

## CS389L - Automated Logical Reasoning Spring 2022 Syllabus

**Instructor:** Isil Dillig

**TA(s):**  
TBD

### **Office Hours:**

Professors will hold virtual office hours through [Adobe Connect/Zoom] by appointment only. TAs will hold virtual office hours as well according to the schedule above.

### **Course Overview/Objectives:**

*Automated logical reasoning has enabled substantial progress in many fields of computer science, including software and hardware verification, theorem proving, program analysis, and artificial intelligence. In this course, we will study widely-used logical theories and decision procedures for answering whether formulas in these theories are satisfiable. In particular, we will consider automated reasoning techniques for propositional logic, first-order logic, linear arithmetic over reals and integers, theory of uninterpreted functions, and combinations of these theories. We will also look at applications of logic in program analysis and verification.*

**Prerequisites:** Discrete Mathematics, Algorithms

**Textbooks:** There are no required textbooks. However, students may find the following two textbooks to be useful: (1) *The Calculus of Computation* by Aaron Bradley and Zohar Manna, (2) *Decision Procedures: An Algorithmic Point of View* by Daniel Kroening and Ofer Strichman

### **List of Topics:**

- *Week 1: Normal Forms and DPLL*
- *Week 2: Modern SAT Solvers*
- *Week 3: MaxSAT and Applications of SAT*
- *Week 4: Binary Decision Diagrams*
- *Week 5: Semantics of First-order Logic*
- *Week 6: First Order Theorem Proving*
- *Week 7: Intro to First-Order Theories*
- *Week 8: Congruence Closure Algorithm*
- *Week 9: Linear Programming & Simplex*
- *Week 10: Omega Test & Nelson-Oppen*

- *Week 11: DPLL(T) Framework & Hoare Logic*
- *Week 12: Automating Hoare Logic & Abstract Interpretation*
- *Week 13: Predicate Abstraction*
- *Week 14: Program Verification with Dafny*

### **Assignments:**

*There will be mini problem sets after each video as well as a few programming assignments.*

### **Exam(s):**

*This course will have weekly quizzes.*

### **Grading Policy:**

*50% of the grade will be based on weekly quizzes, and 20% will be based on the mini-problem sets between videos. The remaining 30% of the grade is based on the programming assignments.*

### **Program Grade Requirements:**

30 hour program

9 required hours

21 elective hours Required courses, B- or higher

Elective courses, C or higher To graduate, all students must have a graduate GPA avg of at least 3.00.

### **Late Policy:**

*(if any)*

### **Technical Requirements**

*Requirements listed below are the program's base requirements. Your course may have additional tech requirements on top of this, due to projects or third-party tools used in the course*

Laptop or personal computer with the following requirements:

- Operating System:
  - MAC: OSX Mojave or newer.
  - PC: Windows 10
- Processor/RAM: x86 CPU, multi-core, with virtualization support (Intel: VT-x, AMD: AMD-V); 8GB RAM
- Browser: Mozilla Firefox v20.0 or higher, Google Chrome v25.0 or higher.
- Plug-Ins: Javascript enabled and Third Party Cookies enabled.
- Internet Connection: Cable modem, DSL or better (300 kbps download, 250 kbps upload).
- Camera Resolution: 800 x 600 resolution or better.
- Smartphone or scanner to take pictures and make PDFs of homework submissions.
- Smartphone or other device capable of being used for dual-factor authentication

## **Academic Integrity in This Online Course**

*You may add any language you like about collaboration or other academic integrity concerns specific to your course.*

The online course format allows for multiple methods of identity verification, collusion, collaboration and plagiarism monitoring and detection. A violation of the course policy may include (but is not limited to) the following:

- Providing your UT EID to any other person
- Collaborating or sharing information with another person regarding the material on any quiz, assessment or assignment, before, during and/or after any quiz, assessment or assignment
- Recording any quiz, assessment or assignment material in any format
- Failing to properly cite language, ideas, data, or arguments that are not originally yours
- The public (such that it can be viewed by more than one person) posting of any form of a test bank or group of questions from any assignment
- Consulting forbidden materials or sources of information

The University of Texas at Austin Academic Integrity principles call for students to avoid engaging in any form of academic dishonesty on behalf of yourself or another student. Grade-related penalties are routinely assessed ("F" in the course is not uncommon), but students can also be suspended or even permanently expelled from the University for scholastic dishonesty. If you have any questions about what constitutes academic dishonesty, please refer to the [Dean of Students website](#) or contact the instructor for this course.

You must agree to abide by the [Honor Code](#) of the University of Texas. You will not work with or collaborate with others in any way while completing any of the graded course assignments.

## **Accommodations**

The University of Texas at Austin guarantees that students with disabilities have access to appropriate accommodations. You may request an accommodation letter from the Division of Diversity and Community Engagement, [Services for Students with Disabilities](#).

If you have approved accommodations for the course, please contact us to arrange them. Please do this as soon as possible, so that you can have the benefit of the accommodations throughout the duration of the course.

## **Course Etiquette**

We expect that you will treat online discussions as though you are having a civil, respectful discussion with your fellow classmates in the same classroom. Please refrain from using profanity or any euphemisms for profanity. Please do not bait other commenters or personally attack them. Please do not use sarcasm in a way that can be misinterpreted negatively. And please do not make the same point over and over again. In short, please just respect the right of your colleagues to ask questions and discuss their opinions about the subject matter of our course.

on the discussion board. Violators of these discussion rules will simply be shut out from all class communications—email, Piazza, and office hours.

**Academic Advisor Support**

If you have additional questions or require support from an academic advisor, please contact the program coordinator at [mcsogradcoordinator@austin.utexas.edu](mailto:mcsogradcoordinator@austin.utexas.edu).