COMP 409/509
Logic in Computer Science and AI

Fall 2025
http://www.cs.rice.edu/~vardi/comp409/

Background

Logic has been called "the calculus of computer science". The argument is that logic plays a fundamental role in computer science, similar to that played by calculus in the physical sciences and traditional engineering disciplines. Indeed, logic plays an important role in areas of Computer Science as disparate as artificial intelligence (automated reasoning), architecture (logic gates), software engineering (specification and verification), programming languages (semantics, logic programming), databases (relational algebra and SQL), algorithms (complexity and expressiveness), and theory of computation (general notions of computability).

COMP 409/509 provides the student with a thorough introduction to mathematical logic, covering in depth the topics of syntax, semantics, decision procedures, formal systems, and definability for both propositional and first-order logic. The goal is to prepare the students for using logic as a formal tool in computer science.

Basic Information

Instructor: Moshe Y. Vardi
Duncan Hall 3057 (ext. 5977), vardi@cs.rice.edu
Office Hours: by request

TA: Charlie Cruz
seniormars@rice.edu
Office Hours: by request +
Office Hours: Wed: 2:00am - 4:00pm, DH, 3rd Fl. central conversation area

Textbook: Schöning: *Logic for Computer Scientists*, Birkhauser, 2008
(the book is optional; lecture notes will be posted on the course website).

Prerequisites: COMP 182, COMP 280, or instructor's permission

Recommended Reading

M. Gardner: *Logic Machines and Diagrams*, 1982

A. Feferman: *Politics, Logic, and Love: the life of Jean Van Heijenoort*, 1993
M. Davis: *The Universal Computer: The Road from Leibniz to Turing* , 2011.

Grading

There will be two take-home, open-book exams: a mid-term exam and a final exam, as well as periodical problem sets, and a programming project (for those taking COMP 509). Each exam accounts for 35% of the final grade, the problem sets account for 20% of the final grade, and the programming project accounts for 10% of the final grade (project required for COMP 509 only). Exams and assignments are graded on a curve.

Class attendance is expected. Classroom participation will be used to determine boundary cases for grading. All problem sets will be assigned to pairs of students; you will learn more that way. Effort counts more than success on the problem sets. Without, however, doing the problem sets diligently, you have little chance of doing well on the tests. Problem sets and final project must be typeset in LaTeX.
Make-ups: There will be no make-ups for missed coursework, assignments, and examinations unless you receive the permission of the instructor prior to the date of the assignment or exam.

Honor Code

Students are expected to adhere to Rice's Honor Code. Joint work is allowed when explicitly required. Using the course website is encouraged, but searching for solutions on the Internet is not allowed. Using solution sets from previous years is not allowed. Using AI tools is not permitted.

Time

Class starts at 9:25AM (sharp). Late arrivals are **strongly** discouraged.

Device Policy

A no-device rule during lecture will be strictly enforced. All mobile devices must be on "silent" mode and stashed away during class.

Special Accommodations

Any student with a disability requiring accommodations in this class is encouraged to contact me. Alternatively, students could contact the Coordinator for Disabled Student Services.

Title IX Responsible Employee Notification

Rice encourages any student who has experienced an incident of harassment, pregnancy discrimination or gender discrimination or relationship, sexual, or other forms interpersonal violence to seek support from The SAFE Office. At Rice University, unlawful discrimination in any form, including sexual misconduct, is prohibited under Rice Policy on Harassment and Sexual Harassment (Policy 830) and the Student Code of Conduct. As the instructor and a responsible employee, I am required by Title IX to disclose all incidents of non-consensual interpersonal behaviors to the Title IX Coordinator on campus. Although responsible employees are required to make this notification, it is the students choice to pursue a formal complaint. The goal is to make sure that students are aware of the range of options available and have access to the resources when in need. For more information, please visit safe.rice.edu, titleix.rice.edu, or email titleixsupport@rice.edu.