Computer Science 224

Spring 2019

Instructor: Dr. Jonathan Hulgan

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Office Hours: To be announced on Canvas.

Text Material: *Mathematical Structures for Computer Science* (7th edition) by Judith L. Gersting; additional resources on Canvas.

Course Content: Computer Science 224 introduces elementary mathematics necessary for the computer science curriculum. Topics include proof-writing, sets, functions, logic, quantifiers, graphs, automata, languages, and asymptotic notation.

Course Goals: The overall goal is to provide the student with the mathematical background required for advanced computer science courses. At the end of the course, the student should achieve the following goals:

1. Understand basic proof techniques relevant to computer science.
2. Know the notation and operations related to sets.
3. Be able to determine the sizes of sets by applying the fundamental rules of counting.
4. Know symbolic logic and be able to construct and analyze truth tables.
5. Be proficient with relations, equivalence relations and the partitioning of sets.
6. Understand the asymptotic notation of functions and how it relates to the complexity of algorithms.
7. Be able to identify graphs and trees, know the relevant terminology and analyze their structures.
8. Know what a regular language and regular expression are, construct a deterministic and nondeterministic finite automata which computes a given regular language.

Honor Code: Oxford College is a community of scholars. As scholars, we are interested in pursuing truth and becoming more adept at our individual contribution to this pursuit. As a community, we have certain expectations of—and responsibilities to—each other in our scholarly endeavors. The Honor Code is the document detailing expected behaviors as members of this community, as well as the means by which these expectations are upheld; a copy of this document is available at http://oxford.emory.edu/catalog/regulations/honor-code.html.

Generally, if permission is not given in writing to use a certain resource—including collaboration with other people—then any use of that resource in the completion of an assignment constitutes a violation of the Honor Code. While completing in-class assignments, all personal papers and cell phones must be put away for the duration of the assessment. Students who have taken an exam, test, or quiz must not discuss the content or nature of the assessment until all students have completed the assignment. Any graded out-of-class assignments should be completed using only the resources explicitly permitted in that assignment's written instructions. The guidelines listed here are not intended to be exhaustive; if you are uncertain about any aspect of how an assignment is to be completed, ask first!

Absences: It is the student's responsibility to notify the instructor as soon as possible in the event of an absence from an assessment. If an excused absence from a test is known in advance—such as those due to official school functions or religious holidays—arrangements can be made to take the test ahead of time. Missing a test due to an emergency will be handled on a case-by-case basis; such absences must be documented (e.g. a doctor's note in case of illness) in order to be excused.

Grading: Course grades will be determined as follows:

Problem Sets	25%
Tests	45%
Final Exam	30%

Final grades will be based on the following ranges: 90.0-100% A, 80.0-89.9% B, 70.0-79.9% C, 60.0-69.9% D, 0-59.9% F. Plus and minus grades will be assigned based on final grade distributions within each whole letter grade.

Problem Sets: Most weeks, a small collection of problems will be assigned for a grade. These will generally be completed outside of class, but occasionally students may be asked to complete them in class (much like a quiz). These assignments serve as an incentive for students to keep current with the course material, as well as a means to provide formative feedback on solution technique and style in preparation for each test. At least two of the lowest problem sets will be dropped for each student; the average of the remaining scores will be used to determine each student's overall problem set grade.

Tests: Three tests will be given, one before spring break and two after. These appear on the calendar included at the end of this syllabus.

Final Exam: A cumulative final exam will be given at **9am on Friday, May 3**. Students must obtain permission from the Associate Dean of Academic Affairs to take an exam earlier or later than scheduled. Permission may be granted for medical reasons or for participation in educational programs. Any Student who has three exams on the same calendar day (not within a general twenty-four hour period) must document their situation with the Associate Dean for Academic Affairs no later than 5:00 p.m. on Reading Day. Students in this situation will be granted permission to work with one of their instructors to arrange to take one exam at an alternate date (within exam week). You may NOT receive permission to alter your exam schedule for the following reasons: Taking an earlier flight/ride, vacation schedule, weddings (other than your own), graduation or job schedule.

Religious Holidays: Instructors are encouraged, not required, to accommodate students' academic needs related to religious holidays. Please make every effort to negotiate your religious holiday needs within the first two weeks of the semester; waiting longer may compromise your instructor's ability to extend satisfactory arrangements. If you need guidance negotiating your needs related to a religious holiday, the College Chaplain, Rev. Lyn Pace, `ppace@emory.edu`, Candler Hall 202, is willing and available to help. *Please be aware that Rev. Pace is not tasked with excusing students from classes or writing excuses for students to take to their professors.* Emory's official list of religious holidays may be found at `http://www.religiouslife.emory.edu/faith_traditions/holidays.html`.

Accessibility: If you have a documented disability and have anticipated barriers related to the format or requirements of this course, or presume having a disability (e.g. mental health, attention, learning, vision, hearing, physical or systemic), and are in need of accommodations for this semester, we encourage you to contact the Office of Accessibility Services (OAS) to learn more about the registration process and steps for requesting accommodations at `oas_oxford@emory.edu`. If you are a student

that is currently registered with OAS and have not requested or received a copy of your accommodation notification letter, please notify OAS immediately. Students who have accommodations in place are encouraged to coordinate sometime with your professor, during the first week of the semester, to communicate your specific needs for the course as it relates to your approved accommodations. Accommodations are not implemented until the instructor is provided an accommodation letter and discusses the accommodation plan for this course face to face with the OAS student. All discussions with OAS and faculty concerning the nature of your disability remain confidential. For additional information regarding OAS, please visit the website: `http://accessibility.emory.edu`.

Inclusivity: Oxford College of Emory University's ideals of inclusivity compel us to foster an environment where people of diverse backgrounds, identities, abilities, and ideologies are affirmed, respected, and seen as a source of strength—where we strive to learn together, and ultimately thrive communally. When these ideals are not upheld, we encourage discussion to better understand and spur action towards improvement. In my teaching, I always aim to challenge your thinking, but never to challenge your identity. If there is anything I can do to help you feel more comfortable and engaged (pronoun usage, calling on you more often, calling on you less frequently, etc.), please let me know.

A student's submission of any work to be evaluated for course credit constitutes a declaration that he or she has neither given nor received unauthorized information on the work, nor has condoned the giving or receiving of unauthorized information by others.

Each student at Oxford College of Emory University agrees to abide by the honor pledge and takes upon himself or herself the responsibility of upholding the Honor Code. Each student is urged to inquire of the Honor Council about any doubtful case at any time throughout the year.

Read the full Honor Code at `http://oxford.emory.edu/catalog/regulations/honor-code.html`

TOPICS BY DAY
CS 224, Spring 2019
(Calendar is subject to change; any necessary changes will be announced in class.)

Monday	Wednesday	Friday
Jan 14th	Jan 16th **1** 1.1: Statements, Symbolic Representation, and Tautologies	Jan 18th **2** 1.2: Propositional Logic
Jan 21st No Class (MLK Holiday)	Jan 23rd **3** 1.3: Quantifiers, Predicates, and Validity	Jan 25th **4** 1.4: Predicate Logic
Jan 28th **5** 1.6: Proof of Correctness	Jan 30th **6** 2.1: Proof Techniques	Feb 1st **7** 2.2: Induction 2.3: More on Proof of Correctness
Feb 4th **8** 2.4: Number Theory	Feb 6th **9** 3.1: Recursive Definitions	Feb 8th **10** 3.2: Recurrence Relations
Feb 11th **11** 3.3: Analysis of Algorithms	Feb 13th **12** Test 1 Review	Feb 15th **13** Test 1
Feb 18th **14** 4.1: Sets	Feb 20th **15** 4.2: Counting	Feb 22nd **16** 4.3: Principle of Inclusion and Exclusion; Pigeonhole Principle
Feb 25th **17** 4.4: Permutations and Combinations	Feb 27th **18** 4.5: Binomial Theorem	Mar 1st **19** 4.6: Probability
Mar 4th **20** 5.1: Relations	Mar 6th **21** 5.4: Functions	Mar 8th **22** 5.5: Order of Magnitude

Monday	Wednesday	Friday
Mar 11th No Class (Spring Break)	Mar 13th No Class (Spring Break)	Mar 15th No Class (Spring Break)
Mar 18th **23** 5.6: The Mighty Mod Function	Mar 20th **24** 5.6: The Mighty Mod Function	Mar 22nd **25** 5.7: Matrices
Mar 25th **26** Test 2 Review	Mar 27th **27** Test 2	Mar 29th **28** 6.1: Graphs and Their Representations
Apr 1st **29** 6.2: Trees and Their Representations	Apr 3rd **30** 7.1: Directed Graphs and Binary Relations; Warshall's Algorithm	Apr 5th **31** 7.2: Euler Path and Hamiltonian Circuit
Apr 8th **32** 7.3: Shortest Path and Minimal Spanning Tree	Apr 10th **33** 7.4: Traversal Algorithms	Apr 12th **34** 9.1: Algebraic Structures
Apr 15th **35** 9.2: Coding Theory	Apr 17th **36** 9.3: Finite-State Machines	Apr 19th **37** 9.4: Turing Machines
Apr 22nd **38** 9.4: Turing Machines	Apr 24th **39** Test 3 Review	Apr 26th **40** Test 3
Apr 29th **41** Last Day of Class	May 1st	May 3rd **Final Exam** 5/3 at 9am