Introducing
AP® Computer Science Principles
Overview: A Path Forward

1984 – 1988
AP Computer Science AB and A launched

2008
The National Science Foundation approached the College Board and suggested a new AP CS course that would broaden participation. The College Board held a higher education faculty colloquium where they agreed that a new AP CS course was needed to expand the pipeline of students participating in CS.

2009 – 2010
20 professors conceptualized the major components of a curriculum framework for a new introductory CS course – Computer Science Principles (NSF grant funded)

2013-2015
50 high schools and colleges piloted AP CSP

2016
AP Computer Science Principles launched
Agenda

► The value of AP® Computer Science Principles (AP CSP)

► Course and exam details and examples

► Developing a policy

► Q&A
The Value of AP® CSP
About half a million jobs in computer and information technology will be added by 2024. That’s a 12% growth in the tech industry, faster than the average for all occupations.

Development of AP® CSP

Goals

- Make computer science more engaging and accessible
- Reach students underrepresented in computer science
- Better prepare students for the job market of today and tomorrow
Largest AP Course Launch

- 2,500 Schools
- 50,000 Students
- 49 States
- 2,700 Teachers Trained
AP CSP exposes a more diverse group of students to CS in 2017

Percentage of students taking the AP Exam in 2017

- **Female**: 24% (CSA) vs. 30% (CSP)
- **Black/African American**: 4% (CSA) vs. 7% (CSP)
- **Hispanic/Latino**: 11% (CSA) vs. 19% (CSP)
- **Low Income**: 12% (CSA) vs. 20% (CSP)
Number of black or African American students taking an AP Computer Science exam has more than doubled with the addition of CSP.
Number of **Hispanic or Latino** students taking an AP Computer Science exam has more than doubled with the addition of CSP.
Number of female students taking an AP Computer Science exam has doubled with the addition of CSP.
Higher Ed Advisors and Development Committee
AP® CSP is Being Offered Nationwide and in 50 Countries

Not shown: AK (7) and HI (19)
## Two AP® Computer Science Courses

<table>
<thead>
<tr>
<th>Curricular Focus</th>
<th>Computer Science A</th>
<th>Computer Science Principles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem solving and object-oriented programming</td>
<td></td>
<td>Big ideas of computer science (including programming)</td>
</tr>
<tr>
<td>Programming Language</td>
<td>Java</td>
<td>Teachers choose</td>
</tr>
<tr>
<td>Assessment Experience</td>
<td>▶ Multiple-choice and free-response questions</td>
<td>▶ Multiple-choice exam</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▶ Two performance tasks administered by the teacher, and students submit digital artifacts</td>
</tr>
</tbody>
</table>
About the Course

AP Computer Science Principles offers a multidisciplinary approach, focusing on the creative aspects of programming.

Students will learn:

► Creative problem solving
► How to apply computational processes to analyze large data sets
► Programming
► How the Internet works and important cyber security issues
► Impacts of computing innovations

“Every student has this ability to create things that they didn’t even imagine they could create. And when they do, it starts to draw them in and inspire them to think well beyond what they even imagined.”

—Richard Kick
AP® Computer Science Principles Teacher
Overview of Curriculum Framework

Big Ideas

1. Creativity
2. Abstraction
3. Data and Information
4. Algorithms
5. Programming
6. The Internet
7. Global Impact

collegeboard.org/CSPframework
Overview of Assessments

Through-Course Assessment (Weight = 40%)

<table>
<thead>
<tr>
<th>Performance Task</th>
<th>Individual Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explore: Implications of Computing Innovations</td>
<td>16%</td>
</tr>
<tr>
<td>Create: Applications From Ideas</td>
<td>24%</td>
</tr>
</tbody>
</table>

End-of-Course AP® Exam (Weight = 60%)

<table>
<thead>
<tr>
<th>Item Type</th>
<th>Number</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple Choice (Single- and multiple-select)</td>
<td>74 questions</td>
<td>2 hours</td>
</tr>
</tbody>
</table>
Performance Tasks

► Create – Applications from Ideas

- Develop a computer program
  - Flexibility to select the purpose of their program
- Effectively implement programming elements from the language being used
- Students can work collaboratively at various stages of the development process
- Each student submits their own individual program

► Explore – Impact of Computing Innovations

- Investigate a computing innovation using credible sources
- Create an artifact that provides information about the innovation’s intended purpose
  - PDF, video, or audio
- Written responses to describe its usage, relationship to data and impacts
Sample Create Performance Task

AP CSP Performance Task | Create | Sample Response B

The orange bees are attacking the navy wasps.
This particular abstraction is used in the process of replacing wasps with bees. It uses data stored about how many wasps were in the cell, and uses it to place bees in that cell. The abstraction uses mathematical coordinates to know where to place the bees such that no bees are overlapping. It also uses common logic to adjust its y-position if multiple bees are being placed so that additional bees are placed beneath the existing bees. This abstraction is vital to the program because it is used every time the user defeats the computer and takes over its cell. Similarly, a “replace stamps wasps” block was abstracted to do the same function as the “replace stamps bees” block, except it replaces bees with wasps. Both of these abstracted blocks help manage the complexity of the code by hiding the long list of coordinates and coding used to execute the tasks. The abstracted blocks both contain about twenty-five blocks of code, and by abstracting them, it keeps the main code clear and easy to debug in case of any problems.
Explore Performance Task

- Using APCSP performance task wording, but …
  - Require students to create video
  - Could be video of artifact! So actually same thing
  - Overlay audio so YouTube might take it down
- Possible to work in a group
  - Benefits and drawbacks
Explore Performance Task – Sample from Duke University

Occulus Rift

https://www.youtube.com/watch?v=DQutU0otI9o
D. Describe at least one data storage concern, privacy concern, or security concern directly related to the computing innovation.

The ultimate privacy concern with the Oculus Rift, as well as with other VR innovations, develops from the knowledge that data is being gathered and tracked throughout use of the product. Movements, reactions, and all behaviors which occur when operating a product such as the Oculus Rift can be traced and stored. In addition, nearly every element of virtual environments is able to be manipulated. Many concerns over privacy stem from Facebook’s attainment of Oculus VR, as users are constantly irritated with Facebook’s changing privacy policies. In addition, it was exposed that Facebook has previously conducted psychological experiments on users. This information might make consumers wary of using the Rift, as their environments may be manipulated or their behaviors might be documented.

A security risk that may pertain to the Rift is the lack of encrypted communication. The software currently being used to operate many virtual environments is open source and fairly insecure. If users were required to use a password for part of the virtual environment, then these unsafe communication routes may allow for that password to be learned by another individual. However, it is likely that this basic concern would be improved upon in the future.

Bibliography
Explore Performance Task – Sample from Duke University

Google Search Engine and Chrome Browsing

https://www.youtube.com/watch?v=_GhBxAOeQfI

This is beneficial for users, because the search engine learns about you, and can provide better search results and show ads closest to your interest.

People are not always aware of the extent they are being watched online.

Search Engines remember every movement online that you make. They create an index of all of the sites that you have visited.
Explore Performance Task – Sample from Duke University

Google Search Engine and Chrome Browsing

E. Privacy Concern

The highly detailed gathering of personal data by search engines could easily be seen as a violation of privacy. User’s place a lot of trust on search engines such as Google, believing that they won’t share their information with outside third parties. Google has so much information from the world’s internet users, that releasing it could cause serious problems for many people. With so many services on the internet, we are often required to type in information that we do not want anyone else to know. This issue of privacy is also problematic because if user’s feel as though they are being watched by another party, they alter their behavior. Altering one’s internet behavior is an issue when everything is being recorded- false information is not helpful for any important websites, and it is also not helpful when being sorted into an index (“The Second Index: Search Engines, Personalization, and Surveillance”). Because of the issues that were expressed, there have been attempts to give people more control over what data of theirs is collected. Companies have been developing devices and browsers that are intended to block online ads and tracking technologies (https://www.technologyreview.com/s/524046/phones-browsers-and-search-engines-get-a-privacy-overhaul/).
8. The program segment below is intended to move a robot in a grid to a gray square. The program segment uses the procedure `GoalReached`, which evaluates to `true` if the robot is in the gray square and evaluates to `false` otherwise. The robot in each grid is represented as a triangle and is initially facing left. The robot can move into a white or gray square but cannot move into a black region.

```plaintext
REPEAT UNTIL (GoalReached ())
{
    IF (CAN_MOVE (forward))
    {
        MOVE_FORWARD ();
    }
    IF (CAN_MOVE (right))
    {
        ROTATE_RIGHT ();
    }
    IF (CAN_MOVE (left))
    {
        ROTATE_LEFT ();
    }
}
```

For which of the following grids does the program NOT correctly move the robot to the gray square?

(A) ![Grid A](image)

(B) ![Grid B](image)

(C) ![Grid C](image)

(D) ![Grid D](image)
17. Consider the following program code.

Which of the following best describes the result of running the program code?

(A) The number 0 is displayed.
(B) The number 6 is displayed.
(C) The number 10 is displayed.
(D) Nothing is displayed; the program results in an infinite loop.
Developing a Policy
Now, which factors would you consider when making a decision about whether to take an AP course? Select at least 5 items from the list below that you might consider when making this decision.

- College credit awarded: 85%
- College Admissions: 80%
- Interest in subject area: 79%
- Academic challenge: 78%
- Placement into higher level college courses: 74%
- Career alignment: 55%
- Type of college credit: 53%
- Meets high school graduation requirement: 43%
- AP test fee: 22%
- When AP test fee is paid: 14%

n=1274
AP® Credit Policies and College Choice

Just under half of AP student respondents would be less likely to apply to a college that no longer gives credit for AP Exam scores.

Thinking more about the scenario in which a college you are considering no longer gives credit for AP Exam scores, what impact would this have on your decision to apply to this college?

- 11% Much less likely to apply
- 37% A little less likely to apply
- 47% No impact on my decision to apply
- 4% A little more likely to apply
- 2% Much more likely to apply

n=14,048
Students are researching CSP credit and placement policies at colleges and universities and applying with AP CSP on their transcript.

Student registration begins in January and a driver will be the availability of credit and placement policies for AP CSP.

Colleges and universities will start receiving exam scores for AP CSP.
Since 2010, computer science professors [at Duke] have been revamping the course to place more emphasis on real-world applications and solving problems ... — using techniques from APCSP into the introductory course for majors, where in Fall of 2015 more than 50% of students are women.

But [Fred Wilson] said it was only in the past several years that the city had evidence, from the Academy for Software Engineering and other programs, that students ... could benefit from computer science classes.
Berkeley Achieves Gender Parity & Extends BJC Into K-12

Women Outnumber Men for the First Time in Berkeley’s Intro to Computer Science Course

San Francisco Chronicle
TECH SHIFT: MORE WOMEN IN COMPUTER SCIENCE CLASSES

The Department of Education has received a four-year grant to bring an Advanced Placement curriculum called “Beauty and Joy of Computing” to New York City.
“The whole notion of purposeful creation is lacking from the popular stereotype, which equates programming with computer science... Changes are in place with the introduction this fall of a new AP exam, Computer Science Principles.”

“...Women now make up 45% of Columbia’s computer science majors.”

“...shifting the emphasis from coding to the tremendous potential of computer science to solve problems in the real world.”
Example policy: Texas A&M University

Course: Programming I
Course #: CSCE 110
Cut Score: 3
Description: Basic concepts in using computation to enhance problem solving abilities; understanding how people communicate with computers, and how computing affects society; computational thinking; representation of data; analysis of program behavior; methods for identifying and fixing errors in programs; understanding abilities and limitation of programs; development and execution of programs.
Example policy: University of Illinois Urbana-Champaign

<table>
<thead>
<tr>
<th>Course:</th>
<th>Little Bits to Big Ideas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course #:</td>
<td>INFO 102/CS102</td>
</tr>
<tr>
<td>Cut Score:</td>
<td>3</td>
</tr>
<tr>
<td>Description:</td>
<td>Broad introduction to the nature, capabilities, and limitations of computing. Topics range from the way data is represented and stored, to the way today's computers work, to the general ideas of algorithms and computational efficiency, to the future of computing. Covers &quot;Great Ideas&quot; across various areas of the field, including, for example, cryptography and internet security, problem solving, modeling and simulation, and artificial intelligence.</td>
</tr>
</tbody>
</table>
### Example policy: Clemson University

<table>
<thead>
<tr>
<th>Course:</th>
<th>Computational Thinking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course #:</td>
<td>CPSC 1210</td>
</tr>
<tr>
<td>Cut Score:</td>
<td>3</td>
</tr>
<tr>
<td>Description:</td>
<td>Introduces the central idea of computer science, and instills ideas and practices of computational thinking. Students engage in creative activities to learn how computing can change the world.</td>
</tr>
</tbody>
</table>
Example credit policy: University of Wisconsin Madison

<table>
<thead>
<tr>
<th>Course:</th>
<th>Introduction to Computation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course #:</td>
<td>CS 202</td>
</tr>
<tr>
<td>Cut Score:</td>
<td>4 or 5</td>
</tr>
<tr>
<td>Credit:</td>
<td>General Education</td>
</tr>
<tr>
<td>Description:</td>
<td>An introduction to the principles that form the foundation of computer science. Suitable for students with a general background who wish to study the key principles of computer science rather than just computer programming.</td>
</tr>
</tbody>
</table>
Assemble a policy team on your campus.

This team can CS department faculty involved in setting policies

You may want to consider including provosts, deans, or other campus leaders who play a role in setting academic policies.

Be specific that you need to develop a credit and placement policy for AP CSP and set a timeline for the review process.

Make sure everyone involved has a solid understanding of the institution-wide AP policies and how the AP CSP policy will fit in.

Go to APHigherEd.org to download AP CSP course materials including the course overview and the full course and exam description and share with the policy team.

If you need additional materials or further guidance, contact the College Board at apcsp@collegeboard.org
Developing credit & placement policies: key information

The AP CSP Course and Exam Description is a key resource in developing a credit and placement policy. It contains information including:

► How the exam is scored, using and interpreting scores
► College course equivalence and prerequisites
► Learning objectives
► Through-course assessment and weighting
► Sample performance tasks
► Exam and item examples
► Faculty and organizations involved in development

Download the course and exam description at aphighered.org
Submit Your Policy

To attract highly qualified students for your discipline and majors, consider a strong credit and placement policy. To get started:

► Assemble a committee to evaluate a credit policy for AP CSP
► Make sure committee members have a solid understanding of the course and current policies on your campus
► Review the curriculum framework and other materials to decide on:
  - The amount of credit to grant
  - Cut scores
  - Equivalent course(s) and placement
► Let the College Board know your policy for the spring semester

collegeboard.org/CSPcredit
Become a Reader or Refer One

- Looking for AP Readers for CSA and CSP
- New this year for CSP – Score student responses online

Join 15,000 Educators
Exchange ideas and experiences with a global network of teachers, faculty, and AP Development Committee members.

Score from Home
Online Distributed Scoring opportunities are available in Computer Science Principles, European History, French Language and Culture, Research, Seminar, Spanish Language and Culture, U.S. History, and World History. Apply today.

Earn CEU Credits
Earn professional development hours and Continuing Education Units (CEUs).

Get Compensated
All Readers receive compensation for their work during the Reading. Expenses, lodging, and meals are covered for Readers who travel.

apcentral.collegeboard.org/readers