CptS 317: Automata and Formal Languages

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About me

• **Name**: Assefaw Gebremedhin  
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• **Webpage**: [www.eecs.wsu.edu/~assefaw](http://www.eecs.wsu.edu/~assefaw)
• **Research interests**: Data science, graph algorithms, high performance computing, bioinformatics
• **Lab**: Scalable Algorithms for Data Science (SCADS) Laboratory ([https://scads.eecs.wsu.edu](https://scads.eecs.wsu.edu))
• **Teaching at WSU**:
  • CptS 475/575: Data Science (Fa. 2015--2020)
  • CptS 591: Elements of Network Science (Sp. 2015–2021)
  • CptS 317: Automata and Formal Languages (Sp. 2020)
  • CptS/STAT 424: Data Analytics Capstone (Sp. 2019)

• **CptS 317 Spring 2021**:
  • **Lectures**: MWF, 10:10--11, via Zoom
  • **Instructor Office Hour**: Wed. 11:30am—12:30pm (or by appointment), via Zoom

  • **Graduate Teaching Assistant**: James Halvorsen
  • **Email**: james.halvorsen@wsu.edu
  • **Office Hour**: TBD

  • **UG Teaching Assistant 1**: Makiah Heinzmann
  • **Email**: makiah.heinzmann@wsu.edu
  • **Office Hour**: TBD

  • **UG Teaching Assistant 2**: TBD
  • **Email**: TBD
  • **Office Hour**: TBD
What I know (so far) about the class

- Enrolled: 118
- Majors:
  - BS in Computer Science: 97
  - BS in Software Engineering: 10
  - BA in Computer Science: 3
  - BS in Data Analytics: 2
  - BS in Electrical Engineering: 1
  - BS in Computer Engineering: 1
  - BS in Mechanical Engineering: 1
  - BA in Business: 1
Course management system

• Everything will be done on Canvas
  • Syllabus
  • Lecture notes/slides
  • Zoom Recordings
  • Homework posting
  • Homework submission
  • Announcements
  • Messages (emails)

• Make sure to work you on your Canvas setting
  • Time zone
  • Notification frequency
Course Objectives

• Introduce concepts in automata theory and theory of computation

• Identify different formal language classes and their relationships

• Design grammars and recognizers for different formal languages

• Prove or disprove theorems in automata theory using its properties

• Determine the decidability and intractability of computational problems
Major Course Topics (Modules)

1. Introduction
2. Regular Languages
3. Context-free Languages
4. Church-Turing Thesis
5. Decidability
6. Reducibility
7. Time Complexity
Pre-requisites

- CptS 122/132: Data Structures
- Math 216: Discrete Structures
Textbook

Textbook (required):
• Introduction to the Theory of Computation, 3rd Edition
  • By Michael Sipser

Optional reference:
• Introduction to Automata Theory, Languages and Computation, 3rd Ed.
  • By J.E. Hopcroft, R. Motwani, J.D. Ullman
Coursework and grading

- 8 homeworks (58%) – best 7 out of 8 will be used toward final grade
- 2 midterms (20%)
- 1 final exam (20%)
- Class participation (2%)

- Exam formats not decided yet, likely to be take-home

- Final letter grade based on ranges (see syllabus)
Homework submission policy

- Solutions submitted electronically on Canvas
  - Type up and generate PDF, or
  - Scan hand-written solution
- No late submissions allowed (unless there was prior permission)
  - Permission is given only under extraordinary circumstances
- Homeworks will be posted on Canvas.
- A HW will be posted a week before it is due, typically on a Wed
Homework policy

• All homework must be done individually

• Cheating:
  • Helping others, getting help, looking up website for solution, etc
  • Students caught cheating will be awarded an F grade, and will be subjected to the WSU academic dishonesty policy
  • If something is not clear, on what constitutes cheating and what does not, please consult the instructor in advance
Exam policy

- 2 midterms and 1 final exam
- Likely take-home, creative, will require reflection, challenging, fun
- Make-ups happen only under extraordinary circumstances
- Seek prior permission from instructor (at least two weeks in advance)
# Weekly schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Topics</th>
<th>Assignments/comments</th>
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<tbody>
<tr>
<td>01 (Jan 18)</td>
<td>Intro to course</td>
<td>HW0 (survey) out; NO CLASS 1/18-MLK</td>
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<tr>
<td>02 (Jan 25)</td>
<td>Intro to automata theory</td>
<td>HW0 in, HW1 out</td>
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<tr>
<td>03 (Feb 01)</td>
<td>Finite Automata</td>
<td>HW1 in, HW2 out</td>
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<td>04 (Feb 08)</td>
<td>Regular Expressions</td>
<td>HW2 in, HW3 out</td>
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<tr>
<td>05 (Feb 15)</td>
<td>Nonregular Languages</td>
<td>HW3 in, HW4 out; NO CLASS 2/15</td>
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<td>06 (Feb 22)</td>
<td>Context-free Grammars</td>
<td>HW4 in</td>
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<tr>
<td>07 (Mar 01)</td>
<td>Pushdown Automata</td>
<td>Mid-Term 1</td>
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<tr>
<td>08 (Mar 08)</td>
<td>Non-Context-Free Languages</td>
<td>HW5 out</td>
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<tr>
<td>09 (Mar 15)</td>
<td>Turing Machines</td>
<td>HW5 in, HW 6 out; NO CLASS 3/17</td>
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<tr>
<td>10 (Mar 22)</td>
<td>The Definition of Algorithm</td>
<td>HW 6 in</td>
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<tr>
<td>11 (Mar 29)</td>
<td>Decidable Languages</td>
<td>Mid-Term 2</td>
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<td>12 (Apr 05)</td>
<td>Undecidability</td>
<td>HW7 out</td>
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<td>13 (Apr 12)</td>
<td>Reducibility</td>
<td>HW7 in, HW8 out</td>
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<td>14 (Apr 19)</td>
<td>Time Complexity</td>
<td>HW8 in</td>
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<td>15 (Apr 26)</td>
<td>NP-Completeness</td>
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<tr>
<td>16 (May 03)</td>
<td>Finals Week</td>
<td>Final Exam</td>
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Lecture basics

- Classes will mostly be based on Slides but occasionally may involve “Board” writing
- Lecture slides will be posted on Canvas immediately after class
- Take your own notes in class (can’t stress this enough), even if slides are posted afterwards
In conclusion…

• Welcome to this course again
• This is going to be a fun semester
• Put in your best effort
• You will be rewarded
• Class begins sharp at 10:10, login at least a few minutes early
• Thanks for today and see you in class on Friday!