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COURSE SYLLABUS

## CS 390: Introduction to Theoretical Computer Science

### Course Information

| Item          | Details                                                                                                                                                                                       |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Credits       | 3 credit hours                                                                                                                                                                                |
| Semester      | Fall 2026                                                                                                                                                                                     |
| Delivery Mode | Synchronous Online (8-week accelerated course)                                                                                                                                                |
| Instructor    | Dr. Sumaya Sanober                                                                                                                                                                            |
| Email         | <a href="mailto:ssanober@odu.edu">ssanober@odu.edu</a>                                                                                                                                        |
| Office        | Monarch Hall   2123D                                                                                                                                                                          |
| Office Hours  | In person: Wednesday, 12:00-1:00 PM   Zoom: by appointment                                                                                                                                    |
| Prerequisites | A grade of C or better in CS 381 and in any one of CS 250, CS 251, CS 253, or ECE 250. Students should also be familiar with standard Internet-based tools, including email and web browsers. |

### Welcome to CS 390

In this course, we will explore the foundations of computing and learn how to think carefully about problems, algorithms, computation, and their limitations. Some topics may feel abstract at first, but we will work through them step by step and connect them to ideas you already know from computer science.

**My goal is for you to leave this course not only knowing the models, but also understanding the reasoning behind them.**

#### About Me

I am Dr. Sumaya Sanober, a faculty member in the Department of Computer Science at Old Dominion University. My academic background includes Artificial Intelligence, Machine Learning, algorithms, and interdisciplinary applications of computing. Throughout my teaching career, teaching and student mentorship have remained central to my academic work.

I enjoy teaching Theoretical Computer Science because it helps students understand the ideas that form the foundation of computing. This course goes beyond writing programs: it asks what can and cannot be computed, how computational models work, and how mathematical reasoning helps us understand the capabilities and limitations of computers.

*You do not need to have every concept mastered immediately. Bring your curiosity, practice consistently, and ask questions when you need support.*

## 1. Course Overview

### Catalog Description

Elementary study of theoretical aspects of computer science. Topics in formal languages and automata theory are covered including regular languages, regular expressions, finite automata, context-free languages, pushdown automata, grammar, Turing machines, and unsolvable problems.

### Course Format

This is a synchronous online, accelerated eight-week course. Scheduled live meetings will be used for explanation, worked examples, problem solving, and questions. Canvas will serve as the central location for announcements, course materials, quizzes, assessments, and due dates. Because the course moves quickly and the topics build on one another, consistent weekly engagement is important.

### Course Learning Objectives

- CLO1: Demonstrate knowledge of the primary mathematical models of computation (automata) that underpin Computer Science.
- CLO2: Demonstrate knowledge of formal languages and their relationship to automata.
- CLO3: Construct, work with, analyze, and prove properties of basic forms of automata and formal languages.
- CLO4: Explain and discuss relationships between automata/formal languages and practical issues in programming languages and software development.

## 2. Required Materials and Technology

### Required Textbook

Hopcroft, John E.; Motwani, Rajeev; and Ullman, Jeffrey D. Introduction to Automata Theory, Languages, and Computation, 3rd ed. Addison-Wesley Longman Publishing Co., 2006. ISBN 0321462254.

| Technology           | Requirement                                                                                                                   |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Hardware             | Computer or laptop with reliable Internet access; microphone; speakers or headphones; webcam for synchronous online meetings. |
| Software             | Modern web browser; Microsoft 365 or equivalent for viewing/creating documents; Adobe Acrobat Reader or another PDF reader.   |
| Course Systems       | Canvas LMS and the university-supported platform used for synchronous class meetings.                                         |
| Specialized Software | No specialized automata software is required for this course unless announced for a specific activity.                        |

## 3. How the Course Works

A typical module follows a predictable rhythm so you can plan your work in advance:

1. Attend the scheduled synchronous session and engage with worked examples and problem-solving activities.
2. Review assigned readings, course notes, examples, and recordings/materials posted in Canvas.
3. Practice constructing and analyzing automata and formal languages before attempting graded work.

4. Complete the weekly quiz by the posted deadline (generally Sunday at 11:59 PM; Module 8 follows the shorter final-week schedule).
5. Complete checkpoint assessments and exams in the modules shown in the course schedule.

## 4. Student Support and Success

**Please reach out before a small question becomes a larger obstacle.** Theoretical computer science is cumulative: a concept that is unclear in one module can make the next module harder. Asking questions, revisiting examples, and using office hours are part of successful learning in this course.

### Critical Reading and Practice

CS 390 is theory-intensive and requires careful reading of definitions, examples, proofs, and problem-solving techniques. Do not rely only on lecture explanations. Read course notes and examples before or after class, work problems by hand, and compare your reasoning with the formal definitions used in the course. Regular review is especially important in an accelerated format.

### Office Hours and Getting Help

**In-person office hours:** Wednesday, 12:00-1:00 PM, Monarch Hall | 2123D.

**Zoom office hours:** available by appointment. [Book a Zoom office-hour appointment](#)

If the listed time does not work with your schedule, email me. I will do my best to help you identify an appropriate way to get support.

### Communication

Clear communication is an important part of your success in this course. If you are unsure about a concept, assignment instruction, or course expectation, please ask. You can communicate through email, Canvas discussions, announcements, and office hours.

| Communication      | Guideline                                                                                                                           |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Email subject line | Include “CS 390” in the subject line so I can identify course messages quickly.                                                     |
| Preferred email    | Use your ODU email for individual questions or private matters.                                                                     |
| Response time      | I aim to respond within 24 hours Monday-Friday and within 48 hours on weekends and holidays.                                        |
| Canvas Discussions | Use for general course questions that may benefit the whole class.                                                                  |
| Private matters    | Questions about grades, accommodations, or your individual work should be sent privately by email or discussed during office hours. |

### Asking Effective Questions

When requesting help, include enough context for me to understand where you are in the problem. When appropriate, tell me:

- what you are working on;
- what you have already tried;

- where you became confused or stuck;
- the result, error, or unexpected outcome you received; and
- the specific concept or step you would like help understanding.

The more specific your question is, the more effectively I can guide you. You are encouraged to ask questions early rather than waiting until an assessment is approaching.

### Instructor and Student Expectations

|                             | Expectations                                                                                                                                                                                           |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| What you can expect from me | Accurate course content; clear assignment guidance; availability for questions; meaningful and timely feedback; fair and transparent evaluation; and support in preparing for assessments.             |
| What I expect from you      | Regular engagement; timely completion of readings and assignments; respectful and professional communication; adherence to the ODU Honor Pledge; and thoughtful participation in the learning process. |

## 5. Assessment and Grading

Assessments are designed to build your understanding progressively across the eight modules. The course grade is based on the following categories:

| Graded Category        | Weight      |
|------------------------|-------------|
| Weekly Quizzes         | 50%         |
| Checkpoint Assessments | 5%          |
| Midterm Exam           | 15%         |
| Final Exam             | 30%         |
| <b>Total</b>           | <b>100%</b> |

### Assessment Overview

| Assessment     | Weight | Timing                                        | Purpose and Expectations                                                                                                                                                                                         |
|----------------|--------|-----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Weekly Quizzes | 50%    | Modules 1-8;<br>generally Sunday,<br>11:59 PM | Reinforce weekly concepts in automata theory and formal languages. Questions may include conceptual understanding, DFA/NFA construction, language recognition, regular expressions, and related problem solving. |

| Assessment             | Weight | Timing                                                 | Purpose and Expectations                                                                                                                                                         |
|------------------------|--------|--------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Checkpoint Assessments | 5%     | Checkpoint 1:<br>Module 3<br>Checkpoint 2:<br>Module 5 | Assess cumulative understanding at key transition points. You may construct automata, perform conversions, analyze languages, and provide mathematical or proof-based reasoning. |
| Midterm Exam           | 15%    | Module 4                                               | Covers Modules 1-4, including finite automata, formal languages, conversions, and regular expressions. Clear reasoning and constructions are expected.                           |
| Final Exam             | 30%    | Module 8                                               | Comprehensive assessment with emphasis on context-free grammars, pushdown automata, Turing machines, decidability, and synthesis across course topics.                           |

All graded work is submitted through Canvas unless otherwise specified. Participation and self-assessment activities may be provided throughout the course as ungraded practice and preparation.

#### What Strong Work Looks Like

- correct application of theoretical concepts;
- accurate construction and analysis of computational models;
- correct conversions such as NFA  $\rightarrow$  DFA and regular expressions  $\leftrightarrow$  automata;
- appropriate mathematical notation;
- clear intermediate steps when requested;
- logical and rigorous reasoning; and
- work that reflects your own understanding.

#### Grade-Point Scale

ODU uses a plus/minus 4-point grade system. The official grade-point values are:

| Letter Grade | Points | Letter Grade | Points |
|--------------|--------|--------------|--------|
| A            | 4.0    | C            | 2.0    |
| A-           | 3.7    | C-           | 1.7    |
| B+           | 3.3    | D+           | 1.3    |
| B            | 3.0    | D            | 1.0    |
| B-           | 2.7    | D-           | 0.7    |
| C+           | 2.3    | F            | 0.0    |

Scores on assignments and exams are first converted to percentages. The course uses the following conversion anchors for individual graded items; intermediate values between anchors may result in intermediate 4-point values. Individual item grades may range as high as 4.5.

| Raw Percentage Anchor | 4-Point Value |
|-----------------------|---------------|
| 100%                  | 4.5           |
| ≥ 92%                 | 4.0           |
| ≥ 76%                 | 3.0           |
| ≥ 60%                 | 2.0           |
| ≥ 44%                 | 1.0           |
| ≤ 27%                 | 0.0           |

### Submission and Late Work

| Assessment                | Late Work Policy                                                                                                                  |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Weekly Quizzes            | Late submissions are generally not accepted. The lowest quiz score will be dropped.                                               |
| Checkpoint Assessments    | A 10% deduction per day may be applied for late submissions, up to 48 hours after the deadline.                                   |
| Midterm & Final Exams     | Late or make-up exams are permitted only in accordance with course and university policies or in cases of documented emergencies. |
| Practice/Self-Assessments | These activities are intended to support learning; specific deadlines will be listed in Canvas when applicable.                   |

**If an unusual circumstance may affect your ability to meet a deadline, contact me as early as possible.** When a conflict is foreseeable, communication before the deadline gives us the best chance to identify an appropriate course-consistent solution.

### Incomplete Grades

A grade of “I” may be assigned only upon instructor approval of a student request and only in exceptional circumstances beyond the student’s control. University deadlines and procedures govern completion of an Incomplete grade.

[ODU information on Incomplete, Withdrawal, and Z grades](#)

## 6. Course Policies

### Attendance and Participation

Because CS 390 is synchronous and accelerated, regular attendance at scheduled online meetings is strongly encouraged. Live sessions are used for worked examples, explanations, and problem solving that support the quizzes and exams. If you miss a meeting, you are responsible for reviewing the material and announcements in Canvas and completing all work by the posted deadlines. If circumstances are affecting your participation,

communicate with me as early as possible so I can help you understand your options within course and university policy.

### **Exam Proctoring**

The midterm and final exams will be proctored. Students are responsible for arranging the required proctoring option at least one week before each exam. Weekly quizzes are not proctored.

[ODU Smart Proctoring information](#)

### **Academic Integrity and Collaboration**

Everything submitted for grading must represent your own work unless collaboration is explicitly permitted for a specific activity. You are encouraged to discuss general course concepts, study strategies, definitions, and examples with classmates. However, sharing, posting, requesting, or discussing specific solutions to graded activities is not permitted unless the assessment instructions explicitly allow collaboration.

Assessment instructions will state what resources are permitted. Do not consult another person during an exam or quiz unless the instructions explicitly permit collaboration. When an assessment permits the use of external sources, acknowledge and cite those sources appropriately. Students who provide prohibited assistance to others may also be in violation of the academic integrity policy.

### **Using External Resources**

- If you use another person's ideas, proof strategy, argument, or explanation in work where external sources are permitted, cite the source in a way that allows it to be identified.
- If you use exact wording from a source, place the wording in quotation marks and cite the source.
- You are responsible for checking that any borrowed idea is relevant to the actual question and mathematically correct.
- If an external source uses notation or definitions different from those used in this course, translate the material into the notation and conventions used in CS 390.

### **Artificial Intelligence (AI) Usage**

This course emphasizes independent problem solving, formal reasoning, and proof-writing. You may use AI-based tools such as ChatGPT as study aids unless a specific assignment, quiz, or exam states otherwise. Examples of appropriate study uses include requesting an alternative explanation, generating additional practice, or checking your understanding of a concept.

If AI contributes ideas, explanations, examples, proofs, or arguments to submitted work where such use is permitted, acknowledge that use appropriately. You remain responsible for verifying mathematical correctness, logical validity, relevance, and consistency with the notation and definitions used in this course. AI-generated content can be incorrect or misleading; copying a generated solution without understanding it does not demonstrate the learning outcomes of this course.

**For quizzes and exams, follow the resource rules provided with that specific assessment.**

### **Technology Issues**

Plan to begin online assessments early enough to allow time for routine technical issues. If a significant technology problem prevents you from accessing or submitting required work, document the problem when possible and contact me promptly by ODU email.

### **Course Changes**

The course schedule and activities may be adjusted when needed to support learning or respond to university circumstances. Any changes will be communicated through Canvas Announcements. Students are responsible for checking Canvas and ODU email regularly.

## **7. University Policies and Student Rights**

### **Code of Student Conduct and Academic Integrity**

The [Office of Student Conduct & Academic Integrity \(OSCAI\)](#) oversees the student conduct system. ODU expects students and student organizations to uphold standards of personal and academic integrity, fairness, respect, community, and responsibility.

### **Honor Pledge**

*"I pledge to support the honor system of Old Dominion University. I will refrain from any form of academic dishonesty or deception, such as cheating or plagiarism. I am aware that as a member of the academic community it is my responsibility to turn in all suspected violations of the Honor Code. I will report to a hearing if summoned."*

### **Discrimination Policy**

Old Dominion University is committed to a work and educational environment free from harassment and discrimination and to an environment that respects the dignity and worth of every member of the university community. [ODU Discrimination Policy](#)

### **Diversity and Inclusion**

ODU values the diversity of the Monarch community and is committed to student engagement, inclusion, cultural understanding, and student success. [Office of Intercultural Relations](#)

### **Educational Accessibility and Accommodations**

Old Dominion University is committed to ensuring equal access to all qualified students with disabilities in accordance with the Americans with Disabilities Act. The Office of Educational Accessibility (OEA) is the campus office that works with students who have disabilities to provide and/or arrange reasonable accommodations.

If you experience a disability which will impact on your ability to access any aspect of my class, please present me with an accommodation letter from OEA so that we can work together to ensure that appropriate accommodation is available to you.

If you feel that you will experience barriers to your ability to learn and/or testing in my class but do not have an accommodation letter, please consider scheduling an appointment with OEA to determine if academic accommodation is necessary.

The Office of Educational Accessibility is located at 1021 Student Success Center, and their phone number is (757)683-4655. Additional information is available at the OEA website: [Office of Educational Accessibility \(OEA\)](#) works with students to determine and arrange reasonable accommodations. Students are encouraged to provide their OEA Accommodation Letter to the instructor early in the semester so approved accommodation can be implemented in a timely manner. [Accommodations for Students with Disabilities policy](#)

### **University Email Policy**

ODU email is an official means of university communication. Students are responsible for activating and regularly checking their ODU email account so they remain current with academic and administrative communication.

[Student Email Standard](#) | [Student Computing](#)

### **Withdrawal**

This syllabus describes the course requirements and policies. Review the course expectations early. If you determine that the course does not fit your academic needs or circumstances, consult the university deadlines and withdrawal procedures. [ODU Academic Calendar / Schedule information](#) | [Office of the University Registrar](#)

### **Privacy of Student Information**

Old Dominion University is committed to ethical handling and protection of student information, including responsibilities under FERPA. [Privacy of Student Information](#) | [ODU Code of Ethics](#)

### **Mental Health and Counseling Services:**

College can be exciting and rewarding, but it can also bring periods of stress, uncertainty, and personal or academic challenges. Seeking support is a strength and an important part of taking care of yourself and your success.

ODU's Office of Counseling Services provides free and confidential mental health services to registered students, including individual and group counseling, psychiatric services, crisis intervention, workshops, and other support. Both in-person and virtual appointments are available, including same-day/next-day appointments through the Monarch Wellness Portal.

### **Helpful ODU resources:**

[ODU Counseling Services](#) — information about counseling and mental-health support.

[Make a Counseling Appointment](#) — instructions for scheduling an in-person or virtual appointment.

[Urgent/Crisis Mental Health Support](#) — ODU's current emergency and crisis-support information.

[Student Health Services](#) — medical and health services for current ODU students.

*Counseling Services: Student Recreation and Well-Being Center, 4700 Powhatan Ave., Suite 2403 | 757-683-4401. For urgent mental-health support, students can call 757-683-4401 and select Option 2 to connect with a crisis counselor 24/7.*

### **Caregiver Responsibilities Policy:**

I have great respect for students who are balancing their pursuit of education with the responsibilities of caring for children or other family members. If you run into challenges that require you to miss a class, or if your caregiving responsibilities interfere with your ability to engage in remote learning, please contact me. There may be some instances of flexibility we can offer to support your learning.

### **Academic Support & Learning Resources:**

Need help? Start early. Ask questions. Use your resources. Successful students are not students who never need help, they are students who learn when, where, and how to seek it.

If you are having difficulty with an assignment, managing your time, developing effective study habits, conducting research, writing, understanding course expectations, or planning your next academic step, please reach out. You are encouraged to ask questions during class, during office hours, or by email. I am happy to help you identify an appropriate next step and connect you with available university resources.

ODU provides several academic support resources that can help you throughout your first year:

[Academic Success Center](#): Academic success support, mentoring, tutoring connections, advising resources, and assistance with developing strategies for university success.

[ODU Tutoring Services](#): ODU provides free tutoring opportunities through multiple campus tutoring centers and online services. Students can search by course to identify currently available support.

[Computer Science Undergraduate Resource Center \(CSURC\)](#): Provides tutoring and academic support for students enrolled in several undergraduate Computer Science courses. Students are encouraged to use this resource early not only when they begin having trouble.

[University Libraries & Research Help](#): Librarians and library resources can support research questions, search strategies, finding and evaluating sources, and information-literacy activities.

[Writing Center](#): Students can receive support with brainstorming, organization, drafting, revision, and developing effective academic writing strategies.

[Academic Advising](#): Advisors can help students understand degree requirements, registration, academic planning, goals, and important academic decisions.

[ePortfolio Support](#): Students can receive assistance developing and refining their ePortfolio, including organizing content and communicating their learning, experiences, skills, and professional identity.

## **8. Course Schedule**

The schedule below is the planned sequence for Fall 2026. Always check Canvas for the most current instructions and assessment availability windows.

| Module | Dates | Topics | Assessments | Due |
|--------|-------|--------|-------------|-----|
|--------|-------|--------|-------------|-----|

| Module   | Dates           | Topics                                                                                                                   | Assessments                                                             | Due                                             |
|----------|-----------------|--------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|-------------------------------------------------|
| Module 1 | Aug 24-Aug 30   | Foundations & Mathematical Readiness<br>Sets, relations, functions, notation, course tools                               | Quiz 1: Foundations & Math Review                                       | Aug 30, 11:59 PM                                |
| Module 2 | Aug 31-Sept 6   | Deterministic Finite Automata (DFA)<br>Formal definition, design, basic problems                                         | Quiz 2: DFA Design & Analysis                                           | Sept 6, 11:59 PM                                |
| Module 3 | Sept 7-Sept 13  | NFA + DFA Equivalence<br>NFA concepts, subset construction, equivalence proofs                                           | Quiz 3: NFA & Conversion<br>Checkpoint 1: Automata Review               | Sept 13, 11:59 PM                               |
| Module 4 | Sept 14-Sept 20 | Regular Expressions & Conversions<br>Regex, automata conversion, pattern representation                                  | Quiz 4: Regular Expressions<br>Midterm Exam (Modules 1-4)               | Quiz: Sept 20, 11:59 PM<br>Midterm: Sept 18-20  |
| Module 5 | Sept 21-Sept 27 | Regular Languages & Equivalence<br>Closure properties, $DFA \rightleftharpoons NFA \rightleftharpoons RegEx$ equivalence | Quiz 5: Regular Languages<br>Checkpoint 2: Cumulative Regular Languages | Sept 27, 11:59 PM                               |
| Module 6 | Sept 28-Oct 4   | Context-Free Grammars (CFGs)<br>Grammar rules, derivations, parse trees                                                  | Quiz 6: CFGs                                                            | Oct 4, 11:59 PM                                 |
| Module 7 | Oct 5-Oct 11    | Pushdown Automata (PDA) + CFL Properties<br>PDA design, $CFG \leftrightarrow PDA$ , pumping lemma, closure               | Quiz 7: PDA & CFL Properties                                            | Oct 11, 11:59 PM                                |
| Module 8 | Oct 12-Oct 16   | Turing Machines, Decidability & Church-Turing<br>TM models, undecidability, real-world connections                       | Quiz 8: Turing Machines<br>Final Exam (Comprehensive)                   | Quiz: Oct 16, 11:59 PM<br>Final Exam: Oct 14-16 |

**Questions are welcome. Please ask early, practice consistently, and use the support available to you throughout the course.**