# *Birmingham-Southern College*

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## Institutional and departmental context

* Location: Birmingham, Alabama, 35254, USA
* Undergraduate student body size: 1,126
* Degree(s) offered: BS Applied Computer Science
* Department/major name: Department of Mathematics and Applied Computer Science
* Number of contributing faculty: 2 FTE, both tenure-track
* Number of majors annually: approximately 10
* Does the department offer any graduate programs? No

The mission of [Birmingham-Southern College](http://www.bsc.edu) is “to prepare men and women for lives of significance.” Therefore, the Applied Computer Science major was developed with the focus of incorporating components that would encourage students to examine how the content taught in class either impacts or is impacted by the world. The Applied Computer Science program started in fall 2017 with one faculty member. Throughout the past 3.5 years, the department has grown to its current status of 30 majors, 16 minors and has graduated 11 majors and 11 minors.

Based on reflection of student performance coupled with industry demand, the curriculum has gradually changed from the preliminary curriculum to four tracks in an effort to appeal to a broader student body, particularly, one within a liberal arts institution. Additionally, the program has been designed to:

* Include opportunities for students to apply other subjects, ideally minors, to their projects;
* Incorporate social, legal, and ethical issues, written communication, and cyber security components throughout the curriculum; and
* Be completed in three years.

## Curricular overview

### Major program(s)

The BS in Applied Computer Science has four tracks: Industry (13 units), Computer Engineering, Software Engineering, and Creative Media Manipulation.

Required of all Applied Computer Science Majors (7 units):

* CAC 180: Programming I
* CAC 190: Programming II
* CAC 210: Data Structures and Media Computation
* CAC 220: Storage and Analysis of Data
* CAC 310: Programming Languages
* CAC 430: Human Computer Interaction and Software Engineering
* CAC 470: Senior Capstone

*Industry Track (6 additional units):*

* AR 111: Two-Dimensional Design
* MA 207: General Statistics **OR** MA 231: Calculus I
* Four electives from a very diverse list that includes select courses from Accounting, Art, Business, Applied Computer Science, English, Math, Philosophy, Psychology, and Theatre Tech. Two of the courses must be at the 300/400 level, and one must be from Applied Computer Science. The Applied CS electives are
  + CAC 170: CS Principles
  + CAC 230: Introduction to Web Design
  + CAC 240: Robotics
  + CAC 320: Architecture and Internet of Things
  + CAC 330: Advanced Web Design
  + CAC 340: Digital Media
  + CAC 350: Data Science
  + CAC 410: Systems and Cyber Security
  + CAC 420: Electrical Circuits
  + CAC 440: Software Design

*Computer Engineering Track (8 additional units):*

* CAC 240: Robotics
* CAC 320: Architecture and Internet of Things
* CAC 420: Electrical Circuits
* MA 231: Calculus I
* MA 232: Calculus II
* MA 317: Linear Algebra
* PH 121: General Physics I
* PH 122: General Physics II

*Software Engineering Track (7 additional units):*

* CAC 410: Systems and Cyber Security
* CAC 440: Software Design
* One from
  + CAC 350: Data Science
  + CAC 320: Architecture and Internet of Things
  + CAC 397: Internship
* MA 231: Calculus I
* MA 232: Calculus II
* MA 240: Discrete Structures
* PH 121: General Physics I

*Creative Media Manipulation (6 additional units):*

* MFS 220: Film Production
* MFS 320: Advanced Film Production
* Two from
  + AR 111: Two-Dimensional Design
  + AR 112: Three-Dimensional Design
  + AR 222: Camera Mechanics and Composition
  + AR 321: Photography: From Chemistry to Digital
  + AR 324: Photography as Witness: Documentary Photography and the Art of Visual Narrative
  + AR 325: Photography: The Language of Light
  + AR 333: Digital Printmaking
* Two from
  + THA 201: Theatre Practicum
  + THA 210: Technical Workshop
  + THA 211: Stage Lighting
  + THA 212: Set Design

### Non-major program(s)

The Applied Computer Science program offers two minors:

*Applied Computer Science (5 units):*

* CAC 180: Programming I
* CAC 190: Programming II
* One unit from Applied CS at the 200 level
* Two units from Applied CS at the 300/400 level

*Data Science (5 units):*

* CAC 180: Programming I **OR** CAC 181: Data Science Programming
* One from
  + MA 209: Data Science Statistics
  + MA 207: General Statistics
  + PY 204: Statistics for Research
  + SBS 204: Survey Data Analysis and Statistics
* CAC 350: Data Science
* CAC 450: Advanced Data Science
* MA 372: Mathematical Problem Solving in Business, Industry, and Government **OR** CAC 397: Internship

For non-majors want to receive a general introduction to computer science, the department offers CAC 170: CS Principles. This course is based on the AP CS Principles course, which gives incoming students the opportunity to receive credit for the AP course. It is also used as a recruiting course for the major as it counts as an elective for the Industry Track.

### Co-curricular program(s)

There are currently two co-curricular opportunities for students:

* Tutoring program through the Academic Resource Center; tutors are nominated by Applied CS faculty.
* Panther\_C0de student organization responsible for holding regularly scheduled events, which may consist of programming challenges, resume workshops, speakers, game nights, etc.

## Key contributions

* We have worked very hard to teach traditionally theoretical topics in applied contexts. For example, operating Systems are lightly discussed from the perspective of cyber security, data structures are taught in connection with media (e.g., binary trees and musical composition), and computer architecture is taught in conjunction with the Internet of Things.
* Social, legal, and ethical issues are discussed throughout the curriculum. This is overtly taught in some courses (i.e., CAC 170, CAC 410, CAC 430) and taught with more subtlety in other courses by incorporating accessibility concepts ([examples](https://dramberwagner.com/teaching-accessibility/)) and regular discussion of articles from current news outlets.
* We are in the process of incorporating cyber security concepts into each of the core required courses as appropriate. For example, in programming courses, the importance of coding securely is discussed with examples of good versus bad approaches and why it matters. In the database course, we discuss SQL injections and how to prevent this vulnerability. CAC 170: CS Principles has a designated module on cyber security issues, and CAC 410 obviously focuses on the discipline.
* Because creativity and innovation are important to us, the majority if not all courses require a final project rather than an exam. Most final projects require a written portion where students are required to submit a technical document, reflection, and/or research paper in addition to the corresponding code for the project.

## Limitations/challenges

The program is small but growing, and we have tried to expand offerings as much as possible to ensure students are receiving a well-rounded CS education while meeting demands of industry. While it seems like a large offering, we have planned it to enable each elective to be taught once in four terms while the required courses for all tracks are taught in such a way that students can complete the program in three years. Also, many of the required courses (e.g., math, physics, and art) meet the general education requirements and are requirements the students would need to complete regardless of major.

We would appreciate to learn if the course offerings match that of other liberal arts institutions. Additionally, we are in the process of building a formal undergraduate research co-curricular program. Any examples would be greatly appreciated.