El Monte Union High School District

4/20/16

Course Outline

High School DISTRICT



*Instructional materials appropriate for English Language Learners are required.

** For A P/Honors course attach a page describing how this course is above and beyond a regular course. Also, explain why this course is the equivalent of a college level class.

A P Computer Science Principles (A PCSP) is a full year, rigorous, entry-level course that introduces high school students to the foundations of modern computing. The course covers a broad range of foundational topics such as programming, algorithms, the Internet, big data, digital privacy and security, and the societal impacts of computing.

1. **Prerequisite**(s):

Algebra 1 or Integrated Math 1

2. Short description of course which may also be used in the registration manual:

The course introduces students to the foundational concepts of computer science and challenges them to explore how computing and technology can impact the world. The AP Program designed AP Computer

The units that follow interweave the six Computer Science Principles Computational Thinking Practices listed below:

! P1: Connecting Computing

! P2: Creating Computational Artifacts

! P3: Abstracting

! P4: Analyzing Problems and Artifacts

! P5: Communicating (both orally and written)

! P6: Collaborating

Along with the seven Computer Science Principles Big Ideas:

! Big Idea 1: Creativity

! Big Idea 2: Abstraction

! Big Idea 3: Data and Information

! Big Idea 4: Algorithms

! Big Idea 5: Programming

! Big Idea 6: The Internet

! Big Idea 7: Global Impact

Assessment

Students are primarily evaluated on the basis of their work, which can take the form of worksheets, writing assignments, programs, and online journal entries. From time to time, quizzes are given which check for understanding of essential skills and knowledge.

Units

Unit 1: Introduction to CS Principles (Creativity, Algorithms, Global Impact)

Guiding Questions

! How does continuous access to large amounts of data change how people and organizations make decisions?

! How do computers put things in order and find things in a list?

! What is the connection between data, information, knowledge, and wisdom?

Lessons

! Impact on your life

! What is an algorithm?

! What is a program?

! Program or be programmed

! Experiments on social media users

! Programming as a form of expression

! Making music and art in Scratch

Instructional Activity: Impact on Your Life

On the first day of class, I ask students, "What computing innovation has had the most impact on your life?" Students consider the question individually, in small groups, and as a class. That night they have a conversation with an adult in their life and report back that person's answer. The next day students are asked to write a document that includes both their response and the adult's response. On the third day, I present the seven CSP big ideas to students. Students complete a chart that provides an

Students go through a collaborative activity that demonstrates how domain name servers work. One student acts as the Domain Name Server, and the other students act as individual internet users. The individual users write a domain name (such as collegeboard.org) on a piece of paper and pass it to the person who is the server. That person turns the domain name into an IP Address (such as 128.23.01.22). The class pauses and discusses how this might actually happen on the Internet, and how a single system could scale to handle the large number of domain name servers work. LO 6.1.1[P3], LO 6.2.1[P5], LO 6.2.2[P4] [CR1c] [CR1d] [CR1e] [CR2f]

[CR1c] — Students are provided with opportunities to meet learning objectives connected to Computational Thinking Practice P3: Abstracting.

[CR1d] — Students are provided with opportunities to meet learning objectives connected to Computational Thinking Practice P4: Analyzing Problems and Artifacts.

[CR1e] — Students are provided with opportunities to meet learning objectives connected to Computational Thinking Practice P5: Communicating (both orally and written).

[CR2f] — Students are provided with opportunities to meet learning objectives within Big Idea 6: The Internet. Such opportunities must occur in addition to the AP Computer Science Principles Performance Tasks.

Unit 3: Artificial Intelligence (Creativity, Abstraction, Algorithms, Programming, Global Impact)

! Binary representation of data

! Reading about information theory

! Self-correcting codes

! Introduction to Snap!

! Hexadecimal numbers

! Review of "and, or, not,"

! Designing adders in Logicly

! Storing a bit in Logicly

! Simulating operation of the CPU

! Simulations and models

! Programming simulations with dice and coins

! Programming Monte Carlo simulations

! Programming the cereal box problem

! Simulating real-world events

Instructional Activity: Designing Adders in Logicly

Students use logic gates to demonstrate how computers add two bits. Logicly allows students to abstract a complicated circuit into a "box" with inputs and outputs. Once students create the "box" for an adder with carry in and carry out bits, they can build a circuit that adds two four-bit numbers. Students naturally see a problem when some results are not correct, and this leads to a student-constructed conversation about overflow error. Students write a report describing how abstraction hides levels of complexity. LO 2.1.2[P5], LO 2.2.1[P2], LO 2.2.3[P3] [CR1b] [CR1c] [CR2b]

[CR1b] — Students are provided with opportunities to meet learning objectives connected to Computational Thinking Practice P2: Creating Computational Artifacts.

[CR1c] — Students are provided with opportunities to meet learning objectives connected to Computational Thinking Practice P3: Abstracting.

[CR2b] — Students are provided with opportunities to meet learning objectives within Big Idea 2: Abstraction. Such opportunities must occur in addition to the AP Computer Science Principles Performance Tasks.

Unit 5: Data (Creativity, Abstraction, Data and Information, Algorithms, Programming, Global Impact)

Guiding Questions

! How does continuous access to large amounts of data change how people and organizations make decisions?

! How do computers put things in order and find things in a list?

! What is the connection between data, information, knowledge, and wisdom?

Lessons

! Innovations from data

! Big data

! Visualizing big data

! You-sort

! Sorting algorithms

! Coding bubble sort

! Binary search worksheet

! Programming a reverse guessing game

! Bioinformatics algorithms

! Lossless compression

! Lossy compression

! Coding data compression

! The data, information, knowledge, wisdom (DIKW) pyramid

! Gapminder.org

! Data use in your school

! Privacy in the age of big data

! Downloading public data into spreadsheets

! Manipulating data in Python

Instructional Activity: Applications from Data

The last 20 years have seen waves of trends in computing. Whether it was hardware, software, the Internet, search, social, or mobile, each wave created incredible consumer innovations as well as profits for companies that created those innovations. Will data be the next wave? Students play an online guessing game that is powered by crowd-sourced data, analyze the game, and collaborate by adding more information to the game's data. LO 1.2.5[P4], LO 3.2.2[P3], LO 7.2.1[P1] [CR1a] [CR1c] [CR1d] [CR2a] [CR2c] [CR2f] [CR1a] — Students are provided with opportunities to meet learning objectives connected to Computational Thinking Practice P1: Connecting Computing.

[CR1c] — Students are provided with opportunities to meet learning objectives connected to Computational Thinking Practice P3: Abstracting.

[CR1d] — Students are provided with opportunities to meet learning objectives connected to Computational Thinking Practice P4: Analyzing Problems and Artifacts.

[CR2a] — Students are provided with opportunities to meet learning objectives within Big Idea 1: Creativity. Such opportunities must occur in addition to the AP Computer Science Principles Performance Tasks.

[CR2c] — Students are provided with opportunities to meet learning objectives within Big Idea 3: Data and Information. Such opportunities must occur in addition to the AP Computer Science Principles Performance Tasks.

[CR2f] — Students are provided with opportunities to meet learning objectives within Big Idea 6: The Internet. Such opportunities must occur in addition to the AP Computer Science Principles Performance Tasks. ! Class debates:

- , Smarter or not smarter?
- , Narrowing or widening inequity?
- , Stronger or weaker relationships?

Instructional Activity: Global Impact

Students discuss the following question: What does it mean to have a large impact? What kinds of past innovations have had the most impact? I guide students through some previous global innovations such as the telephone. For each impact discussed, students fill out a worksheet listing the following: creativity, abstraction, data, algorithm, networking, beneficial and harmful effects, and impact on society. Students identify and evaluate credible sources of information in preparation for class debates. LO 7.3.1[P4], LO 7.4.1[P1], LO 7.5.1[P1], LO 7.5.2[P5] [CR1a] [CR1d] [CR2g] [CR1a] — Students are provided with opportunities to meet learning objectives connected to Computational Thinking Practice P1: Connecting Computing. [CR1d] — Students are provided with opportunities to meet learning objectives connected to Computational Thinking Practice P4: Analyzing Problems and Artifacts. [CR2g] — Students are provided with opportunities to meet learning objectives within Big Idea 7: Global Impact. Such opportunities must occur in addition to the AP Computer Science Principles Performance Tasks. **Performance Task:** *Explore—Impact of Computing Innovations* After completing Unit 7, students complete through-course assessment Explore—Impact of Computing Innovations (8 hours in class). [CR3] [CR3] — Students are provided the required amount of class time to complete the AP

Through-Course Assessment Explore - Impact of Computing Innovations Performance Task.

" Indicate references to state framework(s)/standards (If state standard is not applicable then national standard should be used)

AP Computer Science Curriculum Framework

" Student performance standards

See Above in Units 1-7

" Evaluation/assessment/rubrics

The course provides a number of assessment types and opportunities. For students, the goal

contains two types of summative assessments that teachers may elect to use. They are intended to mimic the AP assessments though in more bite

It is up to the classroom teacher:

- to determine the appropriateness of the assessments for their classrooms
- to decide how to use, or not to use, the assessments for grading purposes. The curriculum and Code Studio does not provide teachers with a gradebook, and we do not provide recommendations for how to assign grades based on performance on an assessment.

Include minimal attainment for student to pass course Students must complete and pass 70% of all Performance Tasks and Tests