday at 3 pm may not receive a response until Tuesday at 3 pm.

via Zoom meeting: By appointment. <https://monmouth.zoom.us/j/3473278602>

Prerequisites: MA-130 and CS-205, passed with a grade of C or higher.

Office Hours: Tues 2:40-3:40 pm, Thur 1:00-2:30 pm **Credits:** 3.

Course Description: : Introduction to fundamental concepts of computer science theory and methods of parallel and distributed programming, The course covers automata theory (including finite-state machines and Turing machines, algorithm complexity (including the distinction between P and NP problems), BNF specification of programming languages, methods of parallel programming, methods of distributed programming, measuring the speedup obtained by parallelization, and methods of addressing NP completeness through approximation. The course will provide experience in the implementation of parallel and distributed programming.

Course Objectives: This course builds upon the material of CS205 on data structures and algorithms, to introduce the students to areas of CS theory (The Chomsky hierarchy and the theory of automata) as well as techniques for using parallel and distributed programming.

AI policy: Please check our university AI policy. [https://my.monmouth.edu/policies/Documents/Use_of_ArtificialIntelligence_\(AI\)_Policy.pdf](https://my.monmouth.edu/policies/Documents/Use_of_ArtificialIntelligence_(AI)_Policy.pdf)

Recoding in class:

"Unless a student has an approved accommodation with the Department of Disability Services, students are prohibited from video or audio recording in all classroom settings, whether in-person or online, without explicit permission from the professor. Recording of fellow students for distribution without explicit permission from the professor and classmates is also prohibited due to privacy and potential FERPA concerns. A prohibited recording includes, but is not limited to, recordings using online platforms (Zoom, Teams, etc.), a cell phone, tablet, video camera, audio capture device, etc. Students may be subject to disciplinary action under the Student Code of Conduct if found to have made any video and/or audio recording of classroom activities without proper consent."

Textbook and Material:

- Title: **Introduction to Automata Theory, Languages and Computation (3rd edition)** by John Hopcroft, Rajeev Motwani, and Jeffrey Ullman. Pearson. 2016 (earlier editions may be available online).
- Title: **Parallel Programming with Python: Developing Efficient Parallel Systems using the Robust Python Environment**, by Jan Palach. Packt Publishing. 2014.

General Outcomes of Instruction:

1. Design, implement and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline (ABET)
2. Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline (ABET)
3. Apply computer science theory and software development fundamentals to produce computing-based solutions (Computer Science Department)

Relationship of courses to student outcomes listed: In this course, students are given an opportunity to:

- Students will be able to design a finite state machine to accept a specified language
- Students will be able to design a regular expression to formally specify a language.
- Students will be able to explain how finite state machines and regular expressions are related.
- Students will be able to design a pushdown automata to accept a specified language.
- Students will be able to design a context free grammar to formally specify a language.
- Students will be able to explain how pushdown automata and context free grammars are related.
- Students will be able to explain the difference between a finite state machine and a pushdown automata and describe why a pushdown automata can accept more languages than a finite state machine.
- Students will be able to create simple programs on a Turing machine.
- Student's will be able to describe a Turing machine and explain its significance.
- Student's will be able to explain the difference between the classes P and NP.

- Students will be able to code an algorithm using multiple processors in the programming language used in the course and using an approach discussed in the course.
- Students will be able to explain the difference between parallel, distributed and concurrent programs.
- Students will be able to use divide and conquer to convert a sequential algorithm to a parallel algorithm.
- Students will be able to use data decomposition to convert a sequential algorithm to a parallel algorithm.

Course Work: There will be in-class exercises and assignments for each major topic of the course. There will be a midterm, a final exam, and a group project. All papers and reports must be typed and use correct English grammar and spelling. No handwritten papers will be accepted. In-class exams may be neatly handwritten. Homework must be turned-in on the due date. Late assignments will not be accepted.

Grading: The following indicates the grade breakdown, which will be used in assigning grades in the course.

The instructor reserves the right to make changes to the grading criteria, weights, assignments, and course outline to best serve the needs of the class.

The evaluation consists of the following:

1. Final exam: 20 %
2. Assignment: 40%
3. Attendance and in-class exercise: 40%

Letter grades will be assigned based on the following scale.

A	93-100
A-	90-92
B+	87-89
B	83-86
B-	80-82
C+	77-79
C	73-76
C-	70-72
D+	67-69
D	63-66
D-	60-62
F	0-59

Attendance: Students are required to attend every class on time and are responsible for all materials covered and announcements made in class. Students should email the professor in advance for excused absences.

Academic Honesty: Please familiarize yourself with the [Monmouth University's Academic Honesty](#).

All work submitted for grading, with the exception of the project and class group exercises, should be your own individual work. Academic dishonesty subverts the University's mission and undermines the student's intellectual growth. Therefore, we will not tolerate violations of the code of academic honesty. Penalties for such violations include suspension or dismissal and are elaborated upon in the Student Handbook. **The direct use of ChatGPT or similar LLMs in your assignments and exams are forbidden. If any use of AI as a reference, please provide the source of the reference.** Check [Monmouth AI policy](#).

Civility in the Classroom: Since the enterprise of learning and intellectual exchange is something we all value, please respect your fellow students and the instructor by dressing properly for class, arriving on time, not allowing cell phones to interrupt the class, and NOT getting up and leaving the room for ANY reason, short of an emergency, while class is in session. Please turn off all your cell phones when you enter the classroom. No text messaging is allowed during class time.

Make Up Work/Exams: Students need a valid university excuse (e.g., excuse from the doctor, death in the immediate family, etc.) to make up work or tests. If you know ahead of time that you will miss a quiz or exam, please arrange to take it early by contact the professor. Exam makeup after missing the exam will be considered on a case-by-case basis. Please refer to [College Policies and Procedures Manual](#).

COVID-19: Please visit the Monmouth University Covid-19 website for the latest [guidelines](#).

Special Accommodations: The Department of Disability Services for Students utilizes Accommodate, an ADA-compliant automated system, that allows students to submit all accommodation requests online, such as registering with the office, semester requests, and test room booking. Students with disabilities who need special accommodations for this course are encouraged to meet with the appropriate disability service provider on campus as soon as possible. In order to receive accommodations, students must be registered with the appropriate disability service provider on campus as set forth in the Student Handbook and must follow the University procedure for self-disclosure, which is stated in the University Guide to Services and Accommodations for Students with Disabilities. Students will not be afforded any special accommodations for academic work completed prior to the completion of the documentation process with the appropriate disability service office. Students who are interested in utilizing accommodations can begin the process of registering with the DDS office via [Accommodate](#). The link to Accommodate can also be found on the DDS website on eCampus. Students who wish to speak with a disability services administrator should email dds@monmouth.edu.

Help Desk: The Help Desk can be contacted about problems related to student accounts or to report any problems with computers in any of the labs on campus by telephone at (732) 923-4357 (HELP) or by email at helpdesk@monmouth.edu. The help desk is open from 8:45 a.m. until 9:00 p.m. from Monday through Friday. You may go to the help desk located on the third floor of Edison Hall by the Department of Information Management.

Information Technology Tutors and Tutoring Lab: Free peer tutoring is available for students through the CSSE & IT Tutoring Lab. While the lab is physically located in Howard Hall 310, details on contacting a tutor will be provided several weeks into the start of the semester after tutoring schedules have been established.

Laboratory Accommodations:

- Computers on the second floor of the Student Center are available 24 hours, 7 days a week.
- There are many computers available in various locations throughout the library. Go to the MU library's website for the hours of operation.
- Classroom labs, located in Howard Hall in Room 207 and Room 212, are available to students when classes are not in session. The Computer Science department office can tell you the hours of availability for these labs.

Student mental health and wellness: Monmouth University cares about you, your health, and your wellness. As you prepare for your path to success at Monmouth, don't forget there are campus-based, local, and national resources to support your health and mental health along the way! As this list is not exhaustive, please visit www.monmouth.edu/connectwellmu for more information and additional resources on health and wellness. These resources can be used for you or to help you support a friend – Hawks Fly Together!

Course Outlines:

Week	Chapter	Activities
1	Induction	In-class exercise, Lab/Assignments
2,3	Automata, DFA, NFA	In-class exercise, Lab/Assignments
4,5	Regular Expression	In-class exercise, Lab/Assignments

Week	Chapter	Activities
6,7	Context free grammar, Push-down automata	Lab/Assignment
8,9	Turing machine	Assignment
10,11	P, NP, NP completeness	Lab/Assignment;
12,13	Distributed Computing	Lab, Assignment
14	Final Exam	Final exam