Overview

Are there fundamental restrictions to what computers can and cannot do? If so, what do these restrictions look like? And what would such restrictions mean for our ability to computationally solve meaningful problems?

In **CMPU 240**, we'll explore the answers to these important questions. We'll consider what is an appropriate mathematical model of a computer and what types of computations are and are not possible in such a model. During the course, you will gain an understanding of the intimate connection between computation and language recognition as we study several classes of abstract machines, including finite automata, pushdown automata, and Turing machines, along with several classes of languages, such as regular and context-free languages.

We'll see the strengths and weaknesses of these models, and you'll learn how to think about computation itself and how to show that certain problems are impossible to solve.

**Prerequisites**

**CMPU 102**: Data Structures and Algorithms  
**CMPU 145**: Foundations of Computer Science

**Course Goals**

By the end of the semester, you should understand:

- the relationships between languages (problems) and machines
- the inherent limits of what can be computed
- the application of theoretical topics to practical problems
- how to create rigorous arguments using various proof techniques

This course provides essential background for **CMPU 331**, Compiler Design; ideally, you should take **CMPU 331** the next semester. It's also a good foundation for **CMPU 336**, Computational Linguistics.
Calendar

The calendar with lecture notes, assigned readings and exercises, and exams is on the course website and will be updated throughout the semester.

Class Sessions

The class sessions are intended to augment and support the material in your readings by providing an opportunity for in-depth discussion of topics, working through examples, and the chance for you to ask questions.

The material covered each week builds on what was covered in prior weeks. As such, it is essential that you attend every lecture and keep up with the reading assignments.

As a courtesy to your classmates and your instructor, the use of computers, tablets, mobile phones, or other electronic devices during lectures is discouraged. If for any reason it is important that you use such a device during lecture, please talk to me about how we can best accommodate you.

Textbook

Introduction to the Theory of Computation, third edition
Michael Sipser

The textbook is on reserve at the library.

Assignments

One goal of this course is to develop your facility to manipulate language formalisms, so completion of weekly assignments is extremely important. Assignments and due dates will be listed on the course calendar on the webpage. All assignments are due at the beginning of class on the indicated days and should be turned in directly to me.

No late assignments are accepted under any circumstances. However, in computing the final grade, the lowest assignment grade will be dropped. Full solutions to all problems will be posted on the course website after they are handed in.

Additional instructions will be provided with the first assignment.

Collaboration Policy

The goal of the course is to gain an understanding of theory of computation, not to compete with each other. Indeed, in real research, collaboration is the norm. As such, you're encouraged to discuss class mate-
rial with other CSC 240 students when reading, studying, and thinking about the problems.

You have the option to complete the assignments individually or with one classmate. If you work in a group of two, you will submit a single assignment with both names on it and will receive the same grade for the assignment. There’s no penalty for working in a pair; the assignments will be graded the same as those done individually.

Note: Even if you work in a group of two, you are both expected to work on each problem, and you are responsible for completely understanding all of your group’s answers. (Otherwise you’ll be unhappy when a problem like that shows up on an exam!)

Whether you submit on your own or with a partner, discussing homework with your classmates is encouraged – but your write-up must be your own work and your own words. Do not copy all or part of anyone else’s write-up.

Academic Integrity

Receiving and copying solutions from any source (a classmate, a friend, a published text, an online source, etc.) is not allowed. Note that using material from sources (other than those explicitly given as course resources) as “inspiration” and submitting derivative solutions is considered copying. Please read “Going to the Source”, available from the Dean of the College website. Inappropriate use of sources (including people) will be reported to the Academic Panel. If you’re not sure whether something is allowed, stop and ask me first.

Exams

There will be three exams. The first two exams will be take-home and will focus on material from the immediately preceding segment of the course. The third exam will be regularly scheduled and will focus primarily on later material but may also include material from earlier in the course.

Course Grades

The elements of the course will be weighted approximately as follows:

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<tr>
<th>Element</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Assignments</td>
<td>35%</td>
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<tr>
<td>Exam 1</td>
<td>20%</td>
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<td>Exam 2</td>
<td>20%</td>
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<tr>
<td>Exam 3</td>
<td>25%</td>
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You are not required to work with the same person on each assignment – in fact, it’s a good idea to mix it up!
Academic Accommodations

Academic accommodations are available for students registered with the Office for Accessibility and Educational Opportunity (AEO). Students in need of disability (ADA/504) accommodations should schedule an appointment with me early in the semester to discuss any accommodations for this course that have been approved by the Office for Accessibility and Educational Opportunity, as indicated in your AEO accommodation letter.

Title IX

Vassar College is committed to providing a safe learning environment for all students that is free of all forms of discrimination and sexual harassment, including sexual assault, relationship abuse, and stalking. If you (or someone you know) has experienced or experiences any of these incidents, know that you are not alone. Vassar College has staff members trained to support you in navigating campus life, accessing health and counseling services, providing academic and housing accommodations, helping with legal protective orders, and more.

Please be aware all Vassar faculty members are “responsible employees,” which means that if you tell me about a situation involving sexual harassment, sexual assault, relationship abuse, or stalking, I must share that information with the Title IX Coordinator. Although I have to make that notification, the Title IX office will only provide outreach by email. You will control how your case will be handled – you don’t have to read or respond to the email, and it is completely up to you whether to pursue a formal complaint. Our goal is to make sure you are aware of the range of options available to you and have access to the resources you need.

If you wish to speak to someone privately, you can contact any of the following on-campus resources:

- Counseling Service (counselingservice.vassar.edu, 845-437-5700)
- Health Service (healthservice.vassar.edu, 845-437-5800)
- Nicole Wong, SAVP (Sexual Assault and Violence Prevention) director (savp.vassar.edu, 845-437-7863)
- SART (Sexual Assault Response Team) advocate, available 24/7 by calling the CRC at 845-437-7333 and asking for SART

The SAVP website (savp.vassar.edu) and the Title IX section of the EOA website (eoaa.vassar.edu/title-ix) have more information, as well as links to both on- and off-campus resources.
Acknowledgments

This course incorporates substantial material developed by Nancy Ide and by Keith Schwarz.