BS in Computer Science
Program Assessment Report for Year 2017

Assessment Committee
Spring 2018

Dear BSCS program stakeholders,
In our efforts to continually improve the BSCS program for our students, the CS faculty have been dedicating time and effort to understanding our students' performance across the entire program. For 2017 assessment Cycle, the CS faculty collected data on five program educational objectives of the BSCS program:

1. Students will be able to apply the principles of computer science, mathematics, and scientific investigation to solve real-world problems appropriate to the discipline.
2. Students will have lifelong learning skills, which will allow them to successfully adapt to evolving technologies throughout their professional careers.
3. Students are sufficiently prepared for employment and advanced studies, and will have significant experiences with complex software development for real-world problems.
4. Students will have sufficient teamwork, communication, and interpersonal skills to enable them to work with others effectively in their professional careers.
5. Students can function ethically and responsibly, and are conscious of ethical, social, global, legal, security and professional issues related to computing.

These objectives reflect our BSCS program mission:

> The mission of the Computer Science B.S. program is to provide undergraduate students with a strong foundation in both Computer Science theory and programming practice that is necessary to solve real-world engineering problems. Through the use of state of the art software and hardware students will learn to develop their theoretical and programming skills in order to allow them to apply these learned techniques to analyze a problem, evaluate possible solutions, and create a solution as part of a program development team. The program prepares students for engineering careers in software design, intelligent systems, big data systems and analytics, computer systems and network design, software system security, and bioinformatics. Graduates will be prepared to take positions in these areas in academia, industry and government, the local community, and will be prepared future for graduate studies in Computer Science as well. In addition the program provides students with opportunities to interact with other professional institutions and exhibit the highest ethical standards in the practice of their profession.

Information about our program's success at helping students to achieve these goals comes from Homework's, Exams, Quizzes, Projects, Presentations, Papers, etc. assigned to our CS students in upper level CS courses in which Introduce, Development, and Mastery of the outcome are expected. Our CS faculty collected these assignments as part of normal class requirements each term. The CS faculty use course learning outcomes (CLOs) grading rubric. The CLOs are mapped to the program learning outcomes listed above thru ABET student outcomes (a-k):

a. An ability to apply knowledge of computing and mathematics appropriate to the discipline.

b. An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.
c. An ability to design, implement and evaluate a realistic computer-based system, process, component, or program to meet desired needs.
d. An ability to function effectively on teams to accomplish a common goal.
e. An understanding of professional, ethical, legal, security, and social issues and responsibilities.
f. An ability to communicate effectively with a range of audiences.
g. An ability to analyze the local and global impact of computing on individuals, organizations and society.
h. Recognition of the need for, and an ability to engage in, continuing professional development.
i. An ability to use current techniques, skills, and tools necessary for computing practices.
j. An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.
k. An ability to apply design and development principles in the construction of software systems of varying complexity.

These students outcomes are related to the knowledge, skills, and behaviors that students acquire as they progress through the program. The mapping is important to our program as the CS department prepare for ABET accreditation in Fall 18.
Scores of each grading rubric for these assignments will serve as the data for this assessment. Because the points possible may vary across classes, all scores will be reported as a percentage for the purposes of program assessment. We defined four levels of performance: ⟨1⟩ Inadequate, ⟨2⟩ Approaches Standard, ⟨3⟩ Meets Standard, and ⟨4⟩ Exceeds Standard. In evaluating course rubric the bar is set at the level of Meets Standard or Exceeds Standard. For each course rubric, if the percentage of meeting standard or exceeding standard is 70% or more, the targeted objective is met.
Unlike previous assessment cycles, this year the assessment committee conduct direct and indirect assessment for the BSCS program. For the direct assessment, we used the same methods used in the previous cycle, however, we have added lower level courses to the assessment process. In addition, a survey that includes course learning outcomes (CLOs) was distributed to the students in each of the assessed courses. The CLOs survey is carried out at the end of the term; students rate their confidence in their accomplishment of the Course Learning comes. The rating is on the scale of 1 to 5 where 1 ⟨very confident⟩ is the highest and 5 ⟨not at all confident⟩ is the lowest. Similar to the direct assessment, the CLOs are mapped to the program educational objective thru ABET student outcomes. The results of the assessment is shown in the below table. The Undergraduate Committee reviewed students' performance in this assessment during their monthly meeting in Winter 18.
In the last section of this report, we summarized the assessment results and the action plans approved by the Undergraduate Committee to improve the BSCS program.

PEO	CLOs Direct Assessment		CLOs Indirect Assessment	
	Upper Level	Lower Level	Upper Level	Lower Level
1	81%	75%	76%	70%
2	84%	75%	85%	72%
3	81%	76%	77%	70%
4	83%	70%	87%	68%
5	83%	73%	83%	66%

Assessment Results:

- PEO1: For the direct assessment (upper level courses), 81% of the BSCS students met the criterion for PEO1.
  For the direct assessment (lower level courses), 75% of the BSCS students met the criterion for PEO1. Although this meets the 70% target level of performance, lower level courses need attention; especially, in improving students ability in applying knowledge of computing and mathematics (SO_a); this is critical, since these courses build the necessary skills needed for upper level courses.

  For indirect assessment (upper level courses), 76% of the students of the BSCS students met the criterion for PEO1. Although the score for this objective in the direct assessment is higher (81%), students are less confident in attaining the knowledge and skills included in SO_j. SO_j, which supports PEO1, emphases students ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.
  For indirect assessment (lower level courses), 70% of the students of the BSCS students met the criterion for PEO1. SO_b & SO_k, both support PEO1, have average score; both focus on students ability to analyze a problem, and identify and define the computing requirements appropriate to its solution and students ability to apply design and development principles in the construction of software systems of varying complexity.

  Combining the results of the direct and indirect assessments for PEO1, it looks like there is a gap between what students learn (knowledge) and what they can do with the knowledge (practice). Bridging the gap between knowledge and practice is needed; especially in the lower level courses.

- PEO2: For the direct assessment (upper level courses), 84% of the BSCS students met the criterion for PEO2.
  For the lower level courses, 75% of the BSCS students met the criterion for PEO2. Although this meets the 70% target level of performance, ABET SO_h (Recognition of the need for, and an ability to engage in, continuing professional development) which is mapped to this objective, has an average score; however, the skills needed in this student outcome is underdeveloped at the lower level courses.

For the indirect assessment (upper level courses), 85% of the students of the BSCS students met the criterion for PEO2. All supporting student outcomes score high.
For the indirect assessment (lower level courses), 72% of the students of the BSCS students met the criterion for PEO2. SO_i (An ability to use current techniques, skills, and tools necessary for computing practices.) has a low score; again, this another indicator of the gap between knowledge and practice.

- PEO3: For the direct assessment (upper level courses), 81% of the BSCS students met the criterion for PEO3.
  For the lower level courses, 76% of the BSCS students met the criterion for PEO3. As in PEO1, SO_a, which is mapped to this objective too, needs attention.

  For the indirect assessment (upper level courses), 77% of the students of the BSCS students met the criterion for PEO3. However, SO_j score is low; this is also similar to PEO1.
  For the indirect assessment (lower level courses), 70% of the students of the BSCS students met the criterion for PEO2. SO_b, SO_k and SO_i have low score.

- PEO4: For the direct assessment (upper level courses), 83% of the BSCS students met the criterion for PEO4.

  For the direct assessment (lower level courses), 70% of the BSCS students met the criterion for PEO4.Although this meets the 70% target level of performance, SO_d has a low performance. SO_d includes students understanding of professional, ethical, legal, security, and social issues and responsibilities. These skills are taught in an upper level courses, in particular, CSC 3010); however, it should be introduced in lower level courses.
  For the indirect assessment (upper level courses), 87% of the students of the BSCS students met the criterion for PEO4. All SOs support this PEO have high scores.

  For the indirect assessment (lower level courses), 68% of the students of the BSCS students met the criterion for PEO4. SO_d & SO_e both have low score; both focus on students ability to function effectively on teams to accomplish a common goal and understanding of professional, ethical, legal, security, and social issues and responsibilities. While the score of SO_d and SO_e in the upper level courses exceeded the criterion for PEO4, the performance in the lower level courses is near the criterion. This is because these two SOs are covered, mostly, in upper level courses. However, lower level courses should, at least, introduce the skills included in these outcomes.

- PEO5: For the direct assessment (upper level courses), 83% of the BSCS students met the criterion for PEO5.
  For the direct assessment (lower level courses), 73% of the BSCS students met the criterion for PEO5.
  As in PEO4, SO_d in PEO5 has a low score.

For indirect assessment (upper level courses), 83% of the students of the BSCS students met the criterion for PEO5. All SOs support this PEO have high score.
For indirect assessment (lower level courses), 66% of the students of the BSCS students met the criterion for PEO 5. SO_d & SO_e have low score as in PEO4.

Program Action Plan

To enhance the CS program and improve it much farther, the Undergraduate Committee will mentor and improve the following areas during the next assessment cycle 2018:

- PEO1: For the upper level courses, instructors will improve students ability in modeling and designing computer-based systems. In particular, CSC 3110 (Algorithm Design and Analysis), CSC 4110 (Software Engineering), and CSC 4710 (Database System), instructors will enhance a comprehensive project that demonstrate students' skills in this area.
  For the lower level courses, instructors will improve students' ability to analyze a problem, design a solution, and apply a design to Computer-based system. In particular, CSC 1500 (Discrete Math), CSC 2110 (Computer Science I), and CSC 2200 (Data Structure and Algorithm Analysis) instructors will enhance this area by additional lectures; the instructors, with the coordination of their lab instructors, will create a project that bridge between analyses, design, and implementation.

- PEO2: For the direct assessment (upper level courses), no action is needed.
  For the direct assessment (lower level courses), instructors will Assign a more practical ﴾real-world﴿ problems with different challenges. The lab instructors of CSC 1501, 2111, and 2201 with the coordination of the course instructors, will assign a real world problems to students. There are two type of lab assignments, one that is due in lab and another that can be completed by the next lab session. Both types will be implemented in all lab sections. The more challenging problems will be assigned in the second type of assignments.

- PEO3: It can be say that the deficiencies in both PEO1 and PEO2 can be found in PEO3; so what we suggested for PEO1 and PEO2 apply to PEO3 with emphasis on solving real-world problem in the lower level courses and experience complex software development in upper level courses

- PEO4: For the direct assessment (upper level courses), no action is needed.
  For lower level courses, Ethics and teamwork skills will be introduced; students in both CSC 2110 and CSC 2200, will be assigned a team project. Ethics elements will be introduced during the project development. In particular, the following topics may be introduced:
    - Ethical issues that arise in software development and how to address them technically and ethically; in particular, the responsibility of each team member in software development.

    - Recognize the ethical responsibility of ensuring software correctness, reliability and safety.

- PEO5: Since the deficiencies in this PEO is similar to PEO4, the same actions included in PEO4 apply here.

If you have questions about this report, you may “reply” to Dr. Reynolds and he will respond to your questions as soon as possible.

With great appreciation for our students and our program’s supporters,

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