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SMASH Computer Science Sequence

PROGRAM GOALS:

Through participation in a rigorous and chronological sequence of courses throughout the SMASH summer program and academic school year, the SMASH Computer Science sequence aims to directly impact student engagement, interest, and computer science aspirations, and significantly increase the number of high school students of color in California taking and passing the AP Computer Science exam. This program will also provide a model for replication of computer science pathways to college among underrepresented high school students of color in out-of-school settings, to greatly expand the number of African American and Latino students within the computer science pipeline. This model has implications for scaling and providing an effective out-of-school intervention model to increase exposure, preparation, success, and persistence in computer science for underrepresented students of color.

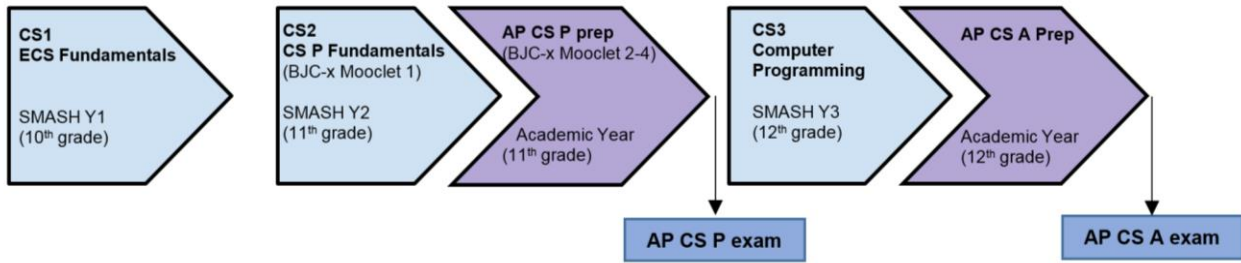
COMPUTER SCIENCE SEQUENCE:

The SMASH computer science curriculum is designed to be a rigorous introduction to various skills and languages in modern digital literacy and programming, which lead to preparation for the Advanced Placement Computer Science courses and exams (AP CS Principles and AP CS A). The course sequence begins with ECS Fundamentals (Computer Science 1), where rising 10th graders focus on developing the foundational problem solving and computational skills and practices that they will then later apply in the more advanced courses. The second course in the sequence, CS Principles Fundamentals (Computer Science 2), exposes rising 11th grade students to three of the “seven big ideas, including the importance of data in computing, the Snap! programming language and the societal impact of computing. After their 5-week exposure to the CS Principles Fundamentals course, SMASH students take the Beauty and Joy of Computing online course (BJCx) in conjunction with in-person instruction throughout the academic school year. This course will cover the basics of computer programming using Snap!, applying the “seven big ideas” and mastering the six computational thinking practices which will prepare students for the AP Computer Science Principles exam (Available in May 2017).¹ In their 3rd summer at SMASH, rising 12th graders take the Computer Programming course (Computer Science 3), which is a deep dive into introductory Java and HTML programming. After their 5-week exposure to the CS Principles course, high school seniors interested in continuing their preparation in programming can take the AP CS A online and in-person course² to prepare for the AP Computer Science A exam.

¹ “seven big ideas” include: creativity, abstraction, data and information, algorithms, programming, the Internet, and global impact; the 6 computational thinking practices include: connecting computing, creating computational artifacts, abstracting, analyzing problems and artifacts, communicating, and collaborating

² The AP CS A course curriculum includes content from the [College Board curriculum framework](#) and Barbara Ericson’s [online interactive Java course](#).

Figure 1. SMASH Computer Science Sequence



COURSE OUTLINES:

CS1

ECS Fundamentals (CS1) is a 5-week introductory course that focuses on the nature of problem solving and the usefulness of computational practices to solve problems. Students are taught how to use and apply visual programming platforms such as Scratch within a larger, culturally relevant pedagogy and curriculum designed by [Exploring Computer Science](#).

Figure 2. CS1 Course Outline

Lesson	Topic	Resource Location
Foundations		
1	Computers and Computing (ECS)	ECS v5.0 page 28
2	Hardware and Software	Included (appendix)
3	Binary Decimal Conversions	Included (appendix)
4	Communications Methods Chart (ECS)	ECS v5.0 page 41
5	Candy Bar Activity (ECS)	ECS v5.0 page 78
6	Handshake Activity (ECS)	ECS v5.0 page 81
7	Tower Building (ECS)	ECS v5.0 page 90
8	Sorting Algorithms (ECS)	ECS v5.0 page 94
Processing		
9	Intro to Processing	Included (appendix)
10	Processing	Included (appendix)
11	Name Scratch project (ECS)	ECS v5.0 page 136-139
12	Dialogue Scratch project (ECS)	ECS v5.0 page 140
13	Moving Scratch Sprites (ECS)	ECS v5.0 page 143
14	Alphabet Scratch Game (ECS)	ECS v5.0 page 146
15	Summer Scratch Story (ECS)	ECS v5.0 page 149
16	Scratch Story Project (ECS)	ECS v5.0 page 158
Scratch		
17	Variable Scratch Lesson (ECS)	ECS v5.0 page 162
18	Conditional Scratch Lesson (ECS)	ECS v5.0 page 164
19	Boolean logic Scratch Lesson (ECS)	ECS v5.0 page 167
20	Rock Paper Scissors (ECS)	ECS v5.0 page 170

CS2:

CS Principles Fundamentals (CS2) is a 5-week intensive course focused on data science and algorithm development with the goal of deepening students’ understanding of the 6 big ideas in computer science. It is designed for students that have been exposed to the foundational units of the Exploring Computer Science curriculum. The course is largely based on U.C. Berkeley's [Beauty and Joy of Computing Curriculum](#) and is comprised of three major topics: (1) the “big ideas” of creativity and abstraction, (2) programming using SNAP! and (3) the impact of computing on society.

Figure 3. CS2 Course Outline

Week 1: Unit 1	Resource Location
Programming Lab 1: Building an App	BJC Curriculum
Programing Lab 2: Sprite Drawing and Communication	
Programming Lab 3: Control Commands	
Programming Lab 4: Building and Debugging Your Own Blocks	
Programming Lab 5: Block Types and Calculations	
Social Implications Lab 6: Explosion of Bits; Games and Violence	
Week 2-3: Unit 2 (1-4)	
Programming Lab 1: Conditional Blocks	BJC Curriculum
Programming Lab 2: Script Variables	
Programming Lab 3: Developing More Complex Programs	
Social Implications Lab 4: Privacy, Community and Online Interactions	
Week 4: Creative Project	Created by SMASH Instructors, Lead Instructors
Week 5: Presentation Preparation	

AP CS Principles Prep Course (Academic Year)

The AP CS Principles course provides students with a full year of content from the Beauty and Joy of Computing online course (BJCx), which will prepare students for the AP CS Principles exam. This course is an online and in-person course, with 23, 4-hour in-person sessions throughout the school year.

Figure 4. AP CS Principles Course Outline

Lesson/Topic	Dates	Resource Location
BJCx: Mootlet 1 (2 class sessions)	August 15, 22	https://www.edx.org/course?search_query=BJC
BJCx: Mootlet 2 (5 class sessions, 2 project sessions)	September 5, 12, 19, 26 October 10, 17, 24	https://www.edx.org/course?search_query=BJC
BJCx: Mootlet 3 (5 class sessions, 2 project sessions)	October 31 November 7, 14, 21 December 5, 12, 19	https://www.edx.org/course?search_query=BJC

BJCx: Moclet 4, <i>optional</i> (5 class sessions, 2 project sessions)	January 9, 16, 23, 30 February 6, 13, 20	https://www.edx.org/course?search_query=BJC
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CS3:

Computer Programming (CS3) follows the Computer Science Principles course by providing a 5-week course introducing students to programming in Java and HTML. Students take this class in preparation for a full year-long course on Java programming to prepare them for the AP CS A exam.

Figure 5. CS3 Course Outline

Lesson	Topic	Resources
Web Development		
1	Basics of HTML and CSS	
2	Margins, Padding, Borders and Fixed-Width Pages with Backgrounds	
3	Lists, links and text highlighting	
4	Block/Inline, Classes and Images	
5	Tables	
6	Create a Website	
Java Programming		
7	Intro to Java, primitives and arithmetic expressions	AP Computer Science A- College Board Curriculum Guide Barbara Ericson's Interactive Java
8	Intro to Java (cont'd) and Problem Solving	
9	Introduction to Conditionals	
10	Creating a Flowchart	
11	Codingbat.com: Solving conditional problems	
12	Intro to Object Behavior	
13	Intro to Object Oriented Programming	

Note: Each lesson spans approximately 2 class sessions

AP CS A Prep Course (Academic Year)

The AP CS A course provides students with a full year of content from the AP CS A College Board Curriculum, which aims to prepare students for the AP CS A exam. This course is provided with in-person instruction, virtual support, and a variety of resources to guide students through the content. This course includes 29, 4-hour in-person sessions along with virtual support throughout the school year.

Figure 6. AP CS A Prep Course Outline

Lesson	Topic	Materials/Resources
1	Intro to AP CS A exam, Review of Problem Solving, Primitives, Control Structure, Strings, Output, Codingbat problems, and DrawHouse project	UC Scout ICT Lessons Blue Pelican Java Book
2	Object Oriented Programming	College Board AP CS A
3	Conditionals and Math Library Operations	summary and practice
4	Logic, Strings, Arrays	exams
5	Boolean Algebra, Loops	Primitives
6	Arrays, Loops	Intro to OOP
7	Recursion, ArrayLists	I/O
8	Practice Exam, Sorting & Searching Algorithm, ArrayLists	OOP
9	Sorting	OOP
10	Inheritance	Math
11	Inheritance Polymorphism	Libraries and APIs
12	Practice Exam	
13	2D Arrays, Practice Exam (M/C)	
14	ArrayLists, Practice Exam (M/C)	
15	Codingbat, Practice Exam (M/C)	
16	Practice Free Response Exam Questions	
17	Practice Free Response Exam Questions	
18	Test Review, Testtaking Tips, Practice Free Response Questions	

SAMPLE LESSON PLANS:

- CS1: [ECS Fundamentals](#)
- CS2: Computer Science Principles Fundamentals
- CS3: [Computer Programming](#)
- AP CS Principles Prep
- [AP CS A Prep](#)