

# CS 4995 – Fall 2021

## Logic and Computability

**Lectures:** Monday/Wednesday 2:40-3:55, 415 Shapiro

**Instructor:** Toniann Pitassi, [toni@cs.columbia.edu](mailto:toni@cs.columbia.edu)

**Office hours:** Monday 4-5

**TA:** Oliver Korten

**Web Page:** <http://www.cs.columbia.edu/toni/Courses/Logic2021/4995.html>

**Course Notes:** Postscript files for course notes and all course handouts will be available on the web page.

### Topics:

Propositional logic: syntax and semantics, Resolution and Propositional Sequent Calculus soundness and completeness. First order logic: syntax and semantics, First Order Sequent Calculus soundness and completeness. Gödel's Incompleteness theorems. Computability: Recursive and recursively enumerable functions, Church's thesis, unsolvable problems

### Marking Scheme:

3 assignments (each worth 20% of final grade)

First Term test (20% of final grade)

Second Term Test (20% of final grade)

### Due Dates:

To be announced

First Test (In Class): Wednesday Oct 13, 2:40-3:55pm 415 Shapiro

Second Test (In Class): Monday, Nov 22, 2:40-3:55pm 415 Shapiro

Assignment 1 due date: Wednesday Oct 6 8pm

Assignment 2 due date: Monday Nov 15 8pm

Assignment 3 due date: Monday Dec 13 8pm

*The work you submit must be your own.* You may discuss problems with each other; however, you should prepare written solutions alone.

### Optional Supplementary References:

S Buss: Chapter I: An introduction to proof theory, in **Handbook of Proof Theory**, S Buss Ed., Elsevier, 1998, pp1-78. (grad)

J Bell and M Machover: **A Course in Mathematical Logic**. North-Holland, 1977. (grad)

H.B. Enderton, **A Mathematical Introduction to Logic** (undergrad)

G Boolos and R.C. Jeffrey, **Computability and Logic** (undergrad)

E. Mendelson, **Introduction to Mathematical Logic**, 3rd edition (undergrad/ grad)

J.N. Crossley and others, **What is Mathematical Logic?** (informal, readable)

A.J.Kfoury, R.Moll, and M. Arbib, **A Programming Approach to Computability** (undergrad)

M.Davis, R. Sigal, and E. Weyuker, **Computability, Complexity, and Languages: Fundamentals of Theoretical Computer Science** (undergrad/grad)