

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

Fall 2015 – Spring 2017 Assessment Cycle  
Review and Revision of the CS Program Student Outcomes

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

Prepared by: Gilbert Ndjatou

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**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 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**

For reasons of consistency with the new ABET's Student Outcomes specified in Criterion 3, this student outcome is revised as specified below:

### **D. Revision**

**Communicate effectively in a variety of professional contexts.**

It will be evaluated in the courses: CS4410, CS3450, CS3500, and CS4800. It will also be reviewed/revised based on the analyses of the CCAR data of these courses.

## **Student Outcome S2:**

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

### **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 CS3410**

The principles of Boolean algebra are applied to switches, providing mathematical tools for the analysis and synthesis of switching systems.

#### **4. From CCAR Analysis of CS3420**

The following fundamental concepts of discrete mathematics are applied in the context of data structures and algorithms: arithmetic and geometric summations; Logarithms and exponents, polynomial functions, recurrence relations, and asymptotic notations.

### **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**

N/A

### **D. Revision**

No revision.

**Student Outcome S3:**

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

**A. Reviews from the CCAR Analysis of CS4800**

**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**

N/A

**D. Revision**

We find it difficult to assess this student outcome in CS4800. We will therefore get rid of it.

## **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**

For reasons of consistency with the new ABET's Student Outcomes specified in Criterion 3, this student outcome is revised as specified below:

### **D. Revision**

**Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.**

It will be evaluated in the courses: CS4410, CS3500, and CS4800. It will also be reviewed/revised based on the analyses of the CCAR data of these courses.

**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**

N/A

**D. Revision**

No revision is needed.

## **Student Outcome S6:**

**Demonstrate abilities to select appropriate data structures and to design and implement algorithms 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**

For reasons of consistency with the new ABET's Student Outcomes specified in Criterion 3, this student outcome is revised as specified below:

### **D. Revision**

**Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.**

This revised student outcome will be assessed in CS3410 and CS3420. It will also be reviewed/revised based on the analyses of the CCAR data of these courses.

**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**

N/A

**D. Revision**

We find this student outcome is a little bit broad and vague which make it a little bit to evaluate. We will therefore get rid of it.

**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**

N/A

**D. Revision**

No revision

## **Student Outcome S9:**

**Demonstrate an understanding of computer systems and their networking.**

### **A. Reviews from the CCAR Analyzes of Related Courses**

#### **1. From CCAR Analysis of CS33800**

#### **2. 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 student outcome is appropriate for true Computer Scientific understanding and professional growth.

### **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**

N/A

### **D. Revision**

We find this student outcome is a little bit vague which make it a little bit to evaluate. We will therefore get rid of it.

**Student Outcome S10:  
Demonstrate competence in computer organization.**

**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**

N/A

**D. Revision**

We find this student outcome is a little bit broad and vague which make it a little bit to evaluate. We will therefore get rid of it.

## **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**

For reasons of consistency with the new ABET's Student Outcomes specified in Criterion 3, this student outcome is revised as specified below:

### **D. Revision**

**Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.**

This revised student outcome will be assessed in CS3500. It will also be reviewed/revised based on the analysis of the CCAR data of this course.

## **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**

For reasons of consistency with the new ABET's Student Outcomes specified in Criterion 3, this student outcome is revised as specified below:

### **D. Revision**

**Recognize professional responsibilities and make informed judgements in computing practice based on legal and ethical principles.**

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

**New Student Outcomes:**

For reasons of consistency with the new ABET's Student Outcomes specified in Criterion 3, we are adding the following student outcome:

**Apply computer science theory and software development fundamentals to produce computing-based solutions.**

This student outcome will be assessed in CS3410 and CS3820. It will also be reviewed/revised based on the analyses of the CCAR data of these courses.

## Table of Revised CS Program's Student Outcomes

Starting with the Fall 2018 semester, the following will be the new CS program's student outcomes:

Program's Students Outcomes	Assessed in the following courses:
<b>S1</b> Communicate effectively in a variety of professional contexts.	CS 3410, CS 3450, CS 3500, CS4800
<b>S2</b> Demonstrate abilities to apply knowledge of mathematics to the discipline of computer science.	CS 2600, CS 2800, CS3410, CS3420
<b>S3</b> Apply computer science theory and software development fundamentals to produce computing-based solutions.	CS 3410, CS3820
<b>S4</b> Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.	CS 3410, CS 3500, CS4800
<b>S5</b> Demonstrate abilities to locate and make effective use of information.	CS 3450, CS 3820, CS 4800
<b>S6</b> Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.	CS3410, CS 3420
<b>S7</b> Demonstrate an understanding of the major programming domains and the knowledge of the most appropriate programming language for each domain.	CS 3820
<b>S8</b> Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.	CS 3500
<b>S9</b> Recognize professional responsibilities and make informed judgements in computing practice based on legal and ethical principles.	CS 4800

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

<b>Program Educational Objectives</b>	<b>Program's Student Outcomes</b>
01. To create an environment conducive to learning through teaching, research and creative activities.	S2, S3, S4, S5, S6, S7, S8
02. To promote student success, academic excellence, and community outreach with opportunities for lifelong learning.	S3, 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
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.	S9
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
08. To emphasize problem analysis and solution design throughout the program.	S3, S6, S8