

William Paterson University
College of Science and Health - Department of Computer Science

Fall 2013 – Spring 2015 Assessment Cycle
Review and Revision of the CS Program's Student Outcomes

Curriculum Committee Members: Erh-Wen Hu, Cyril Ku, John Najarian, Gilbert Ndjatou (chair),
Bogong Su

Prepared by: Gilbert Ndjatou

Date: October 27, 2015

Approved by the Department Curriculum Committee on: December 15, 2015

Report

Student Outcome S1: Effectively communicate in written and oral forms.

A. Reviews from the CCAR Analyzes of Related Courses

1. From CCAR Analysis of CS3410

In this course students complete a digital circuit project that includes its design, implementation and simulation in a team of two students. They also produce a report of their project and also make an oral presentation. The report is evaluated by the instructor of the course based on its style and presentation whereas the presentation is evaluated by the whole class, including the instructor. This student outcome is therefore OK for this course.

2. From CCAR Analysis of CS3450

In this course, each student is required to produce a report on one or more of the following topics: virtualization and the cloud, security, multiple processor systems, LINUX, Android, Window 8, and operating system design. They are encouraged to work in groups of two or three. But some students choose to work by themselves. Although we do not always have the time for the presentations at the end of the semester, we feel that this student outcome is appropriate for this course because of the reports produced by the students. These reports are graded by the instructor of the course.

3. From CCAR Analysis of CS3500

This course requires having a team project which the teams need to produce documentations covering the software development life cycle. The instructor usually splits the documentation according to the different stages of requirements, specification, design, and implementation. The students need to present their software design to the class. The presentation is graded and many questions on tests and final exam are also used to assess students' knowledge of the project. This student outcome is appropriate and is assessed well.

4. From CCAR Analysis of CS3820

In this course, students prepare a report on a new programming language that they learn by themselves. However, the report is presented using a template provided by the instructor. They do not also have the time to present their reports and instead write simple programs in the programming language of their choice. We will therefore recommend that this Student Outcome no longer be assessed in this course.

5. From CCAR Analysis of CS4800

In this class, students are required to produce a report and to make an oral presentation on a topic related to the legal issues for computing professionals and on the impact of computing technology in society. The reports are graded by the instructor of the course, and the presentations are graded by the instructor and the students in the class. Students are also required to complete a team-project on a topic of current interest in computer science or new development in computing technologies. They must also produce a written report of their project and also make an oral presentation. This student outcome is therefore appropriate and is also well assessed in the course.

B. Review of Consistency with the Program Educational Objectives

Related to the program educational objective 05.

C. Review of Consistency with ABET's Student Outcomes

Related to the ABET's student outcome (f).

D. Revision

We are not changing this student outcome, but it will no longer be assessed in CS3820.

Student Outcome S2:

Demonstrate competence in mathematical skills (discrete structures, differential and integral calculus, and Probability and statistics).

A. Reviews from the CCAR Analyzes of Related Courses

1. From CCAR Analysis of CS2600

CS2600 is a discrete math course in which we discuss topics that include elementary propositional and predicate logics; elementary set theory; relations and their properties; functions; congruence and Euclidean algorithm; combinatorics; mathematical reasoning; matrices; elements of graph theory; trees and their applications; and Boolean algebra. Two of its major objectives are to emphasize mathematical reasoning and to show the applications of discrete mathematics. Extensive hands-on exercises are also used to assess students' understanding of these concepts.

2. From CCAR Analysis of CS2800

In addition to discussing number systems (binary, hexadecimal, and octal number systems), the conversions among those number systems and the basic arithmetic operations on those number systems, we also discuss signed decimal arithmetic and two's complement arithmetic. Hands-on exercises are used to help students understand these concepts and many quizzes are used to test their understanding of these concepts.

3. From CCAR Analysis of Math Courses

Because Math courses are taught in another department, it is practically impossible for us to obtain the CCAR data of these courses.

B. Review of Consistency with the Program Educational Objectives

Related to the program educational objectives 02, 03, 04, 08.

C. Review of Consistency with ABET's Student Outcomes

Related to the ABET's student outcomes (a), (i).

D. Revision

Because it is practically impossible for us to obtain the CCAR data of the math courses, and also, in order to make this outcome more specific and focused, it will be replaced with the following:

Demonstrate abilities to apply knowledge of mathematics to the discipline of computer science.

This new student outcome will be assessed in the following courses: CS2600, CS2800, CS3410, and CS3420. It will also be reviewed/revised based on the analysis of the CCAR data of these courses.

Student Outcome S3: Demonstrate competence in scientific principles and methods.

A. Reviews from the CCAR Analyzes of Related Courses

From CCAR Analysis of Science Courses (Bio II, Chem II, and Phys II)

Because these science courses are taught in other departments, it is practically impossible for us to obtain the CCAR data of these courses.

B. Review of Consistency with the Program Educational Objectives

Related to the program educational objectives 01, 03, 04, 08.

C. Review of Consistency with ABET's Student Outcomes

Related to the ABET's student outcome (i).

D. Revision

Because it is practically impossible for us to obtain the CCAR data of these science courses, and also, in order to make this outcome more specific and focused, it will be replaced with the following:

Demonstrate abilities to apply scientific methods to the discipline of computer science.

This new student outcome will be assessed in the CS4800 (seminar) course. It will also be reviewed/revised based on the analysis of the CCAR data of this course.

Student Outcome S4: Work effectively as part of a team in a software or hardware project.

A. Reviews from the CCAR Analyzes of Related Courses

1. From CCAR Analysis of CS3410

In this course students complete a digital circuit project that includes its design, implementation and simulation in a team of two students. They also produce a report of their project and also make an oral presentation. The report is evaluated by the instructor of the course based on its style and presentation whereas the presentation is evaluated by the whole class, including the instructor. One criterion in the evaluation of students' work is how well they work together on the project.

2. From CCAR Analysis of CS3500

A major objective of this course is to produce a group project. The instructor usually divides the class into several 3- to 4-person teams (dependent on enrollment). Each team needs to produce documentations which require substantial coordination among team members. Students need to meet outside class time to work on the project. Tests and final exam include questions of team organization and management. This student outcome is appropriate for this course and is assessed sufficiently well.

3. From CCAR Analysis of CS4800

One major objective of this course is for students to complete a team-project on a topic of current interest in computer science or new development in computing technologies. They must also produce a written report of their project and also make an oral presentation. How well students work in a group is a major criteria in the evaluation of their project. This program's student is therefore well suited for this course and is also well assessed here.

B. Review of Consistency with the Program Educational Objectives

Related to the program educational objectives 01, 02.

C. Review of Consistency with ABET's Student Outcomes

Related to the ABET's student outcome (d).

D. Revision

No revision

Student Outcome S5: Demonstrate abilities to locate and make effective use of information.

A. Reviews from the CCAR Analyzes of Related Courses

1. From CCAR Analysis of CS3450

In this course, each student is required to produce a report on one or more of the following topics: virtualization and the cloud, security, multiple processor systems, LINUX, Android, Window 8, and operating system design. Students are encouraged to work in groups of two or three. But some students choose to work by themselves.

2. From CCAR Analysis of CS3820

In this course, students are required to learn a new programming language and to produce a report based on a template provided by the instructor. They are also required to write program assignments in their chosen programming language. We then assess how substantial are their reports and the quality of their programming projects. This project necessitates a lot of research over the web and we believe that it allows us to assess the abilities of the students to locate and make effective use of information. We therefore feel that this learning outcome is appropriate and is assessed appropriately.

3. From CCAR Analysis of CS4800

One major objective of this course is for students to complete a team-project on a topic of current interest in computer science or new development in computing technologies. They must also produce a written report of their project and also make an oral presentation. The evaluation of project reports and the oral presentations takes into consideration the quality of the reports and the efforts that students put into their research work. In fact, as part of this course, a librarian gives a lecture on how to use the library resources properly.

B. Review of Consistency with the Program Educational Objectives

Related to the program educational objectives 01, 02, 03.

C. Review of Consistency with ABET's Student Outcomes

Related to the ABET's student outcome (h).

D. Revision

No revision is needed.

Student Outcome S6:

Demonstrate abilities to select appropriate data structures and to design algorithm to solve problems.

A. Reviews from the CCAR Analyzes of Related Courses

1. From CCAR Analysis of CS3420

One major objective of this course is to introduce students to the different data structures that are often used to solve computer problems and the algorithms used to manipulate those data structures. Substantial among of exercises and tests are also used to test students' knowledge of these structures and their ability to understand and use the algorithms. This student outcome is therefore appropriate and well assessed.

B. Review of Consistency with the Program Educational Objectives

Related to the program educational objectives 01, 03, 07, 08.

C. Review of Consistency with ABET's Student Outcomes

Related to the ABET's student outcomes (b), (c), (i) .

D. Revision

This outcome is appropriate and is also well assessed. However, in order to satisfy General Criterion 3 (c) of the ABET 2016-2017 Criteria for Accrediting Computing Programs, it will be revised as follows:

Demonstrate abilities to select appropriate data structures and to design and implement algorithms to solve problems.

This revised student outcome will be assessed in CS3420. It will also be reviewed/revised based on the analysis of the CCAR data of this course.

Student Outcome S7: Demonstrate an understanding of programming language concepts.

A. Reviews from the CCAR Analyzes of Related Courses

1. From CCAR Analysis of CS3820

A major objective of this course is to introduce the major programming language concepts. A substantial amount of exercises and questions on tests and the final exam are also used to assess students understanding and knowledge of these concepts. We therefore believe that this student outcome is appropriate and is assessed sufficiently well.

B. Review of Consistency with the Program Educational Objectives

Related to the program educational objectives 01, 03, 07.

C. Review of Consistency with ABET's Student Outcomes

Related to the ABET's student outcome (i).

D. Revision

No revision

Student Outcome S8:

Demonstrate an understanding of the major programming domains and the knowledge of the most appropriate programming language for each domain.

A. Reviews from the CCAR Analyzes of Related Courses

1. From CCAR Analysis of CS3820

A major objective of this course is to introduce the major programming domains and the most appropriate programming language for each domain. A substantial amount of exercises and questions on tests and the final exam are also used to assess students understanding and knowledge of these concepts. We therefore believe that this student outcome is appropriate and is assessed sufficiently well.

B. Review of Consistency with the Program Educational Objectives

Related to the program educational objectives 01, 03, 07.

C. Review of Consistency with ABET's Student Outcomes

Related to the ABET's student outcomes (b) and (i).

D. Revision

No revision

Student Outcome S9:

Be able to develop programs in two or more major programming languages on at least two platforms.

A. Reviews from the CCAR Analyzes of Related Courses

1. From CCAR Analysis of CS3450

Students develop extensive experience with UNIX / Linux in this course with C / C++, to counterbalance the Windows OS prevalence. Student get to work with UNIX system calls, I/O, libraries, internals, file-systems, and basic system programming. They are asked to write programs in C for UNIX in class-assignments (often in a recitation-session walk-through or in a collective programming effort (either the whole class led by teacher or in student teams)), homeworks, projects, and exams. This second platform is more easily studied than Windows and provides a true learning experience and in-depth knowledge, not just a slick superficial GUI used to dumb-down the public with pretty colors and cuteness. This student outcome is appropriate for true Computer Scientific understanding and professional growth.

The evaluation tools \ metrics and procedures for measuring attainment of this outcome are well defined, well-executed, significant, and properly / accurately assessing the outcome.

Perhaps add a Student Outcome (in :

Demonstrate an Understanding of Computer Systems and their Networking

Since the domain of OS is hardly represented in S1, S5, and S9, we could complete the

Proceedings for CS 3380 which would be well assessed by the above proposed outcome.

2. From CCAR Analysis of CS3820

Although we do introduce the Java programming language in this class, the time that we spent on it (three to three weeks and half) is not enough to give substantial programming projects in Java that will allow us to have a good assessment of the ability of students to program in this language. We will therefore recommend that this outcome be revised to: **Be able to develop programs on at least two platforms.**

B. Review of Consistency with the Program Educational Objectives

Related to the program educational objectives 01, 03, 07.

C. Review of Consistency with ABET's Student Outcomes

Related to the ABET's student outcome (c), (i).

D. Revision

Based on the reviews above, this student outcome will be replaced with the following:

Demonstrate an understanding of computer systems and their networking.

This new student outcome will be assessed in the following courses: CS3380 and CS3450. It will also be reviewed/revised based on the analysis of the CCAR data of these courses.

Student Outcome S10:

Demonstrate competence in computer organization and architecture.

A. Reviews from the CCAR Analyzes of Related Courses

1. From CCAR Analysis of CS2800

In this course we introduce the basic computer organization and architecture of the Intel 8086 processor at the machine and assembly levels. We also discuss the instruction set of the Intel 8086 processor and perform many hands-on exercises on using these instructions set to solve computer problems. Students are evaluated on how well they understand the Intel 8086 processor architecture and also use its instruction set to solve computer problems.

2. From CCAR Analysis of CS3410

In this three-credit course, nearly the entire semester is spent on Boolean algebra, Boolean function minimization, combinational and sequential circuit design. As a result, there is little time to teach computer organization at the end of semester. Usually I give a brief introduction to computer organization and architecture, but has no time to give homework, its contents are not covered in final exam.

B. Review of Consistency with the Program Educational Objectives

Related to the program educational objectives 01, 03, 07, 08.

C. Review of Consistency with ABET's Student Outcomes

Related to the ABET's student outcomes (c), (i).

D. Revision

The 2013 ACM/IEEE Curriculum Guidelines now require CS programs to cover only 16 hours of computer organization and to cover the advanced concepts of computer architecture in upper-level elective course. For this reason, this outcome will be replaced with the following:

Demonstrate competence in computer organization

This new student outcome will be assessed in the courses CS2800 and CS3410, and it will be reviewed/revised based on the analysis of the CCAR data of these courses.

Student Outcome S11:

Demonstrate an ability to use software engineering principles to analyze and design large software projects.

A. Reviews from the CCAR Analyzes of Related Courses

1. From CCAR Analysis of CS3500

One of the major objectives of this course is for the students to produce a team project. The students need to use software engineering principles to analyze and design large software projects. The results of the analysis and the design are documented and assessed. Substantial amount of class exercises, tests and final exam questions are used to assess students' knowledge of these software engineering principles. This student outcome is appropriate for this software engineering course and the evaluation of the outcome is well assessed.

B. Review of Consistency with the Program Educational Objectives

Related to the program educational objectives 01, 03, 07, 08.

C. Review of Consistency with ABET's Student Outcomes

Related to the ABET's student outcomes (b), (c), (i).

D. Revision

No revision is needed

Student Outcome S12:

Demonstrate an understanding of the ethical and legal issues for computing professionals and the impact of computing technology in society.

A. Reviews from the CCAR Analyzes of Related Courses

1. From CCAR Analysis of CS4800

In this class, we introduce the ethical and legal issues for computing professionals and the impact of computing technology in society. Students are also required to produce a report and to make a presentation on a topic related to the legal issues for computing professionals and on the impact of computing technology in society. The reports are graded by the instructor of the course, and the presentations are graded by the instructor and the students in the class. This student outcome is therefore appropriate and is also well assessed in the course.

B. Review of Consistency with the Program Educational Objectives

Related to the program educational objective 06.

C. Review of Consistency with ABET's Student Outcomes

Related to the ABET's student outcomes (e), (g).

D. Revision

No revision is needed.

Table of Revised CS Program's Student Outcomes

Starting with the Spring 2016 semester, the following will be the new CS program's student outcomes:

Students Outcomes	<ul style="list-style-type: none"> • Assessed in the following courses: • Reviewed with respect to the Analysis of the CCAR data of the following Courses:
S1 Effectively communicate in written and oral forms.	CS 3410, CS 3450, CS 3500, CS4800
S2 Demonstrate abilities to apply knowledge of mathematics to the discipline of computer science.	CS 2600, CS 2800, CS3410, CS3420
S3 Demonstrate abilities to apply scientific methods to the discipline of computer science.	CS 4800
S4 Work effectively as part of a team in a software or hardware project.	CS 3410, CS 3500, CS4800
S5 Demonstrate abilities to locate and make effective use of information.	CS 3450, CS 3820, CS 4800
S6 Demonstrate abilities to select appropriate data structures and to design and implement algorithms to solve problems.	CS 3420
S7 Demonstrate an understanding of programming language concepts.	CS 3820
S8 Demonstrate an understanding of the major programming domains and the knowledge of the most appropriate programming language for each domain.	CS 3820
S9 Demonstrate an understanding of computer systems and their networking.	CS 3380, CS 3450
S10 Demonstrate competence in computer organization.	CS 2800, CS 3410
S11 Demonstrate an ability to use software engineering principles to analyze and design large software projects.	CS 3500
S12 Demonstrate an understanding of the ethical and legal issues for computing professionals and the impact of computing technology in society.	CS 4800

Relationship Between the Program Educational Objective and the Program's Student Outcomes

Program Educational Objectives	Program's Student Outcomes
01. To create an environment conducive to learning through teaching, research and creative activities.	S2, S3, S4, S5, S6, S7, S8, S9, S10, S11
02. To promote student success, academic excellence, and community outreach with opportunities for lifelong learning.	S4, S5
03. To actively challenge students to high levels of intellectual and professional accomplishment and personal growth in preparation for careers and advanced studies in computing, and productive citizenship.	S2, S3, S5, S6, S7, S8, S9, S10, S11, S12
04. To provide students with a sound foundation in mathematics, science, computer science, and the application of this knowledge, which will equip them either to enter careers or pursue advanced studies in computing	S2, S3
05. To develop students' ability to communicate well, both orally and in writing.	S1
06. To develop students' understanding of the ethical and moral issues for computing professionals and the impact of computing technology in society.	S12
07. To develop a curriculum with core materials that provide our graduates with the fundamental knowledge of algorithms, data structures, software design, concepts of programming languages, computer organization, and computer networks and security, and advanced course work that provides them with breadth of knowledge, and also builds on the core materials to provide them with some depth of knowledge.	S6, S7, S8, S9, S10, S11
08. To emphasize problem analysis and solution design throughout the program.	S2, S3, S6, S10, S11

Relationship Between ABET's Student Outcomes and the Program's Student Outcomes

ABET's Student Outcomes	Program's Student Outcomes
(a) An ability to apply knowledge of computing and mathematics appropriate to the program's student outcomes and to the discipline.	S2
(b) An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.	S6, S8, S11
(c) An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs.	S6, S9, S10, S11
(d) An ability to function effectively on teams to accomplish a common goal.	S4
(e) An understanding of professional, ethical, security and social issues and responsibilities.	S12
(f) An ability to communicate effectively with a range of audiences.	S1
(g) An ability to analyze the local and global impact of computing on individuals, organizations, and society.	S12
(h) Recognition of the need for and an ability to engage in continuing professional development.	S5
(i) An ability to use current techniques, skills, and tools necessary for computing practice.	S2, S3, S6, S7, S8, S9, S10, S11