COMPUTER SCIENCE

ST-CSCI-BA
Faculty:

Student Learning Outcomes

SLO Count: 6

Name	Content
SLO 1: Software &Algorithms	1: Can design, write, &test efficient sw algorithms
SLO 2: System Software Design	2: Can apply knowledge of computer hw &system sw to design reliable &efficient sw systems
SLO 3: Math for Problem Solving	3: Can apply math concepts to problem solving
SLO 4: Problem Solving Techniques &Tools	4: Can learn, evaluate, &apply new problem solving techniques &tools
SLO 5: Problem Solving Across Domains	5: Can learn new problem solving strategies and transfer them from one problem domain to another
SLO 6: Preparation for Career	6: Can do well in Industry or Research (alone, and on a team)

Does this program have specialized accreditation?
No

Assessment Activities and Results

Assessment Activity Count: 4

Assessment Activity: Computer Science Capstone Student Survey

Please provide a brief name for this assessment activity.	Computer Science Capstone Student Survey
Describe the assessment method used to assess the learning outcome(s). Provide enough detail so that we understand the nature of the project.	We conduct indirect assessment through a survey issued to students who have completed CIS 3238 Software Design, which is the first course in the computer science capstone sequence. The survey uses a 5 point scale, with 1 representing strongly disagree and 5 representing strongly agree. The survey includes questions related to the following SLOs: Software and Algorithms, Software System Design, Problem Solving Tools and Techniques, and Preparation for Career.

What were the findings from this assessment?	Our response rate to the student survey was incredibly low (9 responses to the student survey), so the results are not statistically significant and, therefore, it is not possible to draw broad conclusions. Nevertheless, we include a summary of student responses below. SLO 1: Can design, write, &test efficient software algorithms: 7 out of 8 students responding to the survey strongly agreed or agreed that they are able to design, write, and test efficient algorithms as a result of their instruction in the CS capstone course and previous CIS courses. SLO 2: Can apply knowledge of computer hardware &system software to design reliable &efficient software systems: 7 out of 9 students responding to the survey strongly agreed or agreed that they perceived that they were able to apply their knowledge of hardware and operating systems in order to design reliable and efficient software systems. SLO 4: Can evaluate and apply new tools and techniques to problem solving: From these responses, 6/9 students strongly agreed that they perceived that they were able to apply their new tools and techniques to solve problems. The remaining 3 students who completed the survey gave a neutral response. SLO 6: Can do well in Industry or Research (alone, and on a team): Overall, 88% of students that responded to the survey agreed or strongly agreed that the capstone course prepares them for success in an industry career or graduate study related to computing. Our survey included questions on specific areas of career and graduate study preparation. Overall, most of the BS CS students perceive that they gain in these areas of career and graduate study preparation through the capstone course. We see the strongest agreement and the most positive responses from students that the capstone course has resulted in an increase in their professional communication skills. We also included an open-ended response question that asks students to provide suggestions on how to improve the capstone course. One student mentioned the need to provide an equipment budget and process for ordering equipment to support capstone projects. Another mentioned that the program could help to better prepare students for industry careers if they had more experience working in teams on software projects throughout the curriculum, not just in the capstone course.

How are you using or planning to use the findings from this assessment for program improvement? Where applicable, give specific examples of changes you are making to the program as a result of your findings.	We are in the process of revising our curriculum and will integrate these findings into our planned update. Specifically, we plan to incorporate the use of modern software development tools (e.g., git for version control) and practices (e.g., test driven development) in our introductory courses. Currently our students often do not apply these practices or use these tools until they enter the capstone course; introducing them earlier in the curriculum will give students additional practice and should lead to improvements in proficiency. In addition, we are experimenting with new instructional techniques using groups for algorithmic problem solving in the CIS 3223 Data Structures and Algorithms course; the technique helps to teach students how to work in teams and critique a solution. We expect that students will have improved learning outcomes in data structures and algorithms content knowledge, as well as gain in skills related to professional preparation.

Assessment Activity: Computer Science Capstone Instructor Survey

Please provide a brief name for this assessment activity.	Computer Science Capstone Instructor Survey
Describe the assessment method used to assess the learning outcome(s). Provide enough detail so that we understand the nature of the project.	We conducted indirect assessment of several SLOs through a survey issued to the instructor who taught CIS 3238 Software Design, the first course in the computer science capstone sequence, in Fall 2016 and Spring 2017. The survey uses a 5 point scale, with 1 representing strongly disagree and 5 representing strongly agree. The survey includes questions related to the following SLOs: Software and Algorithms, Software System Design, Problem Solving Tools and Techniques, and Preparation for Career.

What were the findings from this assessment?	We asked the instructor to assess satisfaction of several SLOs at the entry into the CIS 3238 course (pre) and at the conclusion of CIS 3238 (post). [SLO1: Software and Algorithms] The instructor survey asked about student ability to design, write, and test efficient algorithms upon entry to the course and completion of the course. The single instructor that completed the instructor survey gave a rating of 2 (disagree) that students had this knowledge and skill upon entry to the CIS 4398 capstone course. The same instructor gave a rating of 4 (agree) that students had this knowledge and skill upon completion of the capstone course. [SLO2: Software System Design]: The instructor survey asked about student ability to apply knowledge of hardware and operating systems to design reliable, efficient software systems upon entry to the course and completion of the course. The single instructor that completed the instructor survey gave a rating of 3 (neutral) that students had this knowledge and skill upon entry to the CIS 4398 capstone course. The same instructor gave a rating of 5 (strongly agree) that students had this knowledge and skill upon completion of the capstone course. [SLO4: Problem Solving Tools and Techniques]: The single instructor that completed the instructor survey gave a rating of 4 (agree) that students had this knowledge and skill upon entry to the CIS 4398 capstone course. The same instructor gave a rating of 5 (strongly agree) that students had this knowledge and skill upon completion of the capstone course. [SLO 6: Preparation for Career]: The instructor indicated that not enough of students (less than 70%) have the skills that they need to be successful in an industry career or graduate program in computing upon entry to the capstone course. The instructor indicated that 80-90% of students leave the capstone course with the skills they need to be successful in a computing profession or graduate program. In addition, we asked the instructor to give feedback on how we can better prepare our students to be successful for future careers in computing. The instructor noted that students that have had internships significantly outperform those who have not in the capstone course and are more likely to be successful in their post-graduation careers. The instructor also noted that students should be introduced to industry-standard practices (e.g., agile development) in our curriculum. The instructor also noted that the students seem to lack an understanding of software architecture and how to assess and select the most appropriate design for a software system.

How are you using or planning to use the findings from this assessment for program improvement? Where applicable, give specific examples of changes you are making to the program as a result of your findings.	We are currently in the process of revising the curriculum and will use this feedback to revise the capstone course. In particular, additional lectures and assignments on software design patterns and reasoning among alternative designs will be introduced.

Assessment Activity: CIS Faculty Survey on Student Knowledge/Skill Gaps

Please provide a brief name for this assessment activity.	CIS Faculty Survey on Student Knowledge/Skill Gaps
Describe the assessment method used to assess the learning outcome(s). Provide enough detail so that we understand the nature of the project.	We issued a survey to the entire CIS faculty. For each of our student learning objectives, we asked faculty to identify particular knowledge and skill gaps related to the learning objective that students have upon entry to a specific course that the faculty member teachers.
What were the findings from this assessment?	[SLO1: Algorithms] Faculty suggested the following areas of improvement related to algorithm knowledge/skills for our students: oStudents should be better prepared to use iterative development, testing, and debugging techniques when implementing algorithm assignments oStudents should be better prepared to plan ahead and design a solution before implementing an algorithm oStudent should be better prepared in terms of programming skills [SLO6: Career Preparation] Faculty suggested the following areas of improvement related to career/graduate school preparation for our students: oStudents should be better able to present their code/design/implementations to others oStudents should be able to work together to solve problems in a team. oStudents would benefit from the experience of internships. oStudents need more knowledge of version control and remote storage for source code. oStudents should be better able to write large scale programs.

How are you using or planning to use the findings from this assessment for program improvement? Where applicable, give specific examples of changes you are making to the program as a result of your findings.	We are currently in the process of revising our curriculum. A key part of the revision is to extend the introductory course sequence from 2 courses to 3 courses, in order to allow for additional coverage of computer science topics and to allow for instructors to integrated the use of iterative development, testing, and debugging techniques as core elements in each of those courses. In addition, we are currently experimenting with a new instructional technique in our CIS 3223 Data Structures and Algorithms course in which students work in groups to solve algorithmic problems and to critique solutions; we believe this approach is a promising step in providing students with additional experience in working in teams and will also provide additional practice in presenting software design/code to others.

Assessment Activity: Algorithms Knowledge Test

Please provide a brief name for this assessment activity.	Algorithms Knowledge Test
Describe the assessment method used to assess the learning outcome(s). Provide enough detail so that we understand the nature of the project.	We conduct direct assessment for these SLOs, reviewing student performance on exam questions in CIS 3223 Data Structures and Algorithms. We identified questions on the final exam that directly relate to SLO1: Software &Algorithms and SLO3: Math for Problem Solving and apply a rubric to evaluate student proficiency. We assess exams for 41 students enrolled in a CIS 3223 course section in Spring 2016.

What were the findings from this assessment?	[SLO1] For SLO1, we identify an exam question that asks students to a) compute the sum of degrees of a node's neighbors in an example undirected graph and b) describe an algorithm to compute the sum of degrees of a node's neighbors in an arbitrary undirected graph. We assess student responses as satisfactory or not satisfactory for part a, which demonstrates their ability to apply and test an algorithm. 73% of students demonstrated satisfactory performance in applying and testing an algorithm. Our rubric assesses student responses as: can correctly design and implement an algorithm (3 points), can design and implement algorithm with minor issues (2 points), can design and implement algorithm with major issues (1 point), cannot design and implement an algorithm (0 points). On this 3 point scale, a “satisfactory” score is 1.5 or above and a “non satisfactory” score is less than 1.5. The average score for the 41 students evaluated was 1.5; 49% of the students demonstrated satisfactory performance in designing and implementing an algorithm. [SLO 3] For SLO 3, we identify an exam question that relates to the ability to use math concepts to solve computer science problems. The question asks students to use a particular method to determine an algorithm’s runtime. We assess student responses as correct (3 points), partially correct (1 point), or not satisfactory (0 points). The average student score was 2.59 points, which is well above the average score.
How are you using or planning to use the findings from this assessment for program improvement? Where applicable, give specific examples of changes you are making to the program as a result of your findings.	The majority of students can satisfactorily apply algorithms and apply math concepts to solve problems in the computing discipline. It appears that approximately half struggle to design and implement them; however, this assessment is conducted using a single question in an exam setting with a fixed time duration. It can be difficult to design an algorithm in such settings. As such, we plan to further explore our students’ proficiency in designing algorithms through other direct assessment methods in the future; specifically, we will conduct direct assessment using student homework and programming assignments.

Planned Assessment

Direct Assessment Activities

corresponding ID	Assessment Name	corresponding ID	Assessment Name
1	Portfolio	2	Practicum, Internship, Other Field Placement
3	Clinical Evaluations	4	Student Work in Capstone WITH Rubric
5	Student Work in Capstone WITHOUT Rubric	6	Student Work WITH Rubric in 1 or More Courses
7	Student Work WITHOUT Rubric in 1 or More Courses	8	Final Paper, Thesis, or Dissertation
9	National or Board Exam	10	Local Test or Exam
11	Juried Show, Performance, or Critique	12	Oral Presentation
13	Design Project	14	Group Project or Demonstration
15	Journal	16	Other

SLO	None	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SLO 1: Software &Algorithms					X		X										

SLO 2: System Software Design							X										
SLO 3: Math for Problem Solving							X										
SLO 4: Problem Solving Techniques &Tools	X																
SLO 5: Problem Solving Across Domains	X																

SLO 6: Preparation for Career					X												

Indirect Assessment Activities

SLO	None	Current Student Survey	Graduating Student Survey	Alumni Survey	Employer Survey	Focus Groups	SFFs	Other
SLO 1: Software &Algorithms			X					
SLO 2: System Software Design			X					
SLO 3: Math for Problem Solving			X					
SLO 4: Problem Solving Techniques &Tools			X					

SLO 5: Problem Solving Across Domains			X					
SLO 6: Preparation for Career			X		X			