

Comp 123—Computer Science 1

Becoming “Introduction to Algorithms and Abstraction” next fall
Department of Mathematics and Computer Science
Macalester College

What?

This course aims to introduce students to some of the “big ideas” that are central to computer science, rather than focusing on pure programming. Two central ideas are algorithms, and abstraction. An algorithm is an unambiguous set of instructions for solving some problem. The course examines how to write algorithms, both in pseudocode and in a programming language. Students study how to determine an algorithm’s correctness through testing and proof techniques, and how to estimate the algorithm’s level of efficiency, using asymptotic (big-O) analysis. In addition, we examine a number of “classic” algorithms in computer science, plus a number of “classic” data structures and the algorithms associated with them. Students learn about different ways to use abstraction to make the design and implementation of computer systems more tractable. Data abstraction focuses on designing a conceptual level description of a system’s data. Procedural abstraction focuses on ways of modularizing the parts of an algorithm or program, and detecting and taking advantage of patterns across different algorithms.

Why?

Everything we do on the computer in these days depends on layer upon layer of abstraction. Users see a graphical, metaphor-laden front end, without knowing how it is implemented inside the operating system, the computer’s architecture, or the hardware. Much less could be accomplished if users had to work with the lower levels, rather than the abstract. For some years now, this course has used the language Scheme for the programming components of the course. Scheme is a functional language, it is very concise, and it is brand-new to 99% of students in the class. Using it allows the course to focus on the more important issues, while still enabling students to become relatively proficient programmers.

Projects/Examples

The following projects or examples have been used in recent semesters:

- Tic-tac-toe game
- Landscape design program
- Library catalog and check-out system
- Mastermind program
- Crazy eights card game