

EXPLORING AP CS PRINCIPLES

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Guiding Questions

1. Why a new Advanced Placement CS course?
2. What is the Course Framework?
3. What are the Curriculum options?
4. What are some Pedagogy approaches?
5. What does the Assessment and Evaluation look like?
6. How to Map APCSP to Grade 11 Computer Science (ICS3U)?
7. Where to go for Resources?

Why?

Google

computer science students



<http://opendiversitydata.org/>

What does it look like?



Source: <https://www.youtube.com/watch?v=VmZTu6rcqJ8>

Course Overview

"Computer Science Principles (CSP) introduces students to the central ideas of computer science, inviting students to develop the **computational thinking** vital for success across multiple disciplines. The course is unique in its focus on fostering students to be **creative** and encouraging students to apply creative processes when developing **computational artifacts**. Students design and implement innovative solutions using an iterative process similar to what artists, writers, computer scientists, and engineers use to bring ideas to life."

Source: Page 4 of AP CSP Course and Exam Description

AP CS Course Comparison

AP Computer Science Principles

Flexible choice of language.

Focus on **problem solving**, working with **data**, understanding the **Internet**, **cybersecurity**, and **programming**

Exam (60%)

Projects (40%)

- research and coding

AP Computer Science A

Java

Focus on **object-oriented design**, **coding**, and **algorithms**.

Exam only (100%)

Activity 1

Open the following [Google doc](#).

Type in your responses to each question.

Protocol

- Ensure each response is on a separate line.
- You may use the same word that others have used – it is actually encouraged!!

Computational artifact

<http://wordcloud.cs.arizona.edu/>

APCSP Computational Thinking Practices

1. Connected Computing
2. Creating Computational Artifacts
3. Abstracting
4. Analyzing Problems and Artifacts
5. Communicating
6. Collaborating

APCSP Big Ideas

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

Activity 2

Problem: How can we determine **the Computer Science teaching experience in the room today?**

Task: In groups of 2-3, brainstorm an algorithm and prepare to share. You have 3 minutes.

Analysis:

As a class, select and test an algorithm using materials and analyze its efficiency.

APCSP Curriculum Options

Beauty and Joy of Computing	UTeach	Mobile CSP	Code.org	Project Lead the Way
Berkeley	University of Texas	Trinity College		
Snap! and Python	Processing, Scratch	App Inventor	App Lab Javascript	Python
http://bjc.berkeley.edu/	https://cs.utexas.edu/	http://www.mobile-csp.org/	https://code.org/educate/csp	

Another good resource is Harvard's [CS50](#) course materials.

Course Design

1 - Computing and Computation

- Binary, hexadecimal, data representation
- Hardware components: transistors, gates
- Software, programming languages, operating systems
- Problem solving using algorithms and pseudocode

2 - Programming

- variables, sequence, selection, iteration, lists, procedures, testing, debugging, string manipulation, math operations

3 - Data and Information

- types of data, metadata, privacy, storage, patterns, predictions

4 - Algorithms

- searching and sorting (basics), efficiency and correctness

5 - Internet

- Fundamentals: protocols, TCP/IP, routers, layers, robustness
- Security: trust relationship, privacy, encryption (shared and public key)

Abstraction
Creativity

Instructional Approaches

- **Cooperative / Collaborative Learning Activities**
 - Pair Programming - Coding
 - Jigsaw - Reading
 - POGIL
 - Process Oriented Guided Inquiry - Roles assigned
 - Peer Instruction / Flipped Classroom
 - Students prepare before class
 - Answer concept questions at beginning of class, discuss, recheck understanding
- **Inquiry based learning**
 - Any programming language is allowed.
- **Project based learning**
 - Final project is student selected and open ended.

A&E: Performance Tasks

1. Explore (16% of total AP mark)

- 8 hours of class time

Create a computational artifact about a Computing Innovation and provide written responses to provided prompts.

2. Create (24% of total AP mark)

- 12 hours of class time

**Design, create, and test a program.
Demonstrate the program and explain the algorithms and abstractions used.**

[Samples](#) are available (more to be added)

Explore Performance Task

Investigate a **Computing Innovation** that has had or has the potential to have significant **beneficial** and **harmful** effects on

society, economy, or culture;

consumes, produces, and/or transforms data;

and raises *at least one* **data storage** concern, **data privacy** concern, or **data security** concern.

Topic must be **student selected** and completed **individually**.

The **computational artifact** must include 3 credible sources (2 must be since end of previous academic year).

Explore Performance Task

Learning Objectives

- Create a computational artifact using tools and techniques to solve a problem.[P2]
- Analyze how data representations, storage, security, and transmission of data involve computational manipulation of information.[P4]
- Explain how computing innovations affect communication, interaction, and cognition.[P4]
- Analyze the beneficial and harmful effects of computing.[P4]
- Explain the connections between computing and real-world context, including economic, social, and cultural contexts. [P1]
- Evaluate online and print sources for appropriateness and credibility [P5]

Create Performance Task

Develop a program of their choice that can help solve problems, enable innovations, or express personal interests.

The process should include **iteratively designing, implementing, and testing** their program.

Students are strongly encouraged to work with another student in their class.

Submission requires a **video** of the program running, individual **written responses** about your program and development process and the program code.

Create Performance Task

Learning Objectives

- Develop an abstraction when writing a program or creating other computational artifacts. [P2]
- Develop an algorithm for implementation in a program. [P2]
- Express an algorithm in a language. [P5]
- *Develop a program for creative expression, to satisfy personal curiosity, or to create new knowledge. [P2]*
- *Develop a correct program to solve problems. [P2]*
- Explain how programs implement algorithms. [P3]
- Use abstraction to manage complexity in programs. [P3]
- Evaluate the correctness of a program [P4]
- Employ appropriate mathematical and logical concepts in programming. [P1]

Create Performance Task

Program must:

- use mathematical and logical concepts
- implement algorithms that integrate other algorithms
- develop and use abstractions (data and procedural)
- submit the code as a PDF file
- a video up to 1 minute must be created demonstrating the features

Exam

- 2 Hours
- 60% of total AP mark
- 74 Multiple Choice questions

Big Ideas	Approximate % of questions
Creativity	
Abstraction	19
Data and Information	18
Algorithms	20
Programming	20
The Internet	13
Global Impact	10

Mapping to ICS3U

AP Computer Science Principles	Grade 11 Introduction to Computer Science – ICS3U
<p>Unit 1 – Computing and Computation</p> <ul style="list-style-type: none"> • LO 2.1.1 Describe the variety of abstractions used to represent data. [P3] • LO 2.1.2 Describe how binary sequences are used to represent digital data [P5] • LO 2.2.3 Identity multiple levels of abstractions that are used when writing programs. [P3] 	<p>C. Computer Environments and Systems</p> <p>C1 Computer Components <i>relate the specifications of computer components to user requirements</i></p> <p>C2 File Maintenance <i>user appropriate file maintenance practices to organize and safeguard data</i></p> <p>C3 Software Development <i>demonstrate an understanding of the software development process</i></p>

Mapping to ICS3U

AP Computer Science Principles	Grade 11 Introduction to Computer Science – ICS3U
<p>Unit 2 – Programming</p> <ul style="list-style-type: none"> • LO 2.2.1 Develop an abstraction when writing a program. [P2] • LO 2.2.2 Use multiple levels of abstraction to write programs [P3]. • LO 2.3.1 Use models and simulations to represent phenomena. [P3] • LO 2.3.2 Use models and simulations to formulate, refine, and test hypotheses. [P3] • LO 5.1.1 Develop a program for creative expression, to satisfy personal curiosity or to create new knowledge [P2] • LO 5.1.2 Develop a correct program to solve problems. [P2] • LO 5.1.3 Collaborate to develop a program [P6] • LO 5.2.1 Explain how programs implement algorithms [P3] • LO 5.3.1 Use abstraction to manage complexity in programs.[P3] <ul style="list-style-type: none"> • lists and procedures • LO 5.4.1 Evaluate the correctness of a program [P4] • LO 5.5.1 Employ appropriate mathematical and logical concepts in programming [P1] 	<p>A Programming Concepts and Skills</p> <p>A1 Data Types and Expressions <i>demonstrate the ability to use different data types, including one-dimensional arrays, in computer programs;</i></p> <p>A2. Control Structures and Simple Algorithms <i>demonstrate the ability to use control structures and simple algorithms in computer programs</i></p> <p>A3 Subprograms <i>demonstrate the ability to use subprograms within computer programs</i></p> <p>A4 Code Maintenance <i>use proper code maintenance techniques and conventions when creating computer programs</i></p> <p>B Software Development</p> <p>B1 Problem-solving Strategies <i>use a variety of problem-solving strategies to solve different types of problems independently and as part of a team</i></p> <p>B2. Designing Software Solutions <i>design software solutions to meet a variety of challenges</i></p> <p>B3 Designing Algorithms <i>design algorithms according to specifications</i></p>

Mapping to ICS3U

AP Computer Science Principles	Grade 11 Introduction to Computer Science – ICS3U
<p>Unit 4 – Algorithms</p> <p><i>Focus on understanding of pseudocode</i></p> <ul style="list-style-type: none"> • LO 4.1.1 Develop an algorithm for implementation in a program. [P2] • LO 4.1.2 Express an algorithm in a language. [P5] • LO 4.2.1 Explain the difference between algorithms that run in a reasonable time and those that do not run in a reasonable time. [P1] • LO 4.2.2 Explain the difference between solvable and unsolvable problems in computer science. [P1] • LO 4.2.3 Explain the existence of undecidable problems in computer science. [P1] • LO 4.2.4 Evaluate algorithms analytically and empirically for efficiency, correctness, and clarity. [P4] 	<p>A Programming Concepts and Skills</p> <p>A2. Control Structures and Simple Algorithms</p> <p><i>demonstrate the ability to use control structures and simple algorithms in computer programs.</i></p> <p>B Software Development</p> <p>B2. Designing Software Solutions</p> <p><i>design software solutions to meet a variety of challenges.</i></p> <p>B3. Designing Algorithms</p> <p><i>design algorithms according to specifications.</i></p>

Mapping to ICS3U

AP Computer Science Principles	ICS3U
<p>Unit 5 – Internet</p> <ul style="list-style-type: none"> LO 6.1.1 Explain the abstractions in the Internet and how the Internet functions. [P3] LO 6.2.1 Explain characteristics of the Internet and the systems built on it. [P5] LO 6.2.2 Explain how the characteristics of the Internet influence the systems built on it. [P4] LO 6.3.1 Identify existing cybersecurity concerns and potential options to address these issues with the Internet and the systems built on it. [P1] 	<p>NOT COVERED</p>
<p>PRACTICE: EXPLORE PERFORMANCE TASK</p> <ul style="list-style-type: none"> <i>LO 1.2.1 Create a computational artifact for creative expression. [P2]</i> <i>LO 1.2.2 Create a computational artifact using tools and techniques to solve a problem.[P2]</i> LO 3.3.1 Analyze how data representations, storage, security, and transmission of data involve computational manipulation of information.[P4] LO 7.1.1 Explain how computing innovations affect communication, interaction, and cognition.[P4] LO 7.3.1 Analyze the beneficial and harmful effects of computing.[P4] LO 7.4.1 Explain the connections between computing and real-world context, including economic, social, and cultural contexts. [P1] LO 7.5.2 Evaluate online and print sources for appropriateness and credibility [P5] 	<p>D. Topics in Computer Science</p> <p>D1 Environmental Stewardship and Sustainability</p> <p><i>describe policies on computer use that promote environmental stewardship and sustainability</i></p>
<p>EXPLORE PERFORMANCE TASK</p> <p>(8 hours)</p>	<p>Student Selected Topic</p>

Mapping to ICS3U

AP Computer Science Principles	ICS3U
<p>CREATE PERFORMANCE TASK (12 hours)</p> <ul style="list-style-type: none"> • LO 2.2.1 Develop an abstraction when writing a program or creating other computational artifacts. [P2] • LO 4.1.1 Develop an algorithm for implementation in a program. [P2] • LO 4.1.2 Express an algorithm in a language. [P5] • <i>LO 5.1.1 Develop a program for creative expression, to satisfy personal curiosity, or to create new knowledge. [P2]</i> • <i>LO 5.1.2 Develop a correct program to solve problems. [P2]</i> • LO 5.2.1 Explain how programs implement algorithms. [P3] • LO 5.3.1 Use abstraction to manage complexity in programs. [P3] • LO 5.4.1 Evaluate the correctness of a program [P4] • LO 5.5.1 Employ appropriate mathematical and logical concepts in programming. [P1] 	<p>Student Selected Programming Topic B4 The Software Development Life Cycle <i>apply a software development life-cycle model to a software development project</i></p>
<p>Through course learning objectives – Global Impact and Explore Performance Tasks</p> <ul style="list-style-type: none"> • LO 7.1.1. Explain how computing innovations affect communication, interaction, and cognition.[P4] <ul style="list-style-type: none"> ◦ cloud, social media, GPS, Internet of Things (IoT), assistive technologies • LO 7.1.2 Explain how people participate in a problem-solving process that scales. [P4] <ul style="list-style-type: none"> ◦ citizen science, crowdsourcing, Google book project • LO 7.5.1 Access, manage, and attribute information using effective strategies. [P1] • LO 7.5.2 Evaluate online and print sources for appropriateness and credibility. [P5] 	
<p>Post AP Exam activities</p>	<p>D. Topics in Computer Science D3 Postsecondary Opportunities <i>describe postsecondary education and career prospects related to computer studies</i></p>

Global Impact

Essential Questions

1. How does computing enhance human communication, interaction, and cognition?
2. How does computing enable innovation?
3. What are some potential beneficial and harmful effects of computing?
4. How do economic, social, and cultural contexts influence innovation and the use of computing?

Global Impact Topics

Technology enhances communications

- Cloud computing, Open data, Search trends, GPS, social media (video, messaging), IoT (sensors), assistive technologies, impact of Internet and the Web (positive and negative), scalability, citizen science, human computation, crowdsourcing, mobile computing

Technology enables innovation in every field

- machine learning, data mining, scientific computing (finance and science), creative commons, improved creativity

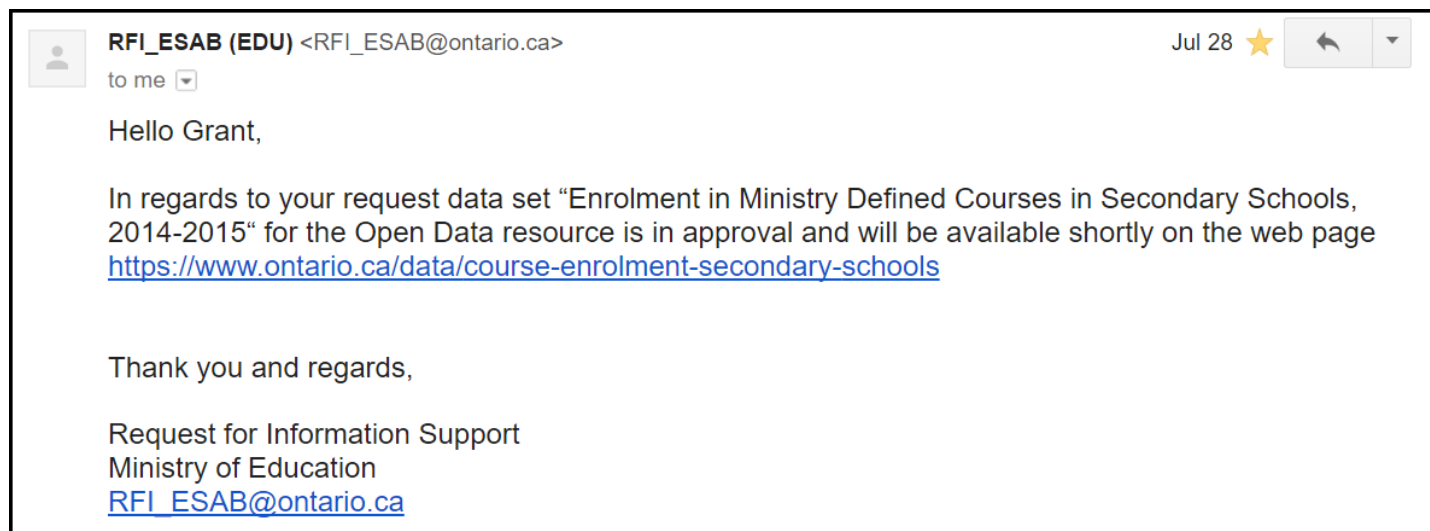
Global effects of technology

- legal and ethical concerns (innovations, creative works (movies, songs), peer to peer networks, censorship, personal privacy and security, anonymity, collection of personal data, targeted advertising copyright issues, digital divide, commercial interests, equity issues

Data Unit

Recommendations

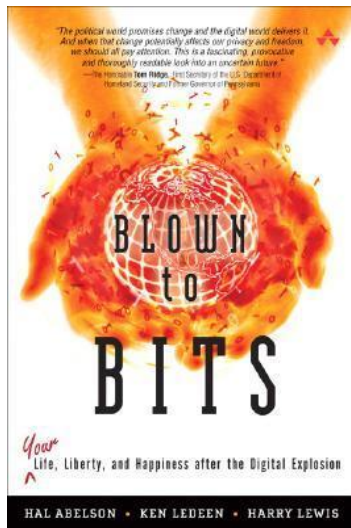
- Open Data sources - [example analysis](#)
- Spreadsheet Software Overview
- Google Fusion tables
- App Inventor - Firebase (Web data)
- Expose students to R or Python for analysis



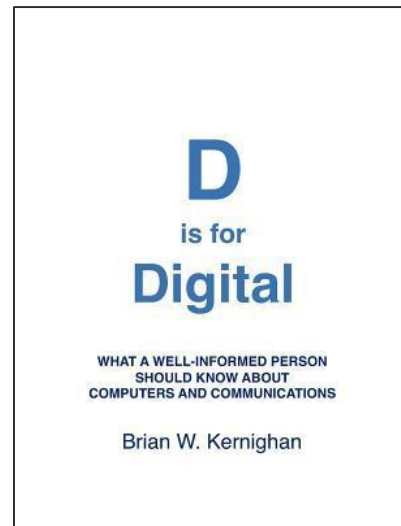
Resources

- AP CSP community
 - <http://apcsprinciples.org/>
- Official College Board site
 - <https://apstudent.collegeboard.org/apcourse/ap-computer-science-principles>
- AP CSP Teacher community
 - <https://apcommunity.collegeboard.org/group/csprinciples/resource-library/>
- Mobile CSP course
 - <http://mobile-csp.org/>

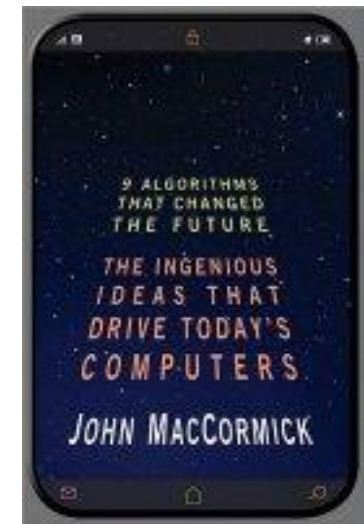
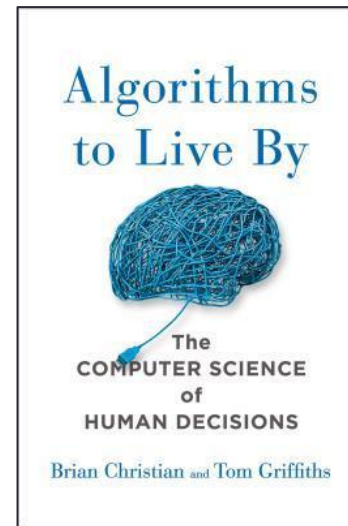
Reading Resources



Free



\$20



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