SAMPLE SYLLABUS #2

AP® Computer Science A

Curricular Requirements

CR1	Students and teachers have access to a college-level computer science textbook or resource in print or electronic format.	*See page:* 2
CR2	The course provides opportunities to develop student understanding of the required content outlined in each unit described in the AP Course and Exam Description (CED).	*See page:* 2
CR3	The course provides opportunities for students to develop the skills related to Computational Thinking Practice 1: Design Code, as outlined in the AP Course and Exam Description (CED).	*See pages:* 4, 5
CR4	The course provides opportunities for students to develop the skills related to Computational Thinking Practice 2: Develop Code, as outlined in the AP Course and Exam Description (CED).	*See pages:* 3, 4, 5
CR5	The course provides opportunities for students to develop the skills related to Computational Thinking Practice 3: Analyze Code, as outlined in the AP Course and Exam Description (CED).	*See page:* 4
CR6	The course provides opportunities for students to develop the skills related to Computational Thinking Practice 4: Document code and computing systems, as outlined in the AP Course and Exam Description (CED).	*See page:* 3
CR7	The course provides opportunities for students to develop the skills related to Computational Thinking Practice 5: Use computers responsibly, as outlined in the AP Course and Exam Description (CED).	*See page:* 3
CR8	The course provides students with hands-on lab experience to practice programming through designing and implementing computer-based solutions to problems.	*See pages:* 3, 4, 5

Sample Syllabus #2
AP Computer Science A Syllabus

Textbook

Textbook or resource provided on the AP Course Audit form. CR1

Course Framework

The course will cover the following 4 major themes, as broken down further into units detailed in the Course Outline table. CR2

1. Using Objects and Methods
2. Selection and Iteration
3. Class Creation
4. Data Collections

CR1
The teacher must select or provide a college-level computer science textbook or resource.

CR2
The syllabus must include an outline of course content by unit title using any organizational approach to demonstrate the inclusion of required course content.

Course Outline

Unit	Course and Exam Description Topics	Sample Labs, Assignments, and Activities *Note: The course will include a minimum of 20 hours of in-class, computer-based lab experiences. CR8
Unit 1: Responsible Computing + Java Foundations	- 3.2: Impact of Program Design - 4.1: Ethical and Social Issues Around Data Collection - 1.1: Introduction to Algorithms, Programming, and Compilers - 1.8: Documentation with Comments - 1.2: Variables and Data Types - 1.3: Expressions and Output - 1.4: Assignment Statements and Input - 1.5: Casting and Range of Variables - 1.6: Compound Assignment Operators	**Assignment:** In groups of 3–4, have students create a “Programmer’s Handbook” as a guide for programmers to ensure they are positively impacting their classroom community as well as the world around them. They should include a list of norms, including ones surrounding the use of AI; an explanation of the importance of ethics for programmers; and an example they research on an engineering or programming failure (e.g., a time when engineers, computer scientists, or programmers did not follow ethical boundaries and as a result negatively impacted their community). Keep these handbooks as a reminder for students throughout the year. **(Skill 5.A)** CR7 **Lab #1: Intergalactic Calculations** CR8 In this lab, students will create a calculator that will display a user’s weight on different planets, based on the surface gravity of those planets. They will do research to determine the formulas needed, then prompt the user to input their weight and display their weight on all other planets in our solar system. Students will need to include documentation to cite their sources and explain how their code implements the formulas. **(Skill 4.A)** CR6 **Extension:** Create fictional planets where the formula for a person’s weight is defined by more complicated equations, and have students implement those. **(Skill 2.A)** CR4

CR8
The syllabus must include an explicit statement that at least 20 hours of in-class instructional time is spent in computer-based lab experiences.

CR7
The syllabus must include a brief description of an activity or assignment in which students explain how computing impacts society, economy, **or** culture.

CR8
The syllabus must include titles and descriptions of at least two lab experiences. For each lab, use the label Lab #1 or Lab #2 to identify the experience.

CR6
The syllabus must include a brief description of an activity or assignment in which students document code to demonstrate a skill from Computational Thinking Practice 4.

CR4
The syllabus must include a brief description of an activity or assignment in which students develop code to demonstrate a skill from Computational Thinking Practice 2.

Unit	Course and Exam Description Topics	Sample Labs, Assignments, and Activities *Note: The course will include a minimum of 20 hours of in-class, computer-based lab experiences. CR8
Unit 2: Fundamentals of Objects and Classes	▪ 1.7: Application Program Interface (API) and Libraries ▪ 1.9: Method Signatures ▪ 1.11: Math Class ▪ 1.10: Calling Class Methods ▪ 1.12: Objects: Instances of Classes ▪ 1.13: Object Creation and Storage (Instantiation) ▪ 1.14: Calling Instance Methods ▪ 1.15: String Manipulation	**Activity:** To introduce the idea of objects and classes, in a whole group setting have students brainstorm a blueprint for modeling a Monster (what attributes does a Monster have? What can a Monster do?) Optionally, the teacher can write a Monster class using the students' ideas to show the syntax and structure of a class. **(Skill 1.A)** CR3
Unit 3: Conditional Statements	▪ 2.2: Boolean Expressions ▪ 2.3: if Statements ▪ 2.4: Nested if Statements ▪ 2.5: Compound Boolean Expressions ▪ 2.6: Comparing Boolean Expressions	**Assignment:** Divide students into pairs. Each pair will be responsible for completing 2 exercises, both involving the creation of a conditional statement with 2 conditions. For the first exercise, Partner A will write a solution using a logical operator, while Partner B will write a solution using a nested *if* statement (and vice versa for the second exercise). For each exercise, the 2 partners will switch solutions and create test cases to manually trace through their partner's code and verify that it works. **(Skills 2.A, 3.A)** CR4 CR5
Unit 4: Iteration	▪ 2.1: Algorithms with Selection and Repetition ▪ 2.7: while Loops ▪ 2.8: for Loops ▪ 2.9: Implementing Selection and Iteration Algorithms ▪ 2.10: Implementing String Algorithms ▪ 2.11: Nested Iteration ▪ 2.12: Informal Run-Time Analysis	**Assignment:** Divide students into groups of 3–4. Each group should write a program that involves loops and conditional statements but that contains 5 errors. They should then swap programs with another group and identify and fix the errors that group had made. **(Skill 3.D)** CR5
Unit 5: Writing Classes	▪ 3.1: Abstraction and Program Design ▪ 3.3: Anatomy of a Class ▪ 3.4: Constructors ▪ 3.5: Methods: How to Write Them ▪ 3.6: Methods: Passing and Returning References of an Object ▪ 3.7: Class Variables and Methods ▪ 3.8: Scope and Access ▪ 3.9: this Keyword	**Lab #2: Coordinate3D** CR8 In this lab, students will create a class that can be used to model 3-dimensional coordinates, along with a driver class to test functionality of their Coordinate3D class. They will work on different components of the lab throughout the unit as their knowledge of creating classes expands. **(Skills 1.A, 2.C)** CR3 CR4

CR8
The syllabus must include an explicit statement that at least 20 hours of in-class instructional time is spent in computer-based lab experiences.

CR3
The syllabus must include a brief description of an activity or assignment in which students design code to demonstrate a skill from Computational Thinking Practice 1.

CR4
The syllabus must include a brief description of an activity or assignment in which students develop code to demonstrate a skill from Computational Thinking Practice 2.

CR5
The syllabus must include a brief description of an activity or assignment in which students analyze code to demonstrate a skill from Computational Thinking Practice 3.

CR8
The syllabus must include titles and descriptions of at least two lab experiences. For each lab, use the label Lab #1 or Lab #2 to identify the experience.

Unit	Course and Exam Description Topics	Sample Labs, Assignments, and Activities *Note: The course will include a minimum of 20 hours of in-class, computer-based lab experiences. CR8
Unit 6: 1-Dimensional Arrays	▪ 4.2: Introduction to Using Data Sets ▪ 4.6: Using Text Files ▪ 4.3: Array Creation and Access ▪ 4.4: Array Traversals ▪ 4.5: Implementing Array Algorithms	**Lab: Cipher Challenge** In this lab, students will read in a text file that has been encrypted using a mono-alphabetic substitution cipher. They will use frequency analysis to decrypt the text by reading in an unencrypted text and counting the frequency of each letter, then storing all of these frequencies in an array. They will then count the frequency of each letter in the encrypted text, store these values in a different array. They will use array traversals to compare the respective distributions **(Skills 1.B, 2.B, 2.C)** CR3 CR4
Unit 7: ArrayLists	▪ 4.7: Wrapper Classes ▪ 4.8: ArrayList Methods ▪ 4.9: ArrayList Traversals ▪ 4.10: Implementing ArrayList Algorithms	**Assignment:** Scenario Drills – Students will be given a list of scenarios and have to write only the loop headers for how they would traverse the ArrayList suggested by the scenario. For example, a scenario could be: "You have an ArrayList of Integers called numList. You want to loop through the ArrayList and remove all odd numbers." Students would need to write a for loop header that could be used to answer the question, and then either write a for-each loop header that could answer the question or explain why a for-each loop could not be used. **(Skill 1.A)** CR3
Unit 8: 2-Dimensional Arrays	▪ 4.11: 2D Array Creation and Access ▪ 4.12: 2D Array Traversals ▪ 4.13: Implementing 2-D Array Algorithms	**Lab: Vigenère Cipher** In this lab, students will create a 2D array with a Vigenère table, then use 2D array traversals to encrypt/decrypt messages using the Vigenère cipher. **(Skills 1.A, 2.A, 2.B, 2.C)** CR3 CR4
Unit 9: Searching, Sorting, and Recursion	▪ 4.14: Searching Algorithms ▪ 4.15: Sorting Algorithms ▪ 4.16: Recursion ▪ 4.17: Recursive Searching and Sorting	**Activity:** Students will create and illustrate a short story (like a children's book) that uses recursion to answer a question by breaking it down into smaller and smaller questions.

CR8
The syllabus must include an explicit statement that at least 20 hours of in-class instructional time is spent in computer-based lab experiences.

CR3
The syllabus must include a brief description of an activity or assignment in which students design code to demonstrate a skill from Computational Thinking Practice 1.

CR4
The syllabus must include a brief description of an activity or assignment in which students develop code to demonstrate a skill from Computational Thinking Practice 2.