Syllabus

CS 420: Introduction to the Theory of Computation

Tiago Cogumbreiro
tiago.cogumbreiro@umb.edu
Office: M03-0201-16, 3rd floor, McCormack

Spring 2025

Course description

Introduction to theoretical aspects of computing including models of computation, inherent limits on computation, and feasible computation. Topics covered:

- finite automata (deterministic, nondeterministic, pushdown)
- regular expressions
- context-free grammars
- decidability
- computable functions (recursive functions, functions computable by Turing machines, functions computable in a programming language)
- insolvability of the halting problem and related problems

Prerequisites

CS 220/CS 320L (Applied Discrete Mathematics) or permission from the instructor.

Required textbooks

- Logical Foundations, Version 5.6, by Benjamin C. Pierce, *et al.*
  URL: `https://softwarefoundations.cis.upenn.edu/lf-current/`

Mini-Test 1	8
Mini-Test 2	7
Mini-Test 3	7
HW1	6
HW2	6
HW3	11
HW4	11
HW5	11
HW6	11
HW7	11
HW8	11
Total	**100**

(a) Final grade in points.

$95 \leq P$	`A`
$90 \leq P < 95$	`A-`
$85 \leq P < 90$	`B+`
$80 \leq P < 85$	`B`
$75 \leq P < 80$	`B-`
$70 \leq P < 75$	`C+`
$60 \leq P < 70$	`C`
$55 \leq P < 60$	`C-`
$50 \leq P < 55$	`D+`
$45 \leq P < 50$	`D`
$40 \leq P < 45$	`D-`
$P < 40$	`F`

(b) From points to a letter grade.

Table 1: Final grade calculation.

Supplementary material

- Introduction to the Theory of Computation, 3rd edition, by Michael Sipser. ISBN: 113318779X
- CS420 Spring 2019, Prof. Peter Fejer, University of Massachusets Boston. URL: `https://www.cs.umb.edu/~fejer/cs420/`
- CSCI3130 Fall 2018, Prof. Siu On Chan, The Chinese University of Hong Kong.
  URL: `https://www.cse.cuhk.edu.hk/~siuon/csci3130-f18/`
- Theory of Computation video course, Prof. Harry H. Porter III. URL: `http://web.cecs.pdx.edu/~harry/videos/`
  YouTube mirror: `https://tinyurl.com/y3j6kq9z`

Course work and grades

No courses required by the CS major, minor, or certificate may be taken pass/fail. The final grade is obtained according to table 1. Course work includes:

- 3 mini-tests (2 remote, 1 in class)
- 8 homework assignments
- 0 exams

Final grade adjustments. The decimal points of your final grade will be truncated (not rounded up). For instance, a final grade of 69.99 yields a `C+`, **not** a `B-`.

- **To pass this course, you must obtain ≥ 40 points in 6 homework assignments**. That is, if you obtain < 40 in 3 homework assignments or more, your final grade is `F`.

Mini-Tests

Mini-tests may be graded on a curve. Mini-test 1 will be taken in class. Remote mini-tests will be made available via Gradescope and can be submitted during a 24-hour window.

Homework assignments

The homework grade will be a (possibly weighted) average of at most 10 homework assignments.

- The final grade of each assignment is given by the *instructor*, regardless of what the grading software shows.
- **The instructor/TA can schedule an interview, outside of lecture hours, to test your knowledge of any homework assignment you submit**; points can be deducted as a result of the interview.
- Assignments may be deducted points for code style.
- **Each student can retake up to 3 homework assignments, but only if student missed 4 or fewer classes.**
- **Retakes are done during the exam season.**
- You may **not** collaborate with anyone else on any homework. Each homework represents your own, individual work.
- It is *acceptable* to discuss the concept in general terms, but *unacceptable* to discuss specific solutions to any homework assignment.
- Homework assignments will be automatically scanned for plagiarism against the present year and all past years of this course.

Incomplete grade policy

We consider a **portion the required class work** to be *at most* 20% of the total work, as per the incomplete policy.[1]

Here is an excerpt from the school's incomplete policy:

[1] `https://www.umb.edu/registrar/academic_policies/incomplete_policy`

> The grade incomplete (INC) is reported only where a portion of the assigned or required class work, or the final examination, has not been completed because of serious illness, extreme personal circumstances, or scholarly reasons at the request of the instructor. If your record is such that you would fail the course regardless of your missing work, you will fail.

Software requirements

Students are expected to have access to Rocq:

- Windows: `coq@2024.10.0` (via Scoop)
- macOS: `coq 8.20.1` (via homebrew)
- Linux: latest coq (via opam)

Homework assignments consist of a Rocq script and possibly a paper that will be submitted to Gradescope (unless stated otherwise).

Attendance

Attendance is required. **Students that miss 5 or more classes will not be able to do homework retakes.** In case of a student not being able to attend a class, the student should contact the instructor as soon as possible. Students are responsible for knowing everything that is covered during class meetings, including announcements. If you must be absent from a class meeting, make arrangements with another student to find out what you missed.

AI tools

AI is prohibited: In this class, all work submitted by students must be generated by the students themselves, whether working individually or in groups. Students should not have another person or entity do the writing of any portion of an assignment; this includes hiring a person or a company to write assignments and using AI tools like ChatGPT. All work submitted must contain citations for any material that has been quoted or referenced. If students are unsure about whether or not a source is appropriate to use in the assignment, they should contact the instructor.

Academic Integrity and Student Code of Conduct

Education at UMass Boston is sustained by academic integrity. Academic integrity requires that all members of the campus community are honest, trustworthy, responsible, respectful, and fair in academic work at the university. As

part of being educated here, students learn, exercise, increase, and uphold academic integrity. Academic integrity is essential within all classrooms, in the many spaces where academic work is carried out by all members of the UMass Boston community, and in our local and global communities where the value of this education fulfills its role as a public good. Students are expected to adhere to the Student Code of Conduct, including policies about academic integrity, delineated in the University of Massachusetts Boston Graduate Studies Bulletin, Undergraduate Catalog, and relevant program student handbook(s), linked at `htts://www.umb.edu/academics/academic_integrity`.

Accommodations

UMass Boston is committed to creating learning environments that are inclusive and accessible. If you have a personal circumstance that will impact your learning and performance in this class, please let me know as soon as possible, so we can discuss the best ways to meet your needs and the requirements of the course. If you have a documented disability, or would like guidance about navigating support services, contact the Ross Center for Disability Services by email (`ross.center@umb.edu`), phone (617-287-7430), or in person (Campus Center, UL Room 211). To receive accommodations, students must be registered with the Ross Center and must request accommodations each semester that they are in attendance at UMass Boston. For more information visit: Ross Center for Disability Services.[2] Please note that the Ross Center will provide a letter for your instructor with information about your accommodation only and not about your specific disability.

Health, Wellbeing, and Success

UMass Boston is a vibrant, multi-cultural, and inclusive institution committed to ensuring that all members of our diverse campus community are able to thrive and succeed. The university provides a wide variety of resources to support students' overall success. As we continue to deal with the evolving impacts of the COVID-19 pandemic, these resources are more important than ever.

- Are you in emotional distress? Call 617.287.5690 to speak with a licensed clinician 24/7 who can offer support, crisis recommendations, and assistance with finding resources.
- Have a campus question or issue? Use Here4U in the UMass Boston app or via `https://www.umb.edu/here4U`
- Want advice in navigating a university or life situation? Contact the Dean of Students Office at `https://www.umb.edu/deanofstudents`

[2] `https://www.umb.edu/academics/seas/disability-services/`

- Want to connect with housing and food insecurity support, student life groups and events, or recreation activities? Visit `https://www.umb.edu/campus-life/`
- Want to access resources specifically for immigrant-origin, DACA, TPS, and undocumented students? Visit `https://www.umb.edu/campus-life/diversity-inclusion/multicultural-affairs/immigrant-student-programs/`
- Looking for additional identity-based community support? Find more resources at `https://www.umb.edu/all-of-us/inclusive-identity/`
- Want to make the most of your academic experience? Visit `https://www.umb.edu/academics/vpass/academic_support`
- Unable to attend class on a specific date or participate in an exam or class requirement due to a religious observance? Fill out the excused absence form (requires 2-weeks' notice) to request religious accommodation at `https://www.umb.edu/campus-life/current-students/policies/right-to-excused-absence-because-religious-belief/`