*Grinnell College*

Contributed by *Henry M. Walker, walker@cs.grinnell.edu*

## Institutional and departmental context

* Location: Grinnell, Iowa
* Undergraduate student body size: 1700 students
* Degree(s) offered: BA in CS
* Department/major name: Computer Science
* Number of contributing faculty: 8 FTE for 2021-2022 (2 tenured, 4 tenure track, 2 multi-year visitors)
* Number of majors annually: about 60 computer science majors graduated annually
* Does the department offer any graduate programs? no

Grinnell College seeks to educate students "for the different professions and for the honorable discharge of the duties of life.” Themes of social responsibility, work toward the common good, equity, and diversity are widely accepted themes.

Within CS, the faculty works to emphasize the college’s themes throughout the curriculum. For example, the use of a multi-paradigm approach in the introductory courses, the widespread use of collaboration, the selection of examples and assignments, and various activities to support community seek to include and engage diverse students, and both policies and practices seek to promote equity and inclusion.

The college has no general-education requirements, with only one first-year tutorial required for all students. Rather, to ensure a breadth of education within the liberal arts, students work with faculty advisors on an “individually-advised” course of study. Students are strongly encouraged to take breadth seriously, taking a range of courses that fit with their interests and needs. As a result, students mostly take courses because they want to, not because the courses are required. However, with strong advising, the vast majority of students take wide-ranging courses that reflect a liberal arts education. For example, over 90% of graduates have taken a math course (either statistics or a math course—calculus I or higher), even though there is no requirement that students must take math.

The department graduated about 13 ± 2 majors almost every year between 1999 and 2015—showing considerable stability and helping to foster a lovely sense of community and connection. Starting in 2016, however, enrollments have increased substantially, and about 60 CS majors have graduated in each of the past couple years. The administration has allowed the department to grow somewhat, but substantial challenges continue.

## Curricular overview

### Major program(s)

The College mostly limits a major to 32 credits in the discipline, perhaps with additional supporting courses. Thus, the CS curriculum has three main categories of courses for majors (Basic, Expanded, and Elective).

**Basic Major** (32 credits in CS plus 12 credits in supporting mathematics)

* Introductory Sequence (three 4-credit courses)
* CSC 151, *Functional Problem Solving*
* CSC 161, *Imperative Problem Solving*
* CSC 207, *Object-oriented Problem Solving, Data Structures, and Algorithms*
* Required Core (four 4-credit courses):
* One of the following (both strongly recommended):
* CSC 211, *Computer Organization and Architecture*
* CSC 213, *Operating Systems and Concurrency*
* CSC 301, *Analysis of Algorithm*s
* CSC 341, *Automata, Formal Languages, and Computational Complexity*
* CSC 324, *Software Development* (with teams, alumni mentors, community client)
* Elective (four credits)
* Supporting Mathematics:
* Calculus I (or higher)
* Discrete Structures/Mathematics (four credits)
* Additional Mathematics Course (four credits creditable toward Math. Major)

**Expanded Major to Meet CS2013** (38 credits: Basic Major + specified electives/courses)

* Introductory Sequence (three 4-credit courses)
* Both CSC 211 and CSC 213 (both Com. Org./Arch. and OS)
* 2 credits for each of security, networking, programming language implementation

**Electives**

* range of courses including topics in systems, AI, soft. dev., learning from alumni, areas related to faculty scholarship

### Non-major program(s)

Although CSC 105, *The Digital Age*, is offered for non-majors, all students are encouraged to take CSC 151 (CS1) to develop logical rigor, problem solving, and computational thinking. Since students do not declare majors until late in their second year, the primary introductory CS course is designed to serve both potential majors and non-majors .

### Co-curricular program(s)

* A weekly CS Table provides an on-going forum to discuss social and ethical issues.
* Members of Grinnell’s “women-in-computing” organization decided to be more inclusive by changing the group’s name to “Women and Gender Minorities in Computing”.
* A student-organized-and-led group for Web apps can be effective responding to campus interests and needs.
* A wide range of student research projects, seminars, outreach to schools, hackathons, etc. can address diverse interests.

## Key contributions

* A multi-paradigm approach over the first three courses levels the playing field for incoming students and provides new perspectives for all.
* Although both organization/architecture and operating systems strongly recommended, only 1 is required to allow some flexibility to meet student priorities and interests.
* Collaborative labs at all levels, particularly at the introductory level, help engage students, aid learning, encourage diversity, and helping to build community.
* Modest requirements (with an elective or two) can yield a respectable CS major.
* When selected, additional courses are offered and clearly advertised, students could choose to take courses needed to meet CS2013 curricular recommendations.
* When 4-credit courses are the norm, 2-credit courses can provide breadth and expand coverage in some areas, but 2-credit courses yield numerous practical challenges.
* Graduating students encouraged (not required) to take the Pledge of the Computing Professional (<http://pledge-of-the-computing-professional.org>)

## Limitations/challenges

* Although the CS faculty work with students on collaborative learning and maintenance of a constructive environment, micro-aggressions can happen.
* 2-credit courses raise logistical, scheduling, and workload challenges, so this approach is under discussion.
* The sense of community faces challenges when the majors expand from about 13 graduates/year to about 60. The faculty continues to work with students on how to maintain and expand a sense of community with over 5-times the enrollments.
* Grinnell’s CS program collaborates with the University of Iowa on a 4+1 program, leading to a BA in CS from Grinnell and an MS in CS from Iowa, with two courses at each institution counting toward the other degree. Most Grinnell students get a TA at Iowa, so the fifth year is usually cost-free. (Another Grinnell/Iowa program leads to an MS in Public Health.)