

**Student Outcomes Assessment and Success Report AY2020-21** *Consult with your college dean's office regarding due date and how to submit. Deans will submit reports to the Office of Assessment & Accreditation annually by October 15.*

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**Part 1a: Summary of Student Learning Outcomes Assessment**

**NOTE: If data is missing due to COVID-19 transition issues, please describe these issues, their impact on your ability to assess student learning, and what, if anything, will change as a result.**

*Rating scale used for all assessed items: 3 Fully mastered, 2 Mostly mastered, 1 Somewhat mastered, 0 No or little mastery.*

*Covid impact on data collection – covid has impacted everything, including data collection. Due to higher workload overall, there has been a lower than normal completion of assessment tasks.*

*Additional notes – this is the first year of data collection using a revised list of learning outcomes, revised method of data collection, and revised major. It is likely there will be moderate revisions to all of these after discussing this preliminary data. We will also be discussing sequencing of topics in the revised major; the outcomes library will help with that discussion.*

a. What learning outcomes did you assess this past year? If this is a graduate program, identify the Graduate Student Learning Outcome each outcome aligns with.	b. (1) What assignments or activities did you use to determine how well your students attained the outcome? (2) In what course or other required experience did the assessment occur?	c. What were your expectations for student performance?	d. What were the actual data/results?	e. What changes or improvements were made or will be made in response to these assessment results or feedback from previous year's report? Can expand on this in Part 2.
1.A.i Can write and debug correct programs for problems that are straightforward (do not need advanced algorithmic techniques) but may require any of the standard programming constructs.	CS151 -final project assessment, which is out of 100 pts. Students will be rated as 90-100%:fully mastered, 75%-90%: most mastered, 30-75%: some mastery, 0-30% no mastery.	Average is at or above "mostly mastered" (2 in our rating scale), in particular in 300/400 level courses.	Average rating in course of 1.69444444444444	To be discussed in fall 2021 along with sequencing of topics in courses.
1.B.i Can program proficiently in the following programming paradigm - Imperative.	CS151 -final project assessment, which is out of 100 pts. Students will be rated as 90-100%:fully mastered, 75%-90%: most mastered, 30-75%: some mastery, 0-30% no mastery. Also asked on exit survey.	Average is at or above "mostly mastered" (2 in our rating scale), in particular in 300/400 level courses.	Average rating in course of 1.69444444444444. Average rating on exit survey of 2.7.	To be discussed in fall 2021 along with sequencing of topics in courses.

<p>1.B.iv Can program proficiently in the following programming paradigm - Event-driven.</p>	<p>CS170 -final project assessment, which is out of 100 pts. Students will be rated as 90-100%:fully mastered, 75%-90%: most mastered, 30-75%: some mastery, 0-30% no mastery. CS479 - JavaScript assignment (3) – 9+ - Full mastery (3), 5-9 Mostly mastered(2), 1-5 – Some mastery(1), 0-1 No mastery(0).</p>	<p>Average is at or above "mostly mastered" (2 in our rating scale), in particular in 300/400 level courses.</p>	<p>Average rating in course of 1.95454545454545.</p>	<p>To be discussed in fall 2021 along with sequencing of topics in courses.</p>
<p>2.A.i Can use basic data structures (lists, stacks, queues, binary search trees, and hash tables ) in writing programs.</p>	<p>CS201 -final project assessment, which is out of 100 pts. Students will be rated as 90-100%:fully mastered, 75%-90%: most mastered, 30-75%: some mastery, 0-30% no mastery. CS202 - Programming assessment, which is out of 5 points. Take their highest programming assessment score, and rate them on this outcome as follows. 4.5-5 - fully mastered (3). 4 - mostly mastered (2). 1.5-3.5 - some mastery (1). 0-1 - no mastery.CS499- Combined quizzes: 17+ - Full mastery(3), 10+ Mostly mastered(2), 2+ Some mastery(1), 0-2 No mastery(0). Also asked on exit survey.</p>	<p>Average is at or above "mostly mastered" (2 in our rating scale), in particular in 300/400 level courses.</p>	<p>Average rating in course of 2.13846153846154. Average rating on exit survey of 1.7</p>	<p>To be discussed in fall 2021 along with sequencing of topics in courses.</p>
<p>2.A.ii Can use basic data structures (lists, stacks, queues, binary search trees, and hash tables ) and answer basic questions on efficiency of these data structures.</p>	<p>CS201 -lab project assessment, which is out of 100 pts. Students will be rated as 90-100%:fully mastered, 75%-90%: most mastered, 30-75%: some mastery, 0-30% no mastery. CS202 -Use scores on some questions from the final exam, and will rate them as follows. 90-100% - fully mastered, 75-90% - mostly mastered, 30-75 - some mastery, 0-30 no mastery. CS499- Mid-term interview: 3- Full mastery, 2 – Mostly mastered, 1 – Some mastery, 0 – no mastery. Also asked on exit survey.</p>	<p>Average is at or above "mostly mastered" (2 in our rating scale), in particular in 300/400 level courses.</p>	<p>Average rating in course of 1.83636363636364. Average rating on exit survey of 1.7</p>	<p>To be discussed in fall 2021 along with sequencing of topics in courses.</p>

2.B.i Can analyze the running time and correctness of standard algorithms which they have learned.	CS201 -lab project assessment, which is out of 100 pts. Students will be rated as 90-100%:fully mastered, 75%-90%: most mastered, 30-75%: some mastery, 0-30% no mastery.	Average is at or above "mostly mastered" (2 in our rating scale), in particular in 300/400 level courses.	Average rating in course of 1.94736842105263	To be discussed in fall 2021 along with sequencing of topics in courses.
2.B.ii Can answer basic questions and reason about Graphs.	CS458 -Use scores on some questions from the final exam, and will rate them as follows. 90-100% - fully mastered, 75-90% - mostly mastered, 30-75 - some mastery, 0-30 no mastery.	Average is at or above "mostly mastered" (2 in our rating scale), in particular in 300/400 level courses.	Average rating in course of 2.46153846153846	To be discussed in fall 2021 along with sequencing of topics in courses.
3.A.i Can explain the basic internal workings of computer systems, including both hardware and software.	CS351 -Final – A – Full mastery(3), B – Mostly mastered (2), D-C Some mastery(1), F – No mastery(0). Also asked on exit survey.	Average is at or above "mostly mastered" (2 in our rating scale), in particular in 300/400 level courses.	Average rating in course of 2. Average rating on exit survey of 2.	To be discussed in fall 2021 along with sequencing of topics in courses.
3.A.iii Can write correct assembly code for basic tasks.	CS351 -The maximum of either the fourth or fifth assignments, 9+ - Fully mastered(3), 5-9 Mostly mastered(2), 1-5 Some mastery(1), 0-1 No mastery (0). CS456 -Third assignment: 9+ - Fully mastered(3), 5-9 – Mostly mastered(2), 1-5 – some mastery, 0-1 No mastery (0).	Average is at or above "mostly mastered" (2 in our rating scale), in particular in 300/400 level courses.	Average rating in course of 2.03389830508475	To be discussed in fall 2021 along with sequencing of topics in courses.
3.A.iv Can explain operating system and file system design concepts.	CS471 -Final, A – Fully mastered(3), B – Mostly mastered(2), C-D Some mastery(1), F – No mastery(0).	Average is at or above "mostly mastered" (2 in our rating scale), in particular in 300/400 level courses.	Average rating in course of 1.63157894736842	To be discussed in fall 2021 along with sequencing of topics in courses.
3.B.ii Can explain how operating systems share the system resource of Memory among many processes, and tradeoffs between different approaches.	CS471 -Select questions from the Final, 9+ - Full mastery(3), 5-9 Mostly mastered(2), 1-5 Some mastery(1), 0-1 No mastery(0).	Average is at or above "mostly mastered" (2 in our rating scale), in particular in 300/400 level courses.	Average rating in course of 2.10526315789474	To be discussed in fall 2021 along with sequencing of topics in courses.
3.B.iii Can explain how operating systems share the system resource of Long-term storage among many processes, and tradeoffs between different approaches.	CS471 -Maximum of assignment 7A/7B- 9+ Fully mastered(3), 5-9 Mostly mastered(2), 1-5 Some mastery(1), 0-1 No mastery(0).	Average is at or above "mostly mastered" (2 in our rating scale), in particular in 300/400 level courses.	Average rating in course of 2.05263157894737	To be discussed in fall 2021 along with sequencing of topics in courses.

3.B.iv Can write operating system code for a full-featured operating system.	CS471 -Maximum of assignments 6, 7A or 7B – 9+ Fully mastered(3), 5-9 Mostly mastered(2), 1-5 Some mastery(1), 0-1 No mastery(0).	Average is at or above "mostly mastered" (2 in our rating scale), in particular in 300/400 level courses.	Average rating in course of 2.57894736842105	To be discussed in fall 2021 along with sequencing of topics in courses.
3.B.v Can write code properly using system calls.	CS456 -First assignment, 9+ Fully mastered (3), 5-9 Mostly mastered (2), 1-5 some mastery(1), 0-1 No mastery (0).	Average is at or above "mostly mastered" (2 in our rating scale), in particular in 300/400 level courses.	Average rating in course of 1.91666666666667	To be discussed in fall 2021 along with sequencing of topics in courses.
3.B.vi Can write code for parsing network protocols and for implementing networked programs.	CS473 -Average of programming HW assignments. 85%+ fully mastered, 70%+ mostly mastered, 30%+ somewhat, < 40 none.	Average is at or above "mostly mastered" (2 in our rating scale), in particular in 300/400 level courses.	Average rating in course of 1.5	To be discussed in fall 2021 along with sequencing of topics in courses.
3.B.vii Can explain how data is packaged in various network protocols, and implications for reliability, security, and efficiency.	CSS 210 -Score on quiz, rated as follows. 90-100% - fully mastered(3), 75-90% - mostly mastered(2), 30-75 - some mastery(1), 0-30 no mastery(0). CS473 -Exam question. 90%+ fully mastered, 70%+ mostly, 30%+ somewhat, else none..	Average is at or above "mostly mastered" (2 in our rating scale), in particular in 300/400 level courses.	Average rating in course of 1.4375	To be discussed in fall 2021 along with sequencing of topics in courses.
3.B.viii Can use program translation tools to build programming languages.	CS456 -7th and 8th assignments combined – 15+ - Fully mastered (3), 10+ - Mostly mastered (2), 5+ - Some mastery (1) 0-4 No mastery (0).	Average is at or above "mostly mastered" (2 in our rating scale), in particular in 300/400 level courses.	Average rating in course of 1.08333333333333	To be discussed in fall 2021 along with sequencing of topics in courses.
3.C.iii Proficient at programming in Networking.	CS473 -Average of programming HW assignments. 85%+ fully mastered, 70%+ mostly mastered, 30%+ somewhat, < 40 none.	Average is at or above "mostly mastered" (2 in our rating scale), in particular in 300/400 level courses.	Average rating in course of 1.82352941176471	To be discussed in fall 2021 along with sequencing of topics in courses.
3.C.iv Proficient at programming in Advanced system administration.	CS469 - Maximum of bash assignments 5 or 6, 9+ - Full mastery(3), 5-9 – Mostly mastered(2), 1-5 Some mastery(1), 0-1 No mastery(0)	Average is at or above "mostly mastered" (2 in our rating scale), in particular in 300/400 level courses.	Average rating in course of 2.375	To be discussed in fall 2021 along with sequencing of topics in courses.

3.D.viii Can apply the standard algorithm technique of Dynamic programming. Proficient at programming and algorithms analysis using this technique.	CS458 -Programming assignment using DP algorithms, give rating of full mastery if > 9/12, mostly mastered > 7/12, some mastery > 4/12, no mastery if <= 4/12.	Average is at or above "mostly mastered" (2 in our rating scale), in particular in 300/400 level courses.	Average rating in course of 1.69230769230769	To be discussed in fall 2021 along with sequencing of topics in courses.
3.D.x Proficient at programming and using basic graph algorithms such as those for shortest path and minimum spanning trees.	CS458 -Use scores on some questions from the final exam, and will rate them as follows. 90-100% - fully mastered, 75-90% - mostly mastered, 30-75 - some mastery, 0-30 no mastery.	Average is at or above "mostly mastered" (2 in our rating scale), in particular in 300/400 level courses.	Average rating in course of 2.15384615384615	To be discussed in fall 2021 along with sequencing of topics in courses.

Note: *If you would like to report on more than three outcomes, place the cursor in the last cell on the right and hit "tab" to add a new row.*

#### Helpful Hints for Completing this Table

- Use your outcomes library as a reference. Note any alignment with professional standards, as applicable.
- Each outcome should be assessed by at least one direct measure (project, practica, exam, performance, etc.). If students are required to pass an examination to practice in the field, this exam should be included as one of the measures. At least one of the program's outcomes must use an indirect measure (exit interview, focus group, survey, etc.). Use your curriculum map to correlate outcomes to courses. Describe or attach any evaluation tools such as rubrics, scales, etc.
- Identify the score or rating required to demonstrate proficiency (e.g., Students must attain a score of "3" to be deemed proficient; at least 80% of students in the program will attain this benchmark.)
- Note what the aggregate level of proficiency actually was and the number of students included in the cohort or sample (e.g., 85% of the 25 students whose portfolios were reviewed met the established benchmark).

### Part 1b: Review of Student Success Data & Activities

Use [Blue Reports](#) to generate the following information (as well as any other information helpful to you). A dashboard has been created in the Chairs view:

- Cohort Sizes
- Year-to-Year Retention
- 5-Year Graduation Rate (undergraduate); Average time to completion (graduate)

<b>Cohort sizes</b>	<i>Computer Science BS (3023)</i>
<i>Fall 2017</i>	131
<i>Fall 2018</i>	118
<i>Fall 2019</i>	110
<i>Fall 2020</i>	112

Cohort sizes have remained fairly stable the past few years.

<b>Year-Year Retention</b>	<i>College of Arts &amp; Sciences</i>	<i>Computer Science BS (3023)</i>

Fall 2014	Cohort Total	828	24
	Cohort Retention %	0.6389	0.5417
Fall 2015	Cohort Total	871	39
	Cohort Retention %	0.6452	0.7436
Fall 2016	Cohort Total	809	40
	Cohort Retention %	0.6811	0.7
Fall 2017	Cohort Total	851	61
	Cohort Retention %	0.6204	0.4918
Fall 2018	Cohort Total	816	41
	Cohort Retention %	0.6716	0.6098
Fall 2019	Cohort Total	641	37
	Cohort Retention %	0.7005	0.5405
Fall 2020	Cohort Total	653	33
	Cohort Retention %	0.608	0.6061

The CS major has always had high variability in terms of the rates of entering students that stay in the major. The retention rates are highly variable, so it takes many many years to see whether there is a particular pattern or not.

<b>5 Year Graduation</b>		College of Arts & Sciences	Computer Science BS (3023)
<i>Fall 2010</i>	Cohort Total	808	20
	Cohort Graduation %	0.3601	0.35
<i>Fall 2011</i>	Cohort Total	780	18
	Cohort Graduation %	0.3936	0.3333
<i>Fall 2012</i>	Cohort Total	824	20
	Cohort Graduation %	0.3786	0.25
<i>Fall 2013</i>	Cohort Total	839	23
	Cohort Graduation %	0.3647	0.5217
<i>Fall 2014</i>	Cohort Total	828	24
	Cohort Graduation %	0.3684	0.1667
<i>Fall 2015</i>	Cohort Total	871	39
	Cohort Graduation %	0.4087	0.3846

We see similar issues with graduation rates as we do with retention – it is highly variable for the computer science major. We have not been able to identify anything in particular that was better or worse in any of the years that were particularly good or bad.

*What worked well in supporting student success this year?*

The need to deliver content online due to covid has had both negative and positive impacts, on both students and faculty. On the positive side, since we now know how to do courses online we have decided to make our programs available via distance (which gives additional flexibility to campus students as well). On the negative side, student performance in early courses seemed to be even more bimodal than normal in the past year.

*What are the most significant opportunities for improvement upon which to focus in the coming year?*

A fairly major revision to the major became active last year, but really only starts to have an impact this year. We need to discuss and decide on topic sequencing in some of the courses. The assessment pieces are an important part of these discussions.

## **Part 2: Continuous Quality Improvement**

***Reflect on the information shared above regarding student learning, success, and career readiness. In no more than one page, summarize:***

- 1) the discoveries assessment and data review have enabled you to make about student learning, success, and career readiness (ex: What specifically do students know and do well—and less well? What evidence can you provide that learning is improving? How might learning, success, and career readiness overlap? What questions do your findings raise?)***
- 2) findings-based plans and actions intended to improve student learning and/or success (expansion of Part 1a, box e as needed)***
- 3) what your assessment plan will focus on in the coming year***
- 4) how this information will be shared with other stakeholders***

We are really at the beginning of the assessment cycle for the computer science BS. The major was revised to add a new concentration (data science) and change how the core sequence of courses leads into the different concentrations. The outcomes library was updated to have more specific outcomes that should be more easily directly assessed. The assessment plan was changed so that assessment data would be collected in courses throughout the major by most of the faculty (as opposed to having students take the MFT just prior to graduation). Once we have this working well we should have better quality data that is more specific and at multiple points of their studies.

As of fall 2021, we are at the stage of collecting data for one year and having some initial feedback from faculty on the whole process. The following are some initial suggestions from faculty after having gone through the process once.

1. Changes to which outcomes are contained in which courses. The sequencing of courses has been changed to be: CS 101 Fundamentals of Computing -> CS 151 Intro to CS -> CS 201 Programming Structures -> CS 303 Discrete Structures and Computing Theory and CS 351 Computer Organization. CS 202 Data Structures and Algorithms is now not required for the Information Science Concentration. Some discussion has begun about CS 202 focusing more on theory/algorithms and less on programming.
2. Changes to the outcomes themselves. Some of the outcomes are not worded in a way that lines up well with what is happening in the courses. The outcomes were written down mostly by one faculty member, so having some changes based on what is happening in the courses makes sense.
3. Reminders at the right time of the semester to collect data.
4. Organize outcomes and data to be more useful. In particular, put all of this into a database to make it easier to answer questions about which students have mastered which skills.

5. Define different levels of “acceptable” for students finishing the program. In particular, some students will have good skills in one particular area (e.g., web programming) but not meeting expectations in other areas (e.g., computer systems or algorithms), which may be sufficient for getting the job they want.
6. Differentiate (or not) “acceptable” levels for students who are not majoring or minoring in computer science. CS has a high rate of students taking beginning courses who do not end up being CS majors in the end. Beginning courses thus have a high rate of students who end up deciding not to continue the major, and these students often do not do well on the assessment. But we might identify some key outcomes that all students should meet, whether or not they will continue with the major.