

CS330: Formal Methods and Models

George Mason University, Computer Science, Fall 2019

Instructor: Prof. Foteini Baldimtsi (foteini@gmu.edu)

Office Hours: Wednesday's 3:00PM-5:00PM, **Office:**
Engineering 5333

Lectures: Mondays and Wednesdays 1:30PM-2:45PM,

Location: Sandbridge Hall 107

Teaching Assistant: Michael

Crawshaw (mcrawsha@masonlive.gmu.edu).

Office hours: Thursdays 3pm-4pm, Fridays 1pm-2pm, **Office:**
Engineering 4456

Course Summary

This course is an introduction to two kinds of formal systems - languages (which are treated as sets of strings) and logics - with important applications to computer science. The study of formal languages underlies important aspects of compilers and other language processing systems, as well as the theory of computation. Various systems of logic and automatic reasoning are put to use in artificial intelligence, database theory and software engineering. The entire course will give you practice in precise thinking and proof methods that play a role in the analysis of algorithms.

Prerequisites: CS211 and Math125 (C or better in both). Exposure to Discrete Mathematics (as in MATH125) is important for success in this course.

Objectives: Will understand the concepts and relevance of logic, formal languages and automata theory, and computability.
Will be able to do mechanical formal proofs, program correctness proofs and solve problems in first-order logic.
Will be able to solve problems in elementary machine models: designing finite-state, pushdown and Turing machines.
Will be able to solve problems in formal languages: writing regular expressions, regular grammars, and context-free grammars.

Required Materials

Text Book: **Logic and Languages Models for Computer Science**, 3rd edition.
Authors: Dana Richards and Henry Hamberger

Available at the campus bookstore. Note that the 3rd edition is substantially different from the 2nd.

Grading

Assignments: 15% (1 weekly assigned problem, lowest grade dropped)

Quizzes: 25% (~10 quizzes, lowest grade dropped)

Midterm + Final: 60%. Of these exams the highest score will count 35%, and the lowest 25%

Homework: Every Monday you will receive a set of 3-5 practice HW problems. One of them will have to be submitted on Blackboard and will be graded.

It will be very hard to do well in this course if you do not do *all* of the practice homework by yourself, including all optional problems. You are strongly encouraged to do *all* of the problems, and to ask questions, in class and in office hours, when you do not understand any of them.

Don't start the homework the day before it is due!

No extensions will be given for homework since we will be solving the assigned problems in class. Group work is not allowed when solving homework - any deviation from this policy will be considered a violation of the GMU Honor Code.

Quizzes: Quizzes are short: 1-3 questions and will be given every Wednesday covering the material of last week. Some of the quizzes will be on paper and some will be electronic (you will be notified ahead of time whether that week's quiz is automated or not). For electronic quizzes you will need a laptop or phone to answer the questions, as the results will be tallied immediately. Each single quiz is worth about 2% of your grade.

Important Exam Dates

Midterm: (tentative) Wednesday 10/09, 1:30pm - 2:45pm

Final: (tentative) Wednesday 12/11, 1:30pm - 4:15pm

Final and Midterm are *closed book*. On sheet of paper with *handwritten* notes on one side allowed - has to be submitted along with exam and include student's name. Cannot be photocopied or copying another student's notes.

CS330 Adviser Forms

It is a departmental requirement that students in CS330 must see their adviser and discuss their degree progress. The form can be downloaded [here](#). Be sure to fill out the form **before** seeing your adviser. Also, if you do it earlier in the semester, you will have a much shorter wait to see your adviser, and you will have more time to correct any problems. Students not fulfilling this requirement will receive an Incomplete grade. (Non-majors and graduate students are not included.)

Communications and HW submissions

We will use **Piazza** to communicate with you. You are welcome to set up study groups and discuss course materials with other students. If you have a question about the course you should: (a) Come to office hours, OR (b) Post on Piazza. Do not use private posts/emails to ask technical questions. The rest of the class is probably also interested in your question, so make it public!

HW submission and electronic quizzes will happen through Blackboard.

Use of Electronics in Class

You will need either a laptop or a phone in order to complete some of the quizzes in class. If you don't own either of these devices please let me know ahead of time to prepare a printed quiz for you. Other than for use with quizzes, I encourage you to leave your devices off. You will find that you learn a lot more, and retain the information better, if you remove the distraction!

Class Schedule (Tentative):

| Week | Topic | Suggested Readings | HWS + Quizzes |
|----------------------------|--|--------------------|---|
| Week 1 08/26 & 08/28 | Introduction & Class logistics. Math Prelims. Propositional Logic and Proofs | Chapters 1 & 2 | 08/28 HW1 out |
| Week 2 09/4 | Propositional Logic and Proofs | Chapter 2 | 09/2 HW 1 in 09/4 Quiz 1 HW2 out |
| Week 3 09/09 & 09/11 | Propositional Logic and Proofs Rules of Inference | Chapter 3 | 09/09 HW2 in 09/11 Quiz 2 HW3 out |
| Week 4 09/16 & 09/18 | Predicate Logic and Mathematical Induction | Chapter 4 | 09/16 HW3 in 09/18 Quiz 3 HW4 out |

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| Week 5 09/23 & 09/25 | Predicate Logic and Mathematical Induction | Chapter 5 | 09/25 HW4 in 09/23 Quiz 4 HW5 out |
| Week 6 09/30 & 10/02 | Program Verification | Chapter 6 | 09/30 HW5 in 10/02 Quiz 5 HW6 out |
| Week 7 10/07 & 10/09 | Review and Midterm | | 10/07 HW6 in |
| Week 8 10/15 (Tuesday) & 10/16 | Formal Languages | Chapter 7 | 10/16 HW 7 out |
| Week 9 10/21 & 10/23 | Regular Expressions and Grammars | Chapter 8 | 10/21 HW 7 in 10/23 Quiz 6 HW 8 out |
| Week 10 10/28 & 10/30 | Regular Expressions and Grammars | Chapter 8 | 10/28 HW 8 in 10/30 Quiz 7 HW 9 out |
| Week 11 11/04 & 11/06 | Finite Automata, Regular Languages | Chapter 9 | 11/04 HW 9 in 11/06 Quiz 8 HW 10 out |
| Week 12 11/11 & 11/13 | Finite Automata, Regular Languages | Chapter 9 | 11/11 HW 10 in 11/13 Quiz 9 HW 11 out |
| Week 13 11/18 & 11/20 | Context Free grammars | Chapter 10 | 11/13 HW 11 in 11/20 Quiz 10 HW 12 out |
| Week 14 11/25 | Push Down Automata | Chapter 11 | 11/25 HW 12 in |
| Week 15 12/02 & 12/04 | Turing Machines + Review | Chapter 12 | 12/04 Quiz 11 |

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