Course Description

Instructor. Prof. Richard Chang <chang@umbc.edu>

Office Hours: Tue & Thu 12:30pm – 2:00pm ITE 326

Wed 2:00pm – 3:00pm online

Teaching Assistant. Budhini Amaraneni <xq43417@umbc.edu>

Office Hours: Mon & Wed 11am – 12pm online

Course Web Page. http://umbc.edu/~chang/cs451

Time & Place. Tue & Thu 2:30pm – 3:45pm, Sondheim 114

Textbook. *Introduction to the Theory of Computation* (third edition), Michael Sipser, Cenage Learning 2013 (ISBN: 978-1-133-18779-0).

Prerequisites. The formal prerequisites for this course are CMSC 202 Computer Science II and CMSC 203 Discrete Structures. Preparation in discrete mathematics is especially important. You should be prepared to read and write proofs using proof by contradiction and proof by induction.

Objectives. There are two objectives for this course: 1) to introduce the student to the concepts in automata theory and formal languages, which form the foundations of theoretical computer science; and 2) to continue the development of the student's skills in reading, writing and understanding mathematical proofs.

Grading. Grades will be based upon the following distribution

Homework (13)	39%
Midterm Exams (2)	36%
Final Exam (1)	25%

The planned schedule has 13 homework assignments, 2 midterm exams and a final exam. However, if a homework assignment and not made up — e.g., because UMBC is closed for an extended period — the proportion of your grade from homework and exams will remain the same. That is, homework will still count for 39% of your grade (each homework assignment would have greater weight).

The final letter grade is based on the standard formula:

$$0 \le F < 60, \quad 60 \le D < 70, \quad 70 \le C < 80, \quad 80 \le B < 90, \quad 90 \le A \le 100$$

Depending upon the final distribution of grades in the class, there may be a curve in your favor, but under no circumstances will grades be curved downward. Grades are given for work done during the semester; incomplete grades will only be given for medical illness or other such dire circumstances.

Lectures & Reading. Lectures provide a unique opportunity for students to ask questions while we are all physically gathered in one location at the same time. The purpose of the lectures is to explain the parts of the reading that are difficult to understand. *Lectures do not replace reading.* The ability to read and understand the language of mathematics is a skill that you develop by practice.

Exams. The midterm exams are scheduled for Tuesday October 17 and Tuesday November 14. The final exam is on Thursday December 14.

Homework Submission. Homework will be submitted online in PDF. You have several options for preparing your responses. You can write on paper and convert to PDF using a smartphone app. This is the recommended method. Please do not just use your phone's camera app and take a picture of your work. Use one of many free scanner apps and adjust the settings so that your submission is legible.

You could also use LaTeX (or equivalent) to prepare a document. (Although drawing diagrams could be quite challenging.) If you have a tablet or a 2-in-1 laptop *and* you have some skill with a stylus, you can use one of those. Microsoft Word and Powerpoint are not recommended since they are terrible with math notation.

In any case, *please* use letter size paper (8.5x11 inches) and leave a good margin.

Late Homework. Homework assignments are due by 11:59pm on Thursdays. Unexcused late homework will be penalized as follows:

1 day late (by Friday 11:59pm)	-5%
2 days late (by Saturday 11:59pm)	-10%
3 days late (by Sunday 11:59pm)	-20%
4 days late (by Monday 11:59pm)	-40%
before next class (by Tuesday 2:30pm)	-100%

Late homework will not be accepted after the start of the next lecture. This allows for timely grading and discussion.

Three times during the semester, you will be allowed to submit a late homework assignment without excuse and without penalty one lecture late (e.g., homework due on Thursday may be submitted on Tuesday without penalty). One full-credit unexcused late assignment will be accepted for Homework 1-5, one for Homework 6-9 and another for Homework 10-13. You do not accrue any credit for submitting homework assignments on time. For example, if you submitted all of Homework 1-9 on time, you can still only turn in one of Homework 10-13 late for full credit.

Homework Policy. You are permitted to work with other students on the homework problems. Collaborators and reference materials must be acknowledged at the top of each homework assignment. However, homework solutions must be written up *independently*. A student who is looking at someone else's solution or notes, whether in print or in electronic form, while writing up his or her own solution is considered to be cheating. All cases of cheating will be reported to the Academic Conduct Committee, this is standard practice.

Finally, looking up the solutions to homework problems completely defeats the purpose of homework assignments, which is to train a student's mind to think. Students who bypass this training will do poorly on the exams.

University Resources & Policies

UMBC's academic integrity policy is available here.

Retriever Essentials <https://retrieveressentials.umbc.edu/> is a faculty, staff, and student-led partnership that addresses food insecurity in the UMBC community. They offer free groceries, toiletries, baby items, and meal swipes, and have opportunities to engage and volunteer. Pick up items from their pantry, The Essential Space, located in RAC 235 or get a pre-assembled bag of non-perishable food items and personal care products at one of their Food Zones. Email retrieveressentials@umbc.edu about their meal swipe program or to find out how to volunteer with them.

Accessibility and Disability Accommodations, Guidance and Resources:
Accommodations for students with disabilities are provided for all students with a qualified disability under the Americans with Disabilities Act (ADA & ADAAA) and Section 504 of the Rehabilitation Act who request and are eligible for accommodations. The Office of Student Disability Services (SDS) is the UMBC department designated to coordinate accommodations that creates equal access for students when barriers to participation exist in University courses, programs, or activities.

If you have a documented disability and need to request academic accommodations in your courses, please refer to the SDS website at sds.umbc.edu for registration information and office procedures.

SDS email: disAbility@umbc.edu
SDS phone: 410-455-2459

If you will be using SDS approved accommodations in this class, please contact the instructor to discuss implementation of the accommodations. During remote instruction requirements due to COVID, communication and flexibility will be essential for success.

Sexual Assault, Sexual Harassment, and Gender Based Violence and Discrimination:

UMBC Policy in addition to federal and state law (to include Title IX) prohibits discrimination and harassment on the basis of sex, sexual orientation, and gender identity in University programs and activities. Any student who is impacted by sexual harassment, sexual assault, domestic violence, dating violence, stalking, sexual exploitation, gender discrimination, pregnancy discrimination, gender-based harassment, or related retaliation should contact the University's Title IX Coordinator to make a report and/or access support and resources. The Title IX Coordinator can be reached at titleixcoordinator@umbc.edu or 410-455-1717.

You can access support and resources even if you do not want to take any further action. You will not be forced to file a formal complaint or police report. Please be aware that the University may take action on its own if essential to protect the safety of the community.

If you are interested in making a report, please use the Online Reporting/Referral Form. Please note that, if you report anonymously, the University's ability to respond will be limited.

Notice that Faculty and Teaching Assistants are Responsible Employees with Mandatory Reporting Obligations

All faculty members and teaching assistants are considered Responsible Employees, per UMBC's Policy on Sexual Misconduct, Sexual Harassment, and Gender Discrimination. Faculty and teaching

assistants therefore required to report all known information regarding alleged conduct that may be a violation of the Policy to the Title IX Coordinator, even if a student discloses an experience that occurred before attending UMBC and/or an incident that only involves people not affiliated with UMBC. Reports are required regardless of the amount of detail provided and even in instances where support has already been offered or received.

While faculty members want to encourage you to share information related to your life experiences through discussion and written work, students should understand that faculty are required to report past and present sexual harassment, sexual assault, domestic and dating violence, stalking, and gender discrimination that is shared with them to the Title IX Coordinator so that the University can inform students of their rights, resources, and support. While you are encouraged to do so, you are not obligated to respond to outreach conducted as a result of a report to the Title IX Coordinator.

If you need to speak with someone in confidence, who does not have an obligation to report to the Title IX Coordinator, UMBC has a number of Confidential Resources available to support you:

- Retriever Integrated Health (Main Campus): 410-455-2472; Monday – Friday 8:30 a.m. – 5 p.m.; For After-Hours Support, Call 988.
- Center for Counseling and Well-Being (Shady Grove Campus): 301-738-6273; Monday-Thursday 10:00a.m. – 7:00 p.m. and Friday 10:00 a.m. – 2:00 p.m. (virtual) Online Appointment Request Form
- Pastoral Counseling via The Gathering Space for Spiritual Well-Being: 410-455-6795; i3b@umbc.edu; Monday – Friday 8:00 a.m. – 10:00 p.m.

Other Resources

- Women's Center (open to students of all genders): 410-455-2714; womenscenter@umbc.edu; Monday – Thursday 9:30 a.m. – 5:00 p.m. and Friday 10:00 a.m. – 4 p.m.
- Shady Grove Student Resources, Maryland Resources, National Resources.

Child Abuse and Neglect

Please note that Maryland law and UMBC policy require that faculty report all disclosures or suspicions of child abuse or neglect to the Department of Social Services and/or the police even if the person who experienced the abuse or neglect is now over 18.

Additional UMBC Policies on Pregnancy and Parenting; Religious Observances & Accommodations; and Hate, Bias Discrimination & Harassment are described at the Office of Equity & Civil Rights website.

Fall 2023 CMSC 451 Automata Theory, Class Schedule

	Lecture topics	Textbook Reading	HW Assigned	HW Due
Thu Aug 31	Introduction	0.1--0.4	HW1	
Tue Sep 05	Deterministic Finite Automata (DFA)	1.1		
Thu Sep 07	Nondeterministic Finitie Automata (NFA)	1.2	HW2	HW1
Tue Sep 12	Equivalence of DFA & NFA			
Thu Sep 14	Minimum DFAs		HW3	HW2
Tue Sep 19	Regular Expressions	1.3		
Thu Sep 21	Pumping Lemma for Regular Languages	1.4	HW4	HW3
Tue Sep 26	Context-Free Grammars (CFG)	2.1		
Thu Sep 28	Context-Free Grammars (CFG)		HW5	HW4
Tue Oct 03	Pushdown Automata (PDA)	2.2		
Thu Oct 05	CFG-PDA Equivalence		HW6	HW5
Tue Oct 10	Pumping Lemma for CFG	2.3		
Thu Oct 12	CFL Properties, Determnisitic PDA	2.4	HW7	HW6
Tue Oct 17	**Midterm Exam 1**			
Thu Oct 19	Turing Machines	3.1	HW8	HW7
Tue Oct 24	Turing Machines	3.1		
Thu Oct 26	Turing Machines		HW9	HW8
Tue Oct 31	Decidable Properties	4.1		
Thu Nov 02	The Halting Problem	4.2	HW10	HW9
Tue Nov 07	Undecidability	5.1--5.2		
Thu Nov 09	Undecidability		HW11	HW10
Tue Nov 14	**Midterm Exam 2**			
Thu Nov 16	Reductions	5.3	HW12	HW11
Tue Nov 21	Recursion Theorem			
Thu Nov 23	***Thanksgiving***			
Tue Nov 28	NP-completeness	7.4		
Thu Nov 30	NP-completeness	7.5	HW13	HW12
Tue Dec 05	Advanced Topic TBA			
Thu Dec 07	Advanced Topic TBA			HW13
Tue Dec 12	Review			
Thu Dec 14	**1:00pm - 3:00pm Final Exam**			