

Proposal for a new
Common Curriculum computing course
“Practical computing for engineers”
A 1-credit supplement to CS 1112

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v4: May 18, 2017

Summary. This is a proposal for a new 1-credit course to be offered on a one-time trial basis in fall 2017. It is a Matlab computer course that supplements CS 1112. The target audience is freshman in CS 1112, who know some calculus, and who plan to be engineers. Especially students not primarily interested in CS. It will add more practical numerical computation to the CS 1112 content.

The proposed add-on is similar in intent to the form course [BEE 1510](#) *Introduction to Computer Programming* taught by Anderson.

[This revision incorporates things that came up in the CCGB subcommittee meeting on Friday April 21 at 8 AM, comments from 26 students in Andy Ruina’s lab, comments from 2 Mechanical Engineering faculty, and May 1, 2017 comments from Daisy Fan, Walker White, David Gries, Fred Schneider, and Claire Cardie in CS. Primarily, v2 is a reduction from an alternative to CS 1112 to an add-on to CS 1112]. v3 reduces the co-req math from 1920 to 1910 and adds some post-course evaluation ideas. v4 eliminates the final exam and expands the final project to a project and demonstration.]

Contents of this proposal

1. Motivation and description of proposal
2. Syllabet

1 General motivation

Computer Science vs Computer Skills. The CCGB computing requirement for all engineers serves two overlapping functions:

1. **An introduction to computer science;** and
2. **To build computational numerical skills** for future engineering work.

The former serves computer science majors and people who will work in software design. The latter serves students who need computation, but more than computational tools written by others, in courses and work.

From talking to many students, over decades, I sense that CS 1112 is taught well, that students like the instructors and organization, and students appreciate learning about computer science. But, leave CS 1112 unprepared for (2), above.

The goal. This course, aimed at computer usage, problem solving with computers, aims to get students as comfortable solving problems with a computer as they are with using a calculator, algebra or elementary calculus. This includes comfort *using* CS 1112 content.

Many of the standard CS concepts will be exercised (e.g., loops, branching, iteration, data types), but in service of engineering-like problems.

The course will also bolster basic math and physics skills and can help improve general problem-solving skills. Successful students will do better work in some of their future engineering and math courses.

Trial year. The proposed trial is for fall 2017. Why so quick and abrupt?: **1)** why wait?, & **2)** in the Spring I have another new course. For this trial year.

TA support. Good devoted undergraduate TAs should suffice. TAs will hold office hours, grade all student work, and record student grades. The college (Thompson) and ME department (Campbell) have committed enough TA support to well cover at least 40 students. Additional students might be recruited to TA for credit.

Why MATLAB ? In short, some standardization is good. The present standard in Cornell engineering is mostly MATLAB . Shouldn't non-computer engineering courses be computer-language agnostic; don't students just need comfort in *some* language? No. Why not? In practice, many courses have to teach some language particulars for their topic. If there is not a college standard, teaching becomes awkward. Lack of standardization either makes trouble in courses that use computers, or inhibits teachers from using computation in their courses at all. At present the college standard, outside of CS, is mostly MATLAB .

There seems to be a movement towards Python and away from MATLAB . If that happens, and this course survives in some form, then it should switch to Python.

What are other schools doing? Most, if not all, Engineering schools have an introduction to computation course. These range from an orientation towards CS concepts (like CS 1112), to a strictly applied-engineering orientation (in the direction of this new course). I have found two courses that are in-between, that also have friendly helpful teachers.: A course at [Duke](#) and a course at [Boston University](#). The latter course, by Stormey Attaway, is an EdX course.

I haven't looked into whether or not any schools have an applied supplement like this.

My **What is the development plan?** At the start of the semester I, Andy Ruina, will get detailed syllabi and homework assignments from CS 1112 Maths 1910, 1920, 2930, & 2940; and Physics 1112. Ruina will also attend most CS 1112 lectures. The course will be developed to use content from these other courses in the way that most resonates with the students in the course. Each week this course will tie into those courses in some ways. Secondly, the course will be organized around the textbook, trying to cover most of the book in the semester.

My **What is the long term goal?** If this course is successful for one or more years, it could be incorporated into CS 1112. Further, if the students who take this course, and the later faculty who work with these students, find the results worthy, the college as a whole could aim to raise the general applied computing competence standards of the students. Students coming from a more CS-like course would have to make up this applied-computation content (Note, however, that, generally, such CS-like students are comfortable with computers, so they do not have trouble with the MATLAB numerics transition).