CQI Report: Systems, Spring 2025

Submitted by:
Shirley Moore, Chair
Eric Freudenthal
Christoph Lauter
Deepak Tosh
Nigel Ward

1 Subcommittee Information

The following courses are part of this report. A course may have several sections and instructors.

Subcommittee CS Courses	CRN number	Instructor name
CS 3432	23717	Shirley Moore
CS 3432	22724	Eric Freudenthal
CS 3432	26954	Christoph Lauter
CS 4375	23426	Nigel Ward
CS 4375	26938	Deepak Tosh
CS 4375	23719	Eric Freudenthal
CS 4175	23419	Shirley Moore

Report date: 06/03/2025
Faculty meeting presentation date: 05/30/2025

2 Summary

The three required systems courses for undergraduate computer science majors are the following:

- CS 3432: Computer Organization
- CS 4375: Operating Systems Concepts
- CS 4175: Parallel Computing

CS3432 and CS4375 have been required courses for decades. CS4175 is a fairly new course that was added as a required course starting in Fall 2021 to address parallelism outcomes that were not previously covered. CS3432 is 4 credits and meets as a 3 contact hour lecture section and an associated 3 contact hour lab section, with the lab section focusing on hands-on learning and programming exercises. CS4375 and CS4175 do not have lab sections, but programming assignments are generally given as homework assignments. CS3432 lab assignments use both C and assembly language (e.g., MIPS, RISC-V, MSP430). CS4375 has been taught using either C or Python, and programming exercises have varied from using OS facilities, e.g., system calls, to modifying or writing kernel code. CS4175 has been taught using a variety of Python, C, C++, Pthreads, OpenMP, and MPI, and programming exercises have carried out either on the students' laptops or on an educational supercomputer allocation. Although the courses are taught in various ways, all instructors for a course use and evaluate the same set of learning outcomes, although they may add additional advanced outcomes as time and student progress permit.

Evidence collection for this assessment took place during the Spring 2025 semester. The report was presented to the CS faculty on 05/30/2025. The committee discussed the report further and agreed on the final version which was submitted to the CS faculty to vote on approval on 06/03/2025.

Links to the individual course reports are provided at the end of this document. We summarize the findings as follows:

- CS3432: There were three sections assessed with final enrollments of 57 (Moore), 24 (Freudenthal), and 59 (Lauter). A grade of C or better is required to not have to repeat CS3432. Almost all outcomes that were assessed were met in all sections on at least one assessment instrument. The outcomes that were not met in one or more sections were HSI1, HSI2, HSI3, HSI5, HSI7, HSI8, NR2, NR4, NR6, and T1. NR2 and NR4 are clerical in nature and students are prone to make mistakes.
- CS4375: Based on the course report for the section taught by Ward, of the 29 course outcomes, 23 were met, and 6 were not met (8, 13, 17, 19, 25, and 29). Of the 50 students who remained enrolled in this section and took the final exam, 44 passed (A grade of D or better is required to pass), and 40 earned a grade of C or better. Based on the course report for the section taught by Tosh, of the 29 course outcomes, 25 were met and 4 were not met (12, 17, 25, 26). Of the 60 students who remained enrolled and took the final exam, 55/60, or 91.6% passed with a grade of D or better, and 53 earned a grade of C or better. Based on the course report for the section taught by Freudenthal, 25 were achieved, three were not achieved (1, 24, 27) and one was not assessed (12). Of the 21 students who remained enrolled in the course, 20 passed.
- CS4175: There was one section of the course taught by Moore with a final enrollment of 146. Of the 29 learning outcomes, 24 were met, 1 (2g) was not met, and 4 are deprecated in the new outcomes and were not taught or assessed, especially since the 29 outcomes are too many for a 1-credit course. Of the students who remained enrolled in the class and took the final exam, 141/146, or 97%, passed.

2.1 Reflection on previous report recommendations and actions taken

- Assess all required outcomes formally and quantitatively. Especially in CS3432, some outcomes were either not assessed or were assessed only informally during class discussion, making it difficult to know how well these outcomes were achieved.

  Action taken: Only a few outcomes were not assessed this cycle. Some outcomes were not assessed because they were deprecated in the new outcomes from the Spring 2023 report that however were not approved until spring 2025. Some outcomes were not assessed in CS4175 because they were deprecated and 29 outcomes is too many for a 1-credit course.

- Cap enrollment in CS4375 at 40 or add more TA support and adapt teaching strategy to larger sections. With only a single instructor and a single TA and no lab session, it is difficult to provide the individual attention that students need.

  Action taken: The CS4375 enrollment could not be capped at 40 due to growing undergraduate enrollment and the lack of availability of additional instructors. However, one of the sections had low enrollment, and we recommend that enrollment between the sections be better balanced if possible. An additional TA was not possible because of limited TA resources.

- Focus on improved teaching for outcomes that were not met. Strategies could include calling on students individually during class, relying less on multiple-choice questions, and conducting individual coaching sessions.

  Action taken: Instructors and TAs called on students during class and one instructor had his TAs conduct individual coaching sessions. Unfortunately, due to the large enrollment in the classes and inadequate TA/IA support for some courses and sections, some instructors had to continue using mostly multiple-choice questions on tests.

- For CS4375, continue looking for better readings on networking and security.

Action Taken: Still looking for focused readings on networking. One instructor supplemented with videos but said quite a few students didn't watch them.

- For CS4175, go into sufficient depth in teaching concurrency topics since students find these to be difficult.

  Action taken: In-depth learning activities were conducted on concurrency topics, and achievement of concurrency-related outcomes improved.

- For CS4375, investigate why reported achievement of learning outcomes and grade distributions vary across the different sections.

  Action taken: This investigation was not done. However grade distribution diOerences between the sections were less pronounced this cycle.

2.2 Recommendations for this cycle that do not require department approval

- Transition from the old CS4375 and CS4175 courses to the new CS4475 course. Because of the deadline for catalog changes, the new CS4475 course will not appear until the 20262027 catalog and even after that students who entered under older catalogs may still need CS4375 or CS4175 if they have taken one but not the other. We recommend that the systems faculty meet and come up with a set of transitional outcomes for CS4375 and CS4175 in the meantime. We also recommend that students be steered towards taking the new CS4475 course as soon as it becomes available so that we can phase out CS4375 and CS4175 as soon as possible.
- Address the attendance problem. A significant number of students quit attending class or attend only sporadically, and these students often fail the class. This problem is noted in the CS3432, CS4375, and CS4175 individual course reports. In-class quizzes can be problematic because they take time away from class, especially since the class usually has CASS students who require time and a half. Also, some students still skip class even when in-class quizzes are given and counted towards their grade. We recommend that systems faculty discuss this issue and come up with strategies for increasing attendance.
- Address the problem of students using generative AI to do assignments. It is up to the individual instructor whether and to what extent to allow students to use generative AI. Instructors should state clearly in their syllabi their policy on use of AI. We recommend that systems faculty discuss this issue and come up with strategies for countering use of AI in ways that reduce student learning. Such strategies may include in-person demos of assignments and whiteboard coding during lab sessions.
- Investigate strategies for balancing enrollment across diOerent sections of the courses. If there are fewer total students needing to take a course, it may be possible to cap enrollment for each section of CS3432 and CS4375 at a lower number than the current 60.
- The challenge of teaching students to program in C in CS 3432 does not stem from the intricacies of the C programming language but from the students' general inability to develop simple algorithms and to express them in an imperative programming language. It

is recommended to engage in a meaningful discussion with the fundamentals CQI committee to address this point.

2.3 Recommendations for this cycle that require departmental approval (e.g., changes in outcomes)

An extensive set of recommendation and changes from the Spring 2023 Systems CQI report were finally approved in spring of 2025. We will proceed with implementing these changes, and no further changes are being recommended at this time.

3 Individual CS Course Outcomes Reports