THE UNIVERSITY OF NORTH CAROLINA AT ASHEVILLE
FACULTY SENATE

Senate Document Number 6617S
Date of Senate Approval 05/04/17

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Statement of Faculty Senate Action:

APC Document 59 (CSCI): Change the major and minor requirements for Computer Science

Effective Date: Fall 2017

1. Delete: On page 115, the entry under **Concentration in Computer Systems:**

The concentration in Computer Systems includes both hardware and software design. This concentration prepares students for careers in system and network programming, computer architecture design, scientific and engineering applications, and software development.

I. Required courses in the major—41 hours, including: CSCI 107, either 181 or 182, 202, 255, 320, 331, 333, 343, 346, 431, 462; and 9 additional hours in CSCI at the 300 level or above.
II. Required courses outside the major—23 hours: MATH 191, 192, and either 251 or 280; PHYS 221, and either 222 or 231; STAT 185 or 225.
III. Other departmental requirements—Major and oral competencies are demonstrated by successful completion of CSCI 462.

Add: On page 115, in place of deleted entry

The concentration in Computer Systems includes both hardware and software design. This concentration prepares students for graduate studies and for careers in system and network programming, computer architecture design, scientific and engineering applications, and software development.

I. Required courses in the major—41 hours: one course from CSCI 182, 183 or 185; CSCI 201, 202, 235, 280, 333, 335, 338, 431, 434, 480, 481; one of the following data science courses: CSCI 312, 343, 346, 347, 412, 441; 6 additional hours at the 300-400 level.
II. Required courses outside the major—23 hours: MATH 191, 251 and at least 8 hours from MATH 192, 291, 365, 441 (if not selected above), STAT 185 or 225; PHYS 221, and either 222 or 231.
III. Other departmental requirements—Information literacy competency is demonstrated by successful completion of CSCI 481. Writing competency is demonstrated by successful completion of CSCI 480.

2. Delete: On page 115, the entry under **Concentration in Information Systems:**

The concentration in Information Systems includes both theory and application of software development. This concentration prepares students for careers in commercial programming, database management, and mobile and web application development.

I. Required courses in the major—38 hours, including: CSCI 107, either 181 or 182, 202, 255, 343, 344, 448, 462; and 15 additional hours in CSCI at the 300 level or above.
II. Required courses outside the major—19 hours: ACCT 215; ECON 306; MATH 191, and either 251 or 280; MGMT 130; STAT 185 or 225.
III. Other departmental requirements—Major and oral competencies are demonstrated by successful completion of CSCI 462.

Add: On page 115, in place of deleted entry:

The concentration in Information Systems includes both theory and application of software development. This concentration prepares students for careers in commercial programming, database management, and mobile and web application development. Students selecting this concentration are encouraged to consider courses in a second discipline. By developing expertise in an additional area students will increase their options for future studies and employment after they graduate.

I. Required courses in the major—38 hours: one course from CSCI 182, 183 or 185; CSCI 201, 202, 280, 235, 333, 338, 343, 344, 480, 481; one of the following data science courses: CSCI 312, 346, 347, 412, 441; 6 additional hours at the 300-400 level.
II. Required courses outside the major—11 hours: MATH 191, 251: STAT 185 or 225.
III. Other departmental requirements—Information literacy competency is demonstrated by successful completion of CSCI 481. Writing competency is demonstrated by successful completion of CSCI 480.

3. Delete: On page 115, under **Minor in Computer Science:**

22 hours in Computer Science: CSCI 107, either 181 or 182, 202, 255; and 9 hours in CSCI at the 300 level or above.

Add: On page 115, in place of deleted entry:

21 hours in Computer Science: one course from 182, 183 or 185; 201, 202, 235 and 9 hours in CSCI at the 300-400 level.

Impact Statement: This document and its related curriculum proposals are the result of a five year review process. Each member of our current full-time faculty has contributed to its development. During our August 2016 retreat, the components of this curriculum passed with a 5-1 vote.

We stress that after an initial transition period, this curriculum will allow our first year students to complete all requirements within four years. The dissenting vote strongly addressed the impact of making the DIP courses a pre/co-requisite to our CSCI 201 course. Our sample schedules show that a well prepared transfer student from a community college will be able to complete the curriculum in five semesters. The majority felt that a completion time of five semesters was adequate for these transfer students.

We anticipate that our high rate of substitutions will decline as we have more students declaring majors under this new curriculum. While the requirements and the offering schedule will greatly reduce the number of special topics courses that we can offer, the increased benefit in reducing student matriculation time is worth this trade-off. The following tables show our proposed offerings, sample student schedules, and transition plan.

Two Year Offering Schedule:

Assumptions:

1. 19 course sections offered per semester. Starting in Fall 2017, we will have seven full-time positions (5 Tenure/Tenure-track, 2 Lecturers). Making an allowance for two course releases, this schedule assumes five full-time faculty will offer at least three sections (4 contact hours each) and the chair will offer 2 sections (4 contact hours each).
2. Each catalog course can be taught by at least two faculty.
3. LA 178 will be offered (for LAC and ACES Scholars program, a joint scholarship program with the Atmospheric Science Department)
4. LA 478 will be offered (for Humanities program)

Table 1: Course Offering Schedule					
	Fall Odd Years (400 CSCI seats)			**Spring Even Years (400 CSCI seats)**	
	Course#	**Title (seats)**		**Course#**	**Title (seats)**
1.	CSCI 18X	DIP (20)		CSCI 18X	DIP (20)
2.	CSCI 18X	DIP (20)		CSCI 18X	DIP (20)
3.	CSCI 18X	DIP (20)		CSCI 18X	DIP (20)
4.	CSCI 18X	DIP (20)		CSCI 18X	DIP (20)
5.	CSCI 201	Intro to Object-oriented Computing (20)		CSCI 201	Intro to Object-oriented Computing (20)
6.	CSCI 201	Intro to Object-oriented Computing (20)		CSCI 201	Intro to Object-oriented Computing (20)
7.	CSCI 202	Introduction to Data Structures (25)		CSCI 202	Introduction to Data Structures (25)
8.	CSCI 202	Introduction to Data Structures (25)		CSCI 202	Introduction to Data Structures (25)
9.	CSCI 280	Computer Science Seminar (25)		CSCI 280	Computer Science Seminar (25)
10.	CSCI 235	Systems I (20)		CSCI 235	Systems I (20)
11.	CSCI 335	Systems II (25)		CSCI 344	Web Technology (20)
12.	CSCI 343	Database Management (25)		CSCI 338	Software Engineering (25)
13.	CSCI 333	Algorithms and Data Structures (25)		CSCI 431	Organization of Programming Languages (25)
14.	CSCI 434	Theory of Computation (25)		**CSCI 346**	**Computer Graphics (25)**
15.	**CSCI 312**	**Artificial Intelligence (25)**		CSCI 480	Capstone I (20)
16.	CSCI 480	Capstone I (20)		CSCI 481	Capstone II (20)
17.	CSCI 481	Capstone II (20)		LA 478	Humanities Course (15)
18.	**CSCI 373**	**Special Topics (20)**		**CSCI 373**	**Special Topics (25)**
19.	**CSCI 373**	**Special Topics (20)**		**CSCI 373**	**Special Topics (25)**

	Fall Even Years (400 CSCI seats)			**Spring Odd Years (410 CSCI seats)**	
	Course#	**Title**		**Course#**	**Title**
1.	CSCI 18X	DIP **(20)**		CSCI 18X	DIP **(20)**
2.	CSCI 18X	DIP **(20)**		CSCI 18X	DIP **(20)**
3.	CSCI 18X	DIP **(20)**		CSCI 18X	DIP **(20)**
4.	CSCI 18X	DIP **(20)**		CSCI 18X	DIP **(20)**
5.	CSCI 201	Intro to Object-oriented Computing **(20)**		CSCI 201	Intro to Object-oriented Computing **(20)**
6.	CSCI 201	Intro to Object-oriented Computing **(20)**		CSCI 201	Intro to Object-oriented Computing **(20)**
7.	CSCI 202	Introduction to Data Structures **(25)**		CSCI 202	Introduction to Data Structures **(25)**
8.	CSCI 202	Introduction to Data Structures **(25)**		CSCI 202	Introduction to Data Structures **(25)**
9.	CSCI 280	Computer Science Seminar **(25)**		CSCI 280	Computer Science Seminar **(25)**
10.	CSCI 235	Systems I **(20)**		CSCI 235	Systems I **(20)**
11	CSCI 335	Systems II **(25)**		CSCI 344	Web Technology **(20)**
12.	CSCI 343	Database Management **(25)**		CSCI 338	Software Engineering **(25)**
13.	CSCI 333	Algorithms and Data Structures **(25)**		CSCI 431	Organization of Programming Languages **(25)**
14.	CSCI 434	Theory of Computation **(25)**		CSCI 347	Game Programming **(25)**
15.	CSCI 412	Computer Vision **(25)**		CSCI 480	Capstone I **(20)**
16.	CSCI 480	Capstone I **(20)**		CSCI 481	Capstone II **(20)**
17.	CSCI 481	Capstone II **(20)**		CSCI 373	Special Topics **(20)**
18.	LA 178	Freshman Colloquium **(15)**		CSCI 373	Special Topics **(20)**
19.	CSCI 373	Special Topics **(20)**		CSCI 373	Special Topics **(20)**

Sample Student Schedules:

Legend: Green – Fulfills Requirement for LAC
Orange – Fulfills Requirement for LAC and Major
Black – Fulfills Requirement for Major

Table 2: Sample 4-Year Schedule -- Computer Systems Concentration

	Fall	Spring
Year 1	LA 178 LANG 120 Domain Intensive Programming Course (Scientific Perspective) MATH 191(Quantitative Perspective)	HUM 124 Social Science CSCI 201 MATH 251
Year 2	HUM 214 CSCI 202 PHYS 221 MATH elective 1	Second Language Requirement CSCI 235 PHYS 222 or 231 CSCI 280 MATH elective 2
Year 3	HUM 324 CSCI 434 CSCI 333 CSCI 335	Diversity Intensive CSCI 338 CSCI Data Science CSCI elective
Year 4	ARTS and Ideas CSCI elective 1 CSCI 480 (Writing Competency)	HUM 414 or LA 478 CSCI 431 CSCI 481 (Oral and Information Competency)

Table 3: Sample Transfer Schedule -- Computer Systems Concentration -- Student enters in Fall

Assumes a 60-61 hour core transfer that includes one programming course and Calculus I

	Fall	Spring
Year 1	PHYS 221 CSCI 201 MATH elective 1 HUM 324	PHYS 222 or 231 CSCI 202 CSCI 235 MATH 251
Year 2	CSCI 280 CSCI 333 CSCI 335 CSCI 434 Math Elective 2	CSCI 338 CSCI Data Science CSCI 431 CSCI 480 (Writing Competency) Diversity Intensive
Year 3	HUM 414 or LA 478 CSCI elective 1 CSCI elective 2 CSCI 481 (Oral and Information Competency)	

Table 4: Sample Transfer Schedule -- Computer Systems Concentration -- Student enters in Spring

Assumes a 60-61 hour core transfer that includes one programming course and Calculus I

	Fall	Spring
Year 1		CSCI 201 MATH elective 1 HUM 324 Diversity Intensive
Year 2	PHYS 221 CSCI 202 CSCI 235 CSCI 333 MATH elective 2	PHYS 222 or 231 MATH 251 CSCI 280 CSCI 338 CSCI 335
Year 3	CSCI 434 CSCI Data Science CSCI elective 1 CSCI 480 (Writing Competency)	HUM 414 or LA 478 CSCI 431 CSCI elective 2 CSCI 481 (Oral and Information Competency)

Table 5: Sample 4-Year Schedule for the Information Systems Concentration

	Fall	Spring
Year 1	LA 178 LANG 120 Domain Intensive Programming Course (Scientific Perspective)	HUM 124 Social Science CSCI 201 STAT 185 (Quantitative Perspective)
Year 2	HUM 214 Lab Science Requirement CSCI 202	Second Language Requirement MATH 251 CSCI 235 CSCI 280
Year 3	HUM 324 CSCI 343 CSCI 333	Diversity Intensive CSCI 344 CSCI 338
Year 4	ARTS and Ideas CSCI elective 1 CSCI Data Science CSCI 480 (Writing Competency)	HUM 414 or LA 478 CSCI elective 2 CSCI 481 (Oral and Information Competency)

Table 6: Sample Transfer Schedule for the Information Systems Concentration

	Fall	Spring
Year 1	CSCI 201 Diversity Intensive HUM 324	HUM 414 or LA 478 CSCI 202 CSCI 235 MATH 251
Year 2	CSCI 280 CSCI 343 CSCI 333 CSCI elective 1	CSCI 344 CSCI 338 CSCI Data Science CSCI 480 (Writing Competency)
Year 3	CSCI elective 2 CSCI 481 (Oral and Information Competency)	

Transition Plans: To reduce the impact on students fulfilling requirements from catalogs prior to Fall 2017, we plan to offer CSCI 472, Senior Project for one year after our proposed changes take effect. After that, we will offer the new capstone sequence CSCI 480/481 in parallel with 472, if needed, depending on the number of seniors who will be graduating that year under the old curriculum. The following shows the mappings that will allow students declared in catalogs prior to Fall 2017 to graduate.

Table 7: Transition mappings for Computer Science Major: Computer Systems

Catalogs prior to Fall 2017	**Fall 2017 catalog**
CSCI 107	CSCI elective
CSCI 181 *Credit will be awarded for either CSCI 201 or for CSCI 181 courses completed prior to Fall 2017, but not both. CSCI 201 will be waived for students who completed CSCI 181 prior to Fall 2017. These students will be required to complete an additional 3 hours in CSCI.*	CSCI 201
CSCI 202	CSCI 202
CSCI 255	CSCI 235
CSCI 320	CSCI 335
CSCI 331	CSCI 300-level elective
CSCI 333	CSCI 333
CSCI 343	CSCI 343
CSCI 346	CSCI 346
CSCI 431	CSCI 431

Table 8: Transition mappings for Computer Science Major: Information Systems

Catalogs prior to Fall 2017	**Fall 2017 catalog**
CSCI 107	CSCI elective
CSCI 181 *Credit will be awarded for either CSCI 201 or for CSCI 181 courses completed prior to Fall 2017, but not both. CSCI 201 will be waived for students who completed CSCI 181 prior to Fall 2017. These students will be required to complete an additional 3 hours in CSCI.*	CSCI 201
CSCI 202	CSCI 202
CSCI 255	CSCI 235
CSCI 343	CSCI 343
CSCI 344	CSCI 344
CSCI 448	CSCI 338

Table 9: Transition mappings for Computer Science Minor

Catalogs prior to Fall 2017	**Fall 2017 catalog**
CSCI 107	CSCI elective
CSCI 181 *Credit will be awarded for either CSCI 201 or for CSCI 181 courses completed prior to Fall 2017, but not both. CSCI 201 will be waived for students who completed CSCI 181 prior to Fall 2017. These students will be required to complete an additional 3 hours in CSCI.*	CSCI 201
CSCI 202	CSCI 202
CSCI 255	CSCI 235

Rationale: In our revised curriculum, the Computer Science faculty seek the following objectives:

1. **To intentionally offer domain-specific introductory courses.** We propose to designate CSCI 182, 183 and CSCI 185 as "domain intensive programming courses" fondly known as DIP in the CSCI department. These project-oriented courses are designed to introduce students to the discipline of computer science, and are intended to have them design and implement applications within a certain domain (mobile applications, robot activities, web games, music composition, etc.) The interdisciplinary focus of these domain-specific courses should also provide students of other majors an opportunity to learn how to write programs appropriate to their field of studies. We are pleased to continue our support of the LAC curriculum by offering these scientific perspective courses.

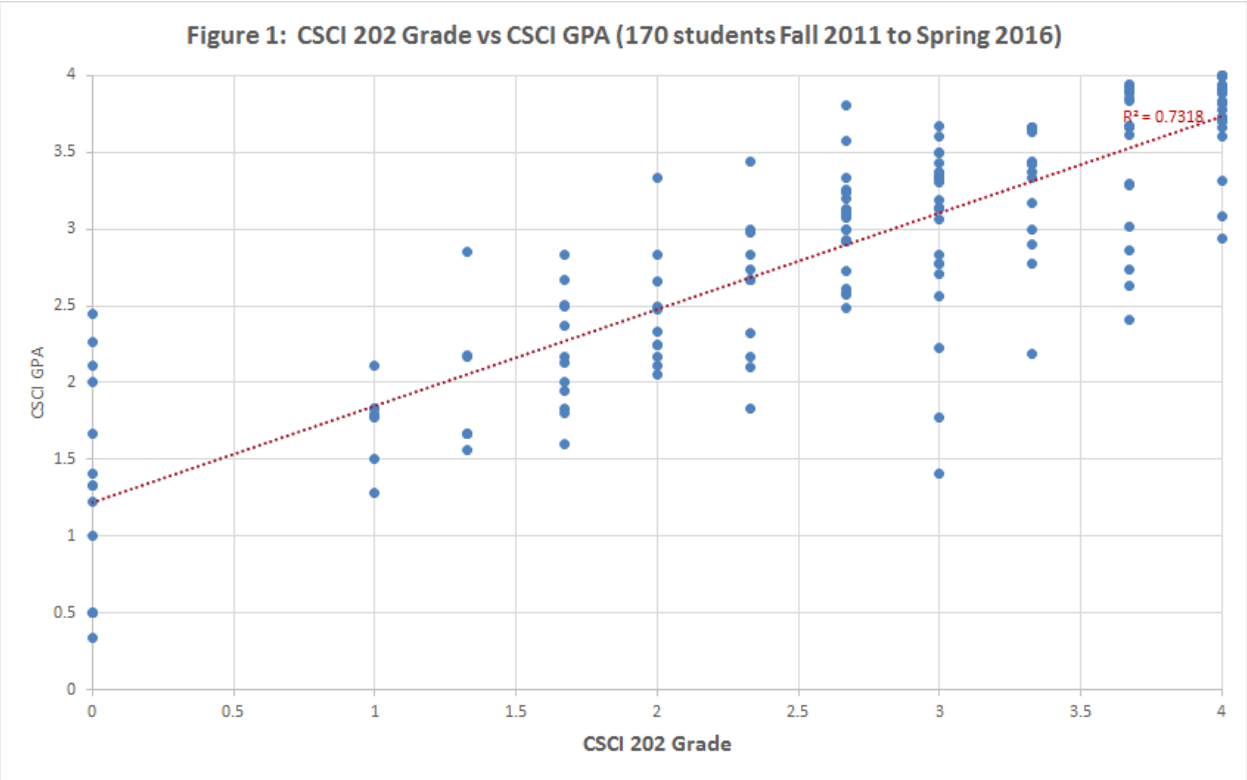
2. **To separate object-oriented CSCI requirements from the courses that provide introductory programming experiences that allow students to create applications that are relevant and engaging.** The current introductory programming courses, CSCI 181 and 182, offer engaging activities in numerical applications and media applications, respectively. Both courses fulfill the prerequisite requirement to CSCI 202. However, CSCI 202 students perceived that CSCI 181, which has JAVA as a programming language, to be better preparation than CSCI 182.

   To address this issue, our new curriculum reinstates CSCI 201 as a separate object-oriented programming course that will be the prerequisite for CSCI 202. We are also creating a new course, CSCI 183, which is essentially the old 181 without the object-oriented concepts that are part of CSCI 201. CSCI 201 will now be the prerequisite for CSCI 202

3. **To formalize our writing competency requirements.** The 2013 curriculum revision moved the writing competencies from the institutional level to departmental level. Since Fall 2015, writing competency in computer science has been demonstrated via our software engineering course which is currently offered as a special topics course. In this proposal we formalize the software engineering course as a catalog course. While each course in our curriculum includes small writing assignments (eg. program documentation), we will formally initiate the development of professional and technical writing in our new offering, CSCI 280: Computer Science Seminar. The student learning outcomes for CSCI 338: Software Engineering will include further development of technical writing skills. Student writing competency will be assessed in CSCI 480: Capstone I.

4. **To reflect the strength of our capstone experiences.** Currently our senior capstone experience is listed as a one hour course. In recent years this project course has been offered as a two hour experience. One to two hours do not accurately reflect the amount of student work - formally propose a project, conduct a literature review, implement the project, write project synopsis, and publicly present the work. The current senior projects have a professional development component in which student explore options available to them upon graduation. In our proposal, the learning outcomes will be distributed across three courses. The sophomore-junior level CSCI 280 -- Computer Science Seminar will provide professional development. Students will consider what ethical conduct in the discipline of computing is, explore internship and research opportunities, examine their own after-graduation goals and opportunities, and strengthen oral and written communications skills. Students will write proposals and conduct literature reviews in CSCI 480: Capstone I, and their projects will be implemented in CSCI 481: Capstone II.

5. **To further strengthen our facilitation of student success.** As demonstrated in Figure 1, the grade received in CSCI 202: Introduction to Data Structures is strongly correlated to a student's overall performance in CSCI courses. Students receiving lower than a C in this course have difficulty completing a CSCI major with the required 2.0 average. In our revised curriculum, we designate CSCI 202 as requiring a C or better, meaning in order to persist in the CSCI major or minor, a student must achieve a C or higher in this course. We hope that this policy, in conjunction with compassionate advising, will aid students in determining a major best suited for their academic goals. Our revised curriculum also aids student success by providing a consistent offering schedule allowing students who enter UNC Asheville as first year students the opportunity to successfully complete either of our concentrations within four years. Our schedules are listed in the impact section of this document. Lastly, our revised curriculum aids in student success by stressing effective academic advising to encourage students to consider which cognate courses to take in order to meet individual goals.



6. **To move closer towards our long-term objective of receiving ABET accreditation.** As other disciplines on this campus, we want our program to receive external recognition for its quality. We want our peers and students to receive further assurance that we do constantly and intentionally self-access and improve our computing curriculum. In Table 1, we address in which course each student learning outcome - ABET, departmental, and institutional - is introduced, developed, and mastered. Table 2 displays the current ABET curricular requirements. A year is considered 30 hours. Our program with 41 credit hours fulfills the computer science component. Our proposal includes the minimum requirement of 15 hours of mathematics and 8 hours of science. We are seven hours short of the posted ABET requirements.

   We acknowledge that achieving ABET accreditation under the current ABET guidelines will cause our computer systems program to exceed our institution's credit hour cap. In the appendix to this document, we provide a table comparing our current hour requirements to the other 29 COPLAC institutions. The table also includes Amherst College and Williams College, the nation's number one and number two liberal arts institutions. This table shows that in terms of our requirements, our program is at the median of the 24 COPLAC institutions that offer computer science programs. We are examining ideas on how to achieve the ABET goal and remain in compliance with the credit cap policy. A developing idea for achieving ABET accreditation is to offer a track that allow students interested in an ABET curriculum to select a minor in mathematics or a natural science. ABET is in the process of updating its Computer Science curriculum requirements. Although it has not been finalized, a recent conference presentation given by ABET officials suggests that our proposed curriculum may conform to the updated ABET updated requirements.

Table 10: ABET/Department Combined Outcome Curriculum Map												
	Required Course # **Legend: I = introduced D = developed M = mastered**											
Outcome	**DIP**	**201**	**202**	**235**	**280**	**DS**	**333**	**335**	**338**	**431**	**434**	**480/ 481**
Design, develop, implement, and test software to solve an assigned problem	I	I	D	I			D	D	M	M		M
Understand problems by offering clear, concise, and comprehensive descriptions.	I		I	I			D	D	D	M	D	M
Systematically evaluate various possible solutions.		I	D	I			D	D	D	M	D	M
Meticulously develop solutions.		I	D	I			D	D	D	M	D	M
Write comprehensive technical documents that engagingly and accurately describe their work.			I						D	D		M
Communicate their work to various audiences.	I		I						D			M
Function effectively on teams.	I		I			D			M			
Understand professional, ethical, legal, security, and social issues and responsibilities.	I	I			I				D			M
Analyze the local and global impact of computing on individuals, organizations, and society.	I				I				D			M
Recognize the need for and ability to engage in continuing professional development.					I				D			M
Use current techniques, skills, and tools necessary for computer practice.		I	D	I		D	D	D	D	M	D	M
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.			I	I		D	D	D	D	M		M
Apply design and development principles in the construction of software systems of varying complexity.			I	I		D	D	D	D	M		M

Table 11: ABET Curricular requirements

Curriculum

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. [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. 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. [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 or engineering majors that provide some exposure to laboratory work. [CS]

Source: ABET Accreditation Criteria for Computing Programs (2016-2017)
http://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-computing-programs-2016-2017/#curriculum