An Analysis of ABET's Revised Criteria for Accrediting Computing Programs

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Abstract

The Computing Accreditation Commission (CAC) of ABET has published revised Criteria for Accrediting Computing Programs in fall 2017. The new criteria apply to computer science, information technology, information systems, and similarly named computing programs. Institutions will be required to use the revised criteria starting the 2019-2020 accreditation cycle. Programs that will undergo review during the 2018-2019 accreditation cycle will have the option to select either the new or old criteria. In this paper, we compare the old and new criteria and point out additional topics that may be required to satisfy the new criteria for computer science and information technology programs.

1 Introduction

For a successful accreditation review, ABET requires every program to satisfy its general criteria as well as program criteria. The *general criteria* has eight components, *viz.,* 1) students, 2) program educational objectives, 3) student outcomes, 4) continuous improvement, 5) curriculum, 6) faculty, 7) facilities, and 8) institutional support. The *program criteria* have discipline specific requirements. The published revisions stay focused on the criterion 3 (student outcomes) and criterion 5 (curriculum). Both general criteria as well as program criteria for computer science, information technology, and information systems have been modified. In this paper, we focus on the changes in the computer science and information technology programs.

2 Analysis

A careful look at Tables 1–6 reveal the following:

- Student outcomes (a), (b), and (c) in the old general criteria have been combined into student outcomes (1) and (2) in the new general criteria (Table 1). These two new student outcomes address technical abilities.

Table 1: General Criterion 3: Student Outcomes [1, 2].*

Old Criterion	New Criterion
The program must have documented student outcomes that prepare graduates to attain the program educational objectives. There must be a documented and effective process for the periodic review and revision of these student outcomes. The program must enable students to attain, by the time of graduation: (a) An ability to apply knowledge of computing and mathematics appropriate to the program's student outcomes and 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 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 practice.	The program must have documented and ***publicly stated*** student outcomes that include (1) through (5) below and any outcomes required by applicable Program Criteria. The program may define additional outcomes. Graduates of the program will have an ability to: 1. Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions. 2. Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline. 3. Communicate effectively in a variety of professional contexts. 4. Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles. 5. Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.

* The table lists ABET CAC criteria verbatim with added emphasis.

Table 2: Computer Science Program Criterion 3: Student Outcomes [1, 2].*

Old Criterion	New Criterion
The program must enable students to attain, by the time of graduation: (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.	In addition to outcomes 1 through 5, graduates of the program will also have an ability to: 6. Apply ***computer science theory*** and software development fundamentals to produce computing-based solutions.

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- Student outcomes (d), (e), and (f) in the old general criteria remain pretty much intact as the student outcomes (3), (4), and (5) in the new general criteria (Table 1). Out of five new student outcomes in the general category, these three are related to non-technical skills such as communication, professional responsibility and judgment, and ability to work in teams.
- Student outcomes (g), (h), and (i) have been removed from the old general criteria (Table 1) and reworded to add them in the curriculum of the new general criteria (Table 4). It should

Table 3: Information Technology Program Criterion 3: Student Outcomes [1, 2].*

Old Criterion	New Criterion
The program must enable students to attain, by the time of graduation: (j) An ability to use and apply current technical concepts and practices in the core information technologies of ***human computer interaction, information management, programming, networking, and web systems and technologies***. (k) An ability to identify and analyze user needs and take them into account in the selection, creation, evaluation and administration of computer-based systems. (l) An ability to effectively integrate IT-based solutions into the user environment.	In addition to outcomes 1 through 5, graduates of the program will also have an ability to: 6. Identify and analyze user needs and to take them into account in the selection, creation, integration, evaluation, and administration of computing-based systems.

* The table lists ABET CAC criteria verbatim with added emphasis.

Table 4: General Criterion 5: Curriculum [1, 2].*

Old Criterion	New Criterion
The program's requirements must be consistent with its program educational objectives and designed in such a way that each of the student outcomes can be attained. The curriculum must combine technical and professional requirements with general education requirements and ***electives*** to prepare students for a professional career and further study in the computing discipline associated with the program, and for functioning in modern society. The technical and professional requirements must include at least ***one year*** of up-to-date coverage of fundamental and advanced topics in the computing discipline associated with the program. In addition, the program must include ***mathematics appropriate to the discipline beyond the precalculus level***. For each course in the major required of all students, its content, expected performance criteria, and place in the overall program of study ***must be published***.	The program's requirements must be consistent with its program educational objectives and designed in such a way that each of the student outcomes can be attained. The curriculum must combine technical, professional, and general education components to prepare students for a career, further study, and ***lifelong professional development*** in the computing discipline associated with the program. The curriculum requirements specify topics, but do not prescribe specific courses. The program must include mathematics appropriate to the discipline and at least ***30 semester credit hours*** (or equivalent) of up-to-date coverage of fundamental and advanced computing topics that provide both ***breadth and depth***. The computing topics must include: 1. ***Techniques***, ***skills***, and ***tools*** necessary for computing practice. 2. Principles and practices for ***secure computing***. 3. ***Local and global impacts*** of computing solutions on individuals, organizations, and society.

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be noted that none of these three old student outcomes retained any presence in the new set of student outcomes. As a result, the revised student outcomes under general criteria become much simpler than the previous ones.

- The new criteria require student outcomes to be publicly stated (Table 1). However, publication of student outcomes is not a requirement under the old criteria.
- The curriculum of the old criteria require publication of expected performance criteria for

Table 5: Computer Science Program Criterion 5: Curriculum [1, 2].*

Old Criterion	New Criterion
Students must have the following amounts of course work or equivalent educational experience: a. Computer science: ***One and one-third years*** that must include: 1. Coverage of the fundamentals of algorithms, ***data structures***, software design, concepts of programming languages and computer organization and architecture. 2. ***An exposure to a variety of programming languages and systems***. 3. Proficiency in at least one higher-level language. 4. ***Advanced course work that builds on the fundamental course work to provide depth***. b. ***One year*** of science and mathematics: 1. Mathematics: At least one half year that must include discrete mathematics. The additional mathematics might consist of courses in areas such as calculus, linear algebra, numerical methods, probability, statistics, number theory, geometry, or symbolic logic. 2. Science: A science component that develops an understanding of the scientific method and provides students with an opportunity to experience this mode of inquiry in courses for science or engineering majors that provide some exposure to laboratory work.	The curriculum requirements ***specify topics, but do not prescribe specific courses***. These requirements are: a. Computer science: At least ***40 semester credit hours*** (or equivalent) that must include: 1. Substantial coverage of algorithms and ***complexity***, computer science theory, concepts of programming languages, and software development. 2. Substantial coverage of at least one general-purpose programming language. 3. Exposure to computer architecture and organization, ***information management***, ***networking and communication***, ***operating systems***, and ***parallel and distributed computing***. 4. ***The study of computing-based systems at varying levels of abstraction***. 5. A ***major project*** that requires integration and application of knowledge and skills acquired in earlier course work. b. Mathematics: At least ***15 semester credit hours*** (or equivalent) that must include discrete mathematics and must have mathematical rigor at least equivalent to introductory calculus. The additional mathematics might include course work in areas such as calculus, linear algebra, numerical methods, probability, statistics, or number theory. c. At least ***six semester credit hours*** (or equivalent) in natural science course work intended for science and engineering majors. This course work must develop an understanding of the scientific method and must include laboratory work.

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courses (Table 4). This requirement has been eliminated in the new criteria.

- The new criteria require all the programs under CAC to have coursework on principles and practices of computer security (Table 4). It is a new requirement for the computer science program. Under the old criteria, only information technology program requires coverage of computer security (Table 6).
- Information management, networking and communication, operating systems, and parallel and distributed computing become required topics for the new computer science curriculum (Table 5). These are also new requirements for the computer science program.
- Emphasis on data structures and requirement of an exposure to a variety of programming languages and systems in computer science curriculum have been removed (Table 5).
- Algorithmic complexity is emphasized in the new curriculum of the computer science program (Table 5).

Table 6: Information Technology Program Criterion 5: Curriculum [1, 2].*

Old Criterion	New Criterion
Students must have course work or an equivalent educational experience that includes: a. Coverage of the fundamentals of 1. the core information technologies of human-computer interaction, information management, programming, networking, web systems and technologies. 2. ***information assurance and security***. 3. system administration and maintenance. 4. system integration and system architecture. b. ***Advanced course work that builds on the fundamental course work to provide depth***.	The curriculum requirements specify topics, but do not prescribe specific courses. The curriculum must include coverage of fundamentals and applied practice in the following: a. The core information technologies of human-computer interaction, information management, programming, web systems and technologies, and networking. b. System administration and system maintenance. c. System integration and system architecture.

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- The revised computer science curriculum requires at least 21 semester credit hours of mathematics and science courses. In the previous curriculum, this requirement was one year of course work. It should be noted that ABET considers one academic year and 30 semester units are equivalent. As a result, a revised computer science curriculum can have 30% fewer coverage of mathematics and science than the old curriculum.

3 Conclusions

Our analysis shows that the new computer science curriculum explicitly require students to take coursework on computer security, parallel and distributed computing, information management, networking and communication, and operating systems. None of these topics are mandatory under the old computer science curriculum. At present, some of these topics are optional in many computer science programs. On the other hand, the new curriculum lowers the requirement of mathematics and science for computer science students. Our analysis shows that the changes in the information technology curriculum are insignificant.

References

[1] Criteria for Accrediting Computing Programs, Computing Accreditation Commission, ABET. Dated: October 29, 2016. (Effective for reviews during the 2017-2018 accreditation cycle.)

[2] Criteria for Accrediting Computing Programs, Computing Accreditation Commission, ABET. Version 2.0. Dated: August 11, 2017. (Approved by the Computing Computing Area Delegation on October 20, 2017. This criteria is optional for programs being reviewed in 2018-2019. It is mandatory starting in 2019-2020.)