

# 15-317 Constructive Logic

Course Syllabus

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## 1 Overview

This multidisciplinary junior/senior-level course is designed to provide a thorough introduction to modern constructive logic, its roots in philosophy, its numerous applications in computer science, and its mathematical properties. The core topics of this class are intuitionistic logic, natural deduction, Heyting arithmetic, proofs as programs, connections between classical and constructive logic, inductive definitions, sequent calculus, and decidable classes. Advanced topics may vary from year to year and include type theory, logic programming, proof search, logical frameworks, temporal logic and model checking, modal logic.

Additional information, including a lecture schedule, homework policy, lectures notes, etc. can be found on the course home page at <http://www.cs.cmu.edu/~aplatzer/course/constlog16.html>.

## 2 Course Information

**Lectures** TuThu 1:30-2:50, MM 103

### Recitations

**A:** Wed 9:30-10:20, PH A22

**B:** Wed 10:30-11:20, WEH 5320

**C:** Wed 4:30-5:20, WEH 5415

**Credit** 9 units

**Prerequisites** 15-150 Functional Programming

**Textbook** There is no textbook, but lecture notes are available from the course web page

**Grading** 40% Homework, 15% Midterm I, 15% Midterm II, 30% Final

**Homework** Weekly, usually Tuesday to Tuesday. 3 late days total.

**Midterm I** Thu 09/29, in class, closed book.

**Midterm II** Thu 11/10, in class, closed book.

**Final** TBD, open book.

**Home** <http://www.cs.cmu.edu/~aplatzer/course/constlog16.html>

**Piazza** discussion board linked from course web page

**Autolab** homework submission web page

### 3 Learning Objectives

1. Understand the working principles of logic
2. Understand how the meaning of a proposition comes from its verifications
3. Distinguish propositions from judgments
4. Use proof rules to conduct formal proofs
5. Formalize informal problems into precise logical language
6. Justify how proof rules fit to one another in sound and complete ways
7. Assess the validity of a formal proof
8. Relate constructive logic to computation and constructive proofs to functional programs
9. Understand propositions as types and proofs as programs
10. Relate induction to recursion and use induction to prove properties in and about logical systems
11. Relate deductive proof search to computation in logic programming

12. Understand formulas as programs
13. Understand the principles and applications of logic programming
14. Identify logical core working principles of an algorithm or a data structure
15. Relate logical reasoning to operational reasoning
16. Distinguish classical reasoning from constructive reasoning
17. Ability to conduct proofs of appropriate scope in simple proof assistants

#### 4 Take care of yourself

Do your best to maintain a healthy lifestyle this semester by eating well, exercising, avoiding drugs and alcohol, getting enough sleep and taking some time to relax. This will help you achieve your goals and cope with stress.

All of us benefit from support during times of struggle. You are not alone. There are many helpful resources available on campus and an important part of the college experience is learning how to ask for help. Asking for support sooner rather than later is often helpful.

If you or anyone you know experiences any academic stress, difficult life events, or feelings like anxiety or depression, we strongly encourage you to seek support. Counseling and Psychological Services (CaPS) is here to help: call 412-268-2922 and visit their website at <http://www.cmu.edu/counseling/>. Consider reaching out to a friend, faculty or family member you trust for help getting connected to the support that can help.