Georgia Institute of Technology
Student-Centered Computing Advanced Placement Computer Science Principles

AP Computer Science Principles

The Georgia Institute of Technology's (Georgia Tech) Student-Centered Computing (SCC) Advanced Placement Computer Science Principles (AP CSP) curriculum is a year-long rigorous course that introduces high school students to the foundational concepts of computer science and explores the impact of computing and technology on our society. The course covers a range of foundational topics such as computer systems, networks and the Internet, safe computing, data representation, big data, programming, algorithms, and abstractions.

AP Endorsed

"The Georgia Institute of Technology is recognized by the College Board as an endorsed provider of curriculum and professional development for AP® Computer Science Principles (AP CSP). Using an Endorsed Provider affords schools access to resources including an AP CSP syllabus pre-approved by the College Board's AP Course Audit, and officially recognized professional learning and curriculum that prepares teachers to teach AP CSP. This endorsement affirms only that components of Endorsed Provider's offerings are aligned to all the AP Course Framework standards and the AP CSP assessment".

Pedagogical Design Principles

Georgia Tech's Student-Centered Computing pedagogical design principles include:

Project-Based Learning and motivation
Equity-driven collaborative work
Culturally Authentic Practices

The curriculum promotes the development of rigorous computational thinking skills by engaging students in authentic and culturally relevant projects. Using these projects as guides, students draw upon their experiences, settings, and culture to iteratively and digitally narrate stories to develop awareness and agency.

By linking student interests and experiences with design-based projects, the abstract concepts embedded in computer science are brought to life in an engaging, relevant, and culturally authentic classroom. Student voice and choice is highly valued and integrated in the AP CSP classroom. Course content based upon AP CSP standards is delivered under an ARC topic that is selected by each student. Student teams are then formed around common topics and AGILE development strategies are utilized to facilitate project completions.

The ARC is an overriding topic selection by each student that "arcs" overall curriculum content. All course standards are connected back to this topic selection through projects that are completed in collaborative teams. By allowing students to select their ARC topic, students are

more personally accountable and student engagement strengthens. Students participate in a facilitated exploration of relevant topics and will identify a current computing innovation directly related to their topic. This innovation becomes the focus of all unit projects and research for the first semester. Curriculum content covered includes the effects and impacts of the innovation, a business case study, explorations of applicable laws and ethical standards, collection and visualizations of data to solve a real-life problem, and complex programming projects related to the innovation.

Georgia Tech's SCC AP CSP curriculum utilizes Culturally Authentic Practices to support students at both the community and individual levels. The curriculum reflects diverse students' cultural heritages, enables students to share their own culture, and connects learning to students' home life. It also enables students to see themselves represented in the materials and allows them to share their life experiences and represent themselves in their projects.

College Board's AP CSP Conceptual Framework

The AP Computer Science Principles Conceptual Framework serves as an initial resource for educators and providers. It offers essential information to grasp the design and purpose of the AP Computer Science Principles course. The CS Principles Conceptual Framework delineates five fundamental "Big Ideas" in computing.

Big Ideas

CRD: Creative Development
DAT: Data
AAP: Algorithms and Programming
CSN: Computing Systems and Networks
IOC: Impact of Computing

Below is a detailed description of each unit with big ideas highlighted.

Curriculum Overview

Unit 0 Introduction to Computer Science	In many high schools, student course enrollment changes during the first 5 - 7 days of the school year. Unit 0 is designed to give the students a glimpse of the big ideas without being detrimental to students who may miss a few class periods due to schedule changes. **This unit is optional.** However, it is really good for building relationships and giving a "taste" of what will be happening throughout the year. These activities can also be incorporated throughout the school year.
Unit 1 Innovation and Impact	Students research at least three computing innovations by explaining how they function, their purpose, and the data that is collected. Students review all of the innovations and select a topic that is meaningful to them. Project teams are formed around common topics. These teams finalize their innovation selection and begin thoroughly researching the impact and effects of this innovation (CRD) and (IOC). The unit culminates in the first team challenge which consists of a website that becomes a digital portfolio of their research and a quiz app/game to educate the general public on their selected innovation (AAP).
Unit 2 Computer Systems and Networks	Students examine the history of the Internet and examine the impact the Internet has had on society (CSN) and (IOC). Students investigate technical aspects of networks and how data travels. Students will complete a business case study. Students will explore EarSketch, and create music for a company recruitment artifact (AAP).
Unit 3 Safe Computing	Students will learn what type of information is considered personally identifiable information (PII) and how this data is collected and stored in a computing system (CSN) and (IOC). We will explore the risks and benefits of stored data to a computer user. Then the unit shifts the focus to how we can protect the information, how computing systems can be misused to gather PII, and how unauthorized access to the system occurs. Students will learn about encryption techniques, common cybersecurity threats, and the trust model of the Internet.

	Students will investigate and analyze the security of their selected innovation as it relates to privacy, legal & ethical issues. Students will also research laws and acts relevant to their innovation (IOC). There is an optional programming plugin where students modify the app they created in Unit 1 (AAP).
Unit 4 Programming Foundations	This unit introduces students to creative programming development using a design emphasis (CRD) and (AAP). In each of the following units, students will design music for an intended audience. The SCC framework is focused on choice and voice so students may choose a client who is inspiring to them. Students use variables, lists, and procedures in their project (DAT).
Unit 5 Algorithms and Procedural Abstractions	Student pairs collaboratively design a musical background for a one-minute TikTok or other visual inspiration where students make their own computationally looped beats that have conditional fills much like a DJ. Students' songs require them to create procedures to apply musical form. Student pairs provide feedback as they have done throughout the course as they iterate on their Javascript musical compositions (AAP).
Unit 6 Event Driven Programming & Data Abstraction	Student pairs use other groups' music from the previous unit in combination with their music to create a Low Fidelity (Low-Fi) Music Player (i.e. Spotify) of songs that play a user's selection or computationally randomly selects the song. Students use data structures to develop the event-centered and random selection of the jukebox while continuing the previous computational concepts of iteration, conditionals, and procedure creation for the songs of the Low-Fi Player. Feedback is again provided as well as continued transfer of Javascript into the AP exam agnostic language (AAP).
Unit 7 Data Representation	Students will explore how data can be represented using bits (DAT). They will begin with the binary concept of a bit and will learn to convert binary values to decimal values and vice versa. Students will gain an understanding of some of the abstractions in computing including, but not limited to, numbers, characters, and color. Students will also examine compression techniques and the trade-offs resulting from each. Students will collect real data and analyze the results. Students will identify the data of their chosen computing innovation and explain how the data is consumed, produced, or transformed (DAT).
Unit 8 Big Data	It is critically important that students learn to manage, interpret, and use the data in an ethical manner. Bias does exist in algorithms and in this unit, students will not only be researching examples of algorithmic bias and analyzing the impacts of those biases, but they will also be developing protocols and standards to prevent that from happening in their own projects (DAT) and (IOC). Students will continue the data analysis from Unit 4. Students explore simulations in this unit (AAP).
Preparing for the Create Task and the AP Exam	Students practice the requirements of the Create Task through the jukebox project and analyze each other's practice submissions based on criteria that are similar to the AP Exam Task. Practice multiple choice exams from the college board site are suggested as preparation for the multiple choice portion of the AP Exam.

Computing Innovations Curricular Requirement

If teaching this course as an AP course, College Board requires students to explore computing innovations and address the following prompts:

A. Explain the beneficial and harmful effects of at least one computing innovation on society, economy, or culture.
B. Identify the data used in at least one computing innovation and explain how the data is consumed, produced, or transformed by the given computing innovation.
C. Identify data privacy, security, or storage concerns for at least one computing innovation.

Unit 1: Students choose a computing innovation and develop a website that outlines its societal impact, including both positive benefits and harmful effects (CI 1, Prompt A).

Unit 3: Students delve into the security aspects of their selected innovation, examining its implications for privacy, legal considerations, and ethical issues. Additionally, they research relevant laws and acts related to their chosen topic (CI 2, Prompt C).

Unit 7: In this phase, students identify and elucidate the data associated with their computing innovation, exploring how this data is produced, consumed, or transformed (CI 3, Prompt B).

Who Should Take This Course?

There are no prerequisites for this course. However, College Board recommends that students have completed a first-year algebra course and have a strong foundation of basic linear functions, the composition of functions, and problem-solving strategies that include collaboration and using multiple approaches to solve problems. Students should also have a basic understanding of the Cartesian (x,y) coordinate system. Although prior computer science experience is not required to take this course, teachers and students should understand that this computer science course builds upon a foundation of mathematical reasoning.

Who Should Teach This Course?

The curriculum is structured to provide ample support and preparation for teachers who are new to teaching this material, particularly those who have completed Georgia Tech's professional development program. If a teacher has limited technical or no formal computer science experience, if they are motivated, they should be able to succeed. We strongly advise that the teacher have a basic level of comfort using computers, such as browsing the web, sending and receiving emails, downloading and saving files, and basic troubleshooting.

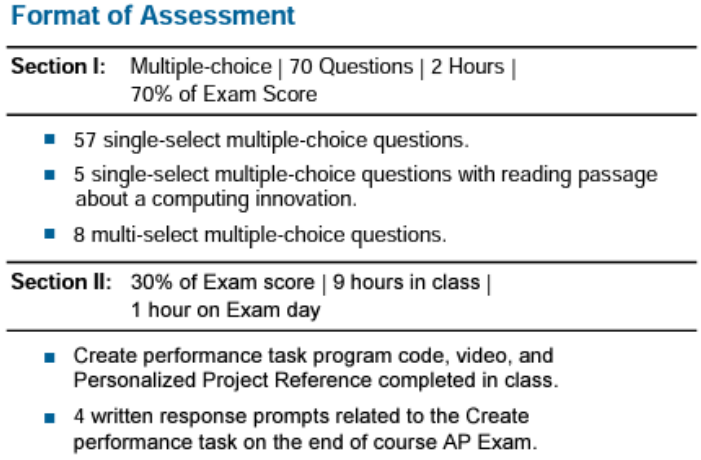
Suggested Supplemental Materials

This course does not require a textbook. Unplugged activities from Blown to Bits, which is a free online resource, can supplement this course. https://www.bitsbook.com/excerpts/

Assessment Overview

The AP Computer Science Principles Exam assesses student understanding of the computational thinking practices and learning objectives outlined in the course framework. The exam consists of the Create performance task and an end-of-course AP Exam.

The image to the right is from the College Board Website.



Format of Assessment

Section I: Multiple-choice | 70 Questions | 2 Hours | 70% of Exam Score

- 57 single-select multiple-choice questions.
- 5 single-select multiple-choice questions with reading passage about a computing innovation.
- 8 multi-select multiple-choice questions.

Section II: 30% of Exam score | 9 hours in class | 1 hour on Exam day

- Create performance task program code, video, and Personalized Project Reference completed in class.
- 4 written response prompts related to the Create performance task on the end of course AP Exam.

The AP Create Performance Task

The AP Create Performance Task is an in-class assessment designed to gather evidence of student proficiency with the course learning objectives.

Each student is provided a minimum of 9 hours of class time to design and implement a computer program that might solve a problem, enable innovation, explore personal interests, or express creativity. Their final program code is accompanied by a video that displays the running of their program

AP Exam

The end-of-course exam is 3 hours long and includes 70 multiple-choice questions and four written response prompts related to the Create Performance Task.