CAC Criteria Changes
Annotated Version

Introduction
The Joint CAC-CSAB Criteria Committee has been working since 2014 on modifications to the CAC Accreditation Criteria. The CAC Executive Committee and the CSAB Board of Directors have approved the Rho Draft of the proposed changes for limited distribution to CAC Commissioners and PEVs for review and comment. The results of this comment period will be considered by the Criteria Committee for another round of revision, which will result in a version of the criteria for consideration by the CAC during the July 2016 meeting.

Motivation for Proposed Changes
These proposed changes have been motivated by three independent considerations:
1. The publication of the CS 2013 Model Curriculum for Computer Science.
2. CAC Structural Issues with Criteria 3 and 5, along with a general desire to reduce the assessment burden and focus the assessment process toward meaningful continuous improvement.
3. Requests from constituents that ABET place greater emphasis on fostering innovation and ensuring cost-benefit is considered in the program’s efforts required to meet accreditation Criteria.

CAC Structural Issues with Criteria 3 and 5
CAC Criterion 3 is entitled “Student Outcomes,” yet only the first paragraph of the criterion refers to SOs. That first paragraph requires that programs have SOs, and that there be a process for reviewing and revising the outcomes. Although the second paragraph of CAC Criterion 3 enumerates several items that look like outcomes, these are actually interpreted by CAC simply as program “characteristics” which (unlike SOs) only have to be enabled but do not have to be assessed unless the program chooses to adopt them as outcomes (which many programs do). Thus, Criterion 3 is at best confusing, as it looks like Criterion 3 from the other commissions – but unlike the other commissions (as well as its title), CAC Criterion 3 does not introduce any required SOs that have to be assessed.

The work here attempts to clear up this issue and have Criterion 3 strictly address outcomes, while Criterion 5 introduces program “characteristics” that do not have to be assessed. This will put the CAC Criteria 3/5 in a similar format to the other commissions. Additionally, this work will look at general content revisions to the criteria (in part considering new recommendations in CS2013) within this revised organizational framework.

Overview of General Criteria 3/5 Changes
The following are the substantive changes to General Criteria 3 and 5 and the rationale for each change:
1. *Addition of 5 required Student Outcomes* – As discussed above, the resolution of the structural Criteria 3/5 issues required that the (a) – (i) elements which were not treated as outcomes, either be treated as outcomes or modified and treated as outcomes. The proposal here involves reducing (a) – (i) to (1) – (5), and requiring (1) – (5) as outcomes for every accredited program. (1) – (5) were structured similarly to the new required outcomes for EAC. However, these outcomes are expressed in computing terms and as reasonable expectations for students graduating from any accredited computing program.

2. *Addition of a technical cyber security requirement for computing majors* – The revision of Criterion 5 includes a substantially increased cyber security requirement. The previous criteria had a “soft skill” requirement of an understanding of security and privacy issues (along with the legal and ethical
implications of computing). But the revision requires that “information assurance and security principles and practices” be included in the curriculum. This reflects an increase in the technical expectations relative to cyber security in all three of the current program criteria, coupled with the practical implications that any computing professional needs to be exposed to appropriate technical material in this area to address the growing national and international crisis in this area that threatens to destroy the global international information technology infrastructure.

Overview of Program Criteria Changes
The Program Criteria were changed as follows:

1. **Student Outcomes were added for CS, IS and IT, now that the list in Criterion 3 consists of outcomes rather than curriculum characteristics.**

2. **Stylistic changes were made for consistency across the various criteria.**

3. **The requirement for faculty with a terminal degree was changed from “some” to “at least one” in both the CS and IS criteria** – The previous version of the criteria only required that “some” faculty must have a PhD (or terminal degree) in the discipline. There was considerable ambiguity over what “some” meant – and whether it allowed for just one. So it is proposed that this be stated in a less ambiguous fashion.

4. **Several changes were made to the CS criteria to strengthen the relationship with new computer science curricular guidelines (CS 2013)** – These changes include:
   a. Addition of curriculum topic areas that are part of CS 2013. Since there are a large number of topics in CS 2013, an attempt was made to find the topics that appear to be applicable to the broadest possible set of Computer Science programs.
   b. Addition of the requirement of a “large unifying project” – such as a capstone project or a large-scale research project – either of which much integrate knowledge and skills acquired from previous courses.
   c. Some clarification of the previous requirements regarding “programming languages and systems.”
Criteria for Accrediting Computing Programs
Effective for Reviews During the 20XX-20YY Accreditation Cycle

The criteria for accreditation are in two sections.

**General Criteria** – General Criteria apply to all programs accredited by an ABET commission. Each program accredited by an ABET commission must satisfy every criterion that is in the General Criteria for that commission.

**Program Criteria** – The Program Criteria provide discipline-specific accreditation criteria. Programs must show that they satisfy all of the specific Program Criteria implied by the program title. Any overlapping requirements need be satisfied only once.

**Definitions**

While ABET recognizes and supports the prerogative of institutions to adopt and use the terminology of their choice, it is necessary for ABET volunteers and staff to have a consistent understanding of terminology. With that purpose in mind, the Commissions will use the following basic definitions:

**Program Educational Objectives** – Program educational objectives are broad statements that describe what graduates are expected to attain within a few years of graduation. Program educational objectives are based on the needs of the program’s constituencies.

**Student Outcomes** – Student outcomes describe what students are expected to know and be able to do by the time of graduation. These relate to the knowledge, skills, and behaviors that students acquire as they progress through the program.

**Assessment** – Assessment is one or more processes that identify, collect, and prepare data to evaluate the attainment of student outcomes. Effective assessment uses relevant direct, indirect, quantitative and qualitative measures as appropriate to the outcome being measured. Appropriate sampling methods may be used as part of an assessment process.

**Evaluation** – Evaluation is one or more processes for interpreting the data and evidence accumulated through assessment processes. Evaluation determines the extent to which student outcomes are being attained. Evaluation results in decisions and actions regarding program improvement.

The Computing Accreditation Commission also uses the following definitions:

**One Academic Year** - For programs using standard semester units, one academic year is defined as 30 semester units. For programs using standard quarter units, one academic year is defined as 45 quarter units. For other programs, one academic year requires an equivalent amount of coursework.

**College-Level Mathematics** – College-level mathematics consists of mathematics above the pre-calculus level.
General Criteria 3 and 5

Criterion 3 Student Outcomes
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 review and revision of these student outcomes. The program must have documented and publicly stated student outcomes that include (1) through (5) below and any additional outcomes required by applicable Program Criteria. The program may define additional student outcomes at its discretion.

1. An ability to analyze a problem, and to identify and define the computing requirements appropriate to its solution.
2. An ability to design, implement, and evaluate a computer-based solution to meet a given set of computing requirements in the context of the discipline.
3. An ability to communicate effectively with a range of audiences about technical information.
4. An ability to make informed judgments in computing practice based on legal and ethical principles.
5. An ability to function effectively on teams to establish goals, plan tasks, meet deadlines, manage risk, and produce deliverables.

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.

Criterion 5 Curriculum
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 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 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 pre-calculus 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 curriculum requirements specify subject areas, but do not prescribe specific courses. The program must include each of the following in a manner appropriate to its discipline:

1. At least one academic year of up-to-date coverage of fundamental and advanced computing topics that provides both breadth and depth.
2. College-level mathematics.
3. Current techniques, skills, and tools necessary for computing practice.
4. Information assurance and security principles and practices.
5. Concepts involving the local and global impact of computing solutions on individuals, organizations, and society.
Program Criteria
Computer Science and
Similarly Named Computing Programs

Lead Society: CSAB

These program criteria apply to computing programs using computer science or similar terms in their titles.

3. Student Outcomes
The program must enable students to attain, by the time of graduation:

(i) 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. [CS]

(k) An ability to apply design and development principles in the construction of software systems of varying complexity. [CS]

In addition to outcomes (1) through (5), the following outcomes are required:

6. An ability to apply theory in the design and implementation of computer-based solutions. [CS]
7. An ability to reason about and explain computer-based solutions at multiple levels of abstraction. [CS]

5. Curriculum
Students must have course work or an equivalent educational experience that includes:

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. [CS]
   2. An exposure to a variety of programming languages and systems. [CS]
   3. Proficiency in at least one higher level language. [CS]
   4. Advanced course work that builds on the fundamental course work to provide depth. [CS]

b. One year of science and mathematics
   1. At least one-half year that must include discrete mathematics. The additional mathematics might consist of course work in areas such as calculus, linear algebra, numerical methods, probability, statistics, number theory, geometry or symbolic logic. [CS]
   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 and engineering majors that provide some exposure to laboratory work. [CS]

The curriculum requirements specify subject areas, but do not prescribe specific courses. These requirements are:

a. Computer science: At least one and one-third academic years that must include:
   1. Computer science fundamentals including:
      a. Algorithms and complexity, computer science theory, concepts of programming languages, and software development.
      b. At least three of the following: computer architecture and organization, information management, networking and communication, operating systems, and parallel and distributed computing.
   2. Advanced course work that builds on fundamental topics to provide both breadth and depth.
4. In-depth coverage of at least one high-level language.
5. A substantial project requiring application of knowledge and skills acquired in earlier course work.

b. Mathematics: At least one-half academic year of college-level mathematics that must include discrete mathematics. The additional mathematics might consist of course work in areas such as calculus, linear algebra, numerical methods, probability, statistics, number theory, or geometry.

c. Science: Natural science course work that develops an understanding of the scientific method, provides exposure to laboratory work, and provides students with an opportunity to experience this mode of inquiry in courses appropriate for science or engineering majors.

6. Faculty
Some At least one full time faculty members must have a Ph.D. in computer science.
Program Criteria
Information Systems and
Similarly Named Computing Programs

Lead Society: CSAB

These program criteria apply to computing programs using information systems or similar terms in their titles.

3. Student Outcomes
The program must enable students to attain, by the time of graduation:

In addition to outcomes (1) through (5), the following outcome is required:

2. (j) An understanding of and an ability to support the use, delivery, and management of information systems within an information systems environment. [IS]

5. Curriculum
Students must have course work or an equivalent educational experience that includes:

a. Information Systems: One year that must include:
   1. Coverage of the fundamentals of application development, data management, networking and data communications, security of information systems, systems analysis and design and the role of Information Systems in organizations. [IS]
   2. Advanced course work that builds on the fundamental core to provide depth. [IS]

b. Information systems environment: One-half year of course work that must include a cohesive set of topics that provide an understanding of an environment in which the information systems will be applied professionally.[IS]

c. Quantitative analysis or methods, including statistics [IS]

The curriculum requirements specify subject areas, but do not prescribe specific courses. These requirements are:

a. Information systems: At least one academic year that includes coverage of fundamentals and applied practice in application development; data and information management; IT infrastructure; systems analysis, design and acquisition; project management; and the role of information systems in organizations.

b. Information systems environment: At least one-half academic year of course work that includes a cohesive set of topics that provide an understanding of an environment in which information systems are applied professionally.

c. Quantitative analysis or methods, including statistics.

6. Faculty
Some At least one full-time faculty members, including those responsible for the IS curriculum development, must hold a terminal degree with a program of study in information systems.
Lead Society: CSAB

These program criteria apply to computing programs using information technology or similar terms in their titles.

3. Student Outcomes
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. [IT]
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. [IT]
l) An ability to effectively integrate IT-based solutions into the user environment. [IT]
m) An understanding of best practices and standards and their application. [IT]

In addition to outcomes (1) through (5), the following outcome is required:

(6) An ability to identify and analyze user needs and to take them into account in the selection, integration, evaluation, and administration of computer-based systems. [IT]

5. Curriculum
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; [IT]
   2. Information assurance and security; [IT]
   3. System administration and maintenance; [IT]
   4. System integration and system architecture; [IT]

b. Advance course work that builds on the fundamental course work to provide depth. [IT]

The curriculum must include coverage of fundamentals and applied practice in the following areas:

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.