Computer Science BS Program Updates

Fall 2018

In anticipation of seeking ABET accreditation for the Computer Science (CS) BS program, we propose the following updates that incorporate or adapt improvements from our current Software Engineering accreditation experiences. The updates preserve credits across categories except for differences in 3- vs 4-credit course alternatives. These program updates are accompanied by a few small changes in course outlines and pre-requisite requirements. See also the co-submitted updates for CS BA and SE BS programs, as well as a summary diagram illustrating updated degree paths for CS, IS, and SE programs, and the set of current department-approved course outlines.

1. [Same as proposed SE BS update.] Dropping CSC 222 as an alternative to CSC 322 in core requirements. The shared core requirements of the Computer Science BA, Computer Science BS, and Software Engineering BS programs have always included (and will continue to include) at least one course covering computer architecture and low-level systems programming: CSC 222 (“Computer Organization and Programming”) focuses primarily on the former, and CSC 322 (“Systems Programming”) on the latter. Over time, in part because of its co-listing with ECE 271, CSC 222 has further increased coverage of digital design, and reduced other topics; as a result, students taking it are not as well prepared for advanced courses (and underlying program objectives) relying on familiarity with systems software. Even our students are aware of this: In a recent alumni survey, CSC 222 was most frequently listed as the least valuable course by our majors; conversely CSC 322 was listed among the top eight most valuable. (CSC 322 also has one more prerequisite, CSC 241, which enables more coverage of programming topics.) Additionally, the ECE department has reduced the number of co-listed seats in CSC 222 as ECE demand increased when the program became self-standing. Over the past few years, we have increasingly advised students to take the CSC 322 option, and most now do. So this change codifies the current state of affairs. Given these existing trends, there are no significant resource issues, at least to the best of our ability to estimate given historically large swings in department majors over the years. CSC 222 will continue to be offered by ECE as a co-list of the required ECE 271 course. But we expect it will be taken by even fewer majors, for example double CS/ECE majors. We will also still allow transfer credit for the course, and will continue to waive the core requirement for transfers who take courses covering both computer organization and systems programming.

2. [Same as proposed SE BS update.] Requiring (currently optional) ISC 300 (Ethics and Policy in the Digital Age; co-listed as PHL300). Ethics and policy issues play increasing roles in the carers of our graduates (as also indicated in our alumni surveys). It is no longer possible to provide sufficient coverage in other required courses. This change adds one course to required courses, and reduces elective courses by one. This change
also requires a simple adjustment in our Writing Plan, because ISC 300 is an approved Writing course. See the co-submitted Writing Plan update.

3. Changing Math/Science cognates to be nearly identical to those in the SE BS program (differing only in that CS BS students still have a choice of four lab science course sequences, but SE BS only one). These credit-preserving changes reduce choice in one way but increase choice in others, and more clearly conform to ABET criteria. The net resource impact consists of possible shifts in enrollment patterns among some Math courses (with effects again less than those due to variation in CS majors enrollments over time). Specifically:

- Changing current requirement of two elective courses in science to three courses in math or science (under advisement; disallowing for example inappropriate selections of lower-level courses covering preliminaries to required courses). One possible result is that it will be easier for some CS students to declare Math minors. It may also allow some transfer students to apply more credits toward the major.
- Requiring a probability/statistics course (MAT 318 or 354) that is now an option (students may currently take MAT 240 instead, but few do). This conforms to current ACM and ABET guidelines. Note: It would be possible to revive MAT 254 (or something like it), and add it as an option.
- No longer specifically requiring MAT 230 (Linear algebra). It will remain available to fulfill math/science elective requirements, and remains a prerequisite to a few CSC electives (470 - Graphics, and CSC/MAT 320 - Numerical Methods). However, this does not justify requiring it versus other courses for those students who could instead make more appropriate choices.

4. Replacing required elective concentrations with a rule that at least three electives be from a list of department-approved 400-level project courses, using the same approval criteria applying to department capstones: A project-based course requires one or more software development projects that apply multiple concepts covered in the course, such that students (alone or in teams) are responsible for formulating some aspects of requirements, design, and implementation, and must complete presentations, demonstrations, and/or reports in addition to software. This change captures the intent of concentrations, but provides more flexibility and future-proofing as electives are introduced or discontinued. The current list of approved courses is: CSC 435, 444, 445, 454, 455, 459, 466, 480, 495. (CS BS students must also choose at least one upper-division elective satisfying Writing Across the Curriculum requirements.)
Course differences are underlined. Credits follow colons. The changes also allow some wording simplifications.

<table>
<thead>
<tr>
<th>old Computer Science BS (73-75 cr)</th>
<th>new Computer Science BS (73 cr)</th>
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<tbody>
<tr>
<td><strong>A. Core Requirements (22 cr)</strong></td>
<td><strong>A. Core Requirements (24 cr)</strong></td>
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<tr>
<td>● CSC 212 - Principles of Programming:3</td>
<td>● CSC 212 - Principles of Programming:3</td>
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<td>● CSC 221 - Foundations of Computer Science:3</td>
<td>● CSC 221 - Foundations of Computer Science:3</td>
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<tr>
<td>● CSC 241 - Abstract Data Types and Programming Methodology:3</td>
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<td>● ISC 300 - Ethics and Policy in the Digital Age:3</td>
<td>● ISC 300 - Ethics and Policy in the Digital Age:3</td>
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<td>● CSC 322 - Systems Programming:3</td>
<td>● CSC 322 - Systems Programming:3</td>
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<td>● CSC 344 - Programming Languages:3</td>
<td>● CSC 344 - Programming Languages:3</td>
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<td>● CSC 365 - Data Structures and Algorithms:3</td>
<td>● CSC 365 - Data Structures and Algorithms:3</td>
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<td>● CSC 380 - Software Engineering:3</td>
<td>● CSC 380 - Software Engineering:3</td>
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<tr>
<td><strong>B. Elective Requirements (21 cr)</strong></td>
<td><strong>B. Elective Requirements (18 cr)</strong></td>
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<tr>
<td>● Select Computer Science Department courses at the 300- or 400-level, under advisement, including a 12 cr concentration approved by the department.</td>
<td>● Select Computer Science Department courses at the 300- or 400-level, under advisement, including at least three department-approved 400-level project-based courses, and at least one approved Writing course.</td>
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<td><strong>C. Cognate Requirements (30-32 cr)</strong></td>
<td><strong>C. Cognate Requirements (31 cr)</strong></td>
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<tr>
<td>● MAT 210 - Calculus I:4</td>
<td>● MAT 210 - Calculus I:4</td>
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<td>● MAT 220 - Calculus II:4</td>
<td>● MAT 220 - Calculus II:4</td>
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<tr>
<td>● MAT 215 - Introduction to Discrete Mathematics:3</td>
<td>● MAT 215 - Introduction to Discrete Mathematics:3</td>
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<td>● MAT 230 - Matrix Algebra:3</td>
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- Select one of the following courses:
  - MAT 240 - Multivariable Calculus: 4
  - MAT 318 - Statistics in the Sciences: 3
  - MAT 354 - Mathematical Statistics A: 3

- Select six credit hours in Natural Sciences different from the following sequence choice

- Select one sequence from the following:
  - Sequence 1:
    - PHY 111 - College Physics I: 4
    - PHY 212 - College Physics II: 4
  - Sequence 2:
    - PHY 112 - General University Physics I: 4
    - PHY 213 - General University Physics II: 4
  - Sequence 3:
    - CHE 111 - General Chemistry: 4
    - CHE 212 - General Chemistry II: 4
  - Sequence 4:
    - BIO 120 - Molecular and Cellular Foundations: 4
    - One 300-level BIO course, under advisement: 4

Note: A C-or better must be earned in all core and cognate courses.

- Select one of the following courses:
  - MAT 318 - Statistics in the Sciences
  - MAT 354 - Mathematical Statistics A

- Select nine credit hours in Mathematics or Natural Sciences different from the following sequence choice

- Select one sequence from the following:
  - Sequence 1:
    - PHY 111 - College Physics I: 4
    - PHY 212 - College Physics II: 4
  - Sequence 2:
    - PHY 112 - General University Physics I: 4
    - PHY 213 - General University Physics II: 4
  - Sequence 3:
    - CHE 111 - General Chemistry: 4
    - CHE 212 - General Chemistry II: 4
  - Sequence 4:
    - BIO 120 - Molecular and Cellular Foundations: 4
    - One 300-level BIO course, under advisement: 4

Note: A C-or better must be earned in all core and cognate courses.