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AP[®] Computer Science A

Course Overview

The A+ curriculum for the AP Computer Science A course includes all topics and the course descriptions for AP Computer Science A as described in the *AP Computer Science Course Description*. All teachers teaching AP Computer Science AP A should be very familiar with all topics listed in the current course description.

The materials provided include full support for new AP CS Labs - Magpie, Elevens, and Picture Lab. These new labs should be used early and often to help reinforce the core concepts tested on the AP Computer Science A exam.

Teacher Resources

Armstrong, Stacey. *A+ Computer Science: Computer Science Curriculum Solutions*.
<http://apluscompsci.com>, 2015

The College Board. *New AP CS A Labs - Magpie, Elevens, PictureLab*. New York: College Entrance Examination Board, 2013.

Teukolsky, Roselyn. *Barron's AP Computer Science A*, 6th ed. Hauppauge, N.Y.: Barron's Educational Series, 2013.

LIST ANY MORE RESOURCES/BOOKS THAT YOU USE

TIME	TOPICS
3 weeks	<p>Computer Science / Programming Fundamentals</p> <p>Course Topics Variables and Classes Methods and Parameters Social and Ethical Implications of Computer Use</p> <p>Learning Objectives Students will learn to create programs using variables, create and call methods, create and use classes, create runner files that instantiate objects and call methods. Students will use a compiler to create a complete java program, find and correct syntax errors and runtime errors, print values to the output window, read in values from an input device, learn how computers work and how programs are used to provide instructions to computers. Students will recognize the social and ethical implications of computer use. Students will research social and ethical topics. Students will find articles that show the positive and negative impact of computer use and computer science on society.</p> <p><i>Materials : Slides, Worksheets, etc.</i> <i>Labs : input and output programs, basic class creation, Jeroo, codingbat</i> <i>Assessments : Labs, Quizzes, and Tests</i></p>
	<p>Conditionals, Strings, and Loops</p> <p>Course Topics Abstraction Strings If and If Else Statements Loops - for and while Object Oriented development Top-down development</p> <p>Learning Objectives Students will learn to create programs using classes, methods, parameters, abstraction, and all aspects of object oriented programming. Students will use write programs that use strings, set string values, return strings, and use string methods - indexOf(), substring(), and length(). Students will use loops to solve problems, design for loops, design while loops, create loops to increase in value, create loops that decrease in value.</p> <p><i>Materials : Slides, Worksheets, etc.</i> <i>Labs : various if labs and loop labs, numerous string programs, codingbat</i> <i>Labs : New AP CS Lab - Magpie parts 1-4</i> <i>Assessments : Quizzes and Tests</i></p>

6 weeks	<p>Arrays and Array Processing</p> <p>Course Topics Boolean Object Oriented Programming One-dimensional arrays Traversals Insertions Deletions</p> <p>Options Topics Scanner String Parsing File Input</p> <p>Learning Objectives Students will learn to use boolean variables, learn to use boolean laws, and learn to solve logic problems with boolean expressions. Students will use 1D arrays, set array values, search for values in an array, create algorithms that manipulate array values, and use different types of loops to process values in an array. Students will implement commonly used algorithms - find biggest, find smallest, search, and count occurrences.</p> <p><i>Materials: Labs, Slides, Worksheets, etc.</i> <i>Labs : find big values, find small values, lots of array processing</i> <i>Labs : New AP CS A Labs - Magpie, codingbat</i> <i>Assessments : Labs, Quizzes, and Tests</i></p>
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6 weeks	<p>Lists and List Processing [List interface and ArrayList class]</p> <p>Course Topics</p> <ul style="list-style-type: none"> Object Oriented Programming Lists - List interface and ArrayList class List - ArrayListTraversals List - ArrayList Insertions - add List - ArrayList Deletions - remove Test classes and libraries in isolation; Identify boundary cases and generate appropriate test data Choose appropriate data representation and algorithms Interface declarations <p>Learning Objectives</p> <p>Students will use lists [List interface and ArrayList class], set list values, get list values, remove list values, search for values in a list, create algorithms that manipulate list values, and use different types of loops to process values in a list.</p> <p>Students will use the ArrayList methods - set, get, remove, size, and clear.</p> <p>Students will implement commonly used algorithms - find biggest, find smallest, search, and count occurrences.</p> <p>Students use the 11s lab to gain a better understanding of how to work with a list of references / list of classes. Students will create a Deck class that contains an ArrayList / List of Card references.</p> <p><i>Materials : Labs, Slides, Worksheets, 11s lab, etc.</i></p> <p><i>Labs : search for values, lists of classes, lots of multi-class manipulation</i></p> <p><i>Labs : 11s lab units 1-4</i></p> <p><i>Assessments : Labs, Quizzes, and Tests(m/c and free response)</i></p>
	<p>END OF SEMESTER ONE</p>

<p>6 weeks</p>	<p>Extending Classes</p> <p>Course Topics</p> <ul style="list-style-type: none"> Object Oriented Programming Lists - List interface and ArrayList class Traversals Insertions Deletions Test classes and libraries in isolation Identify boundary cases and generate appropriate test data Choose appropriate data representation and algorithms Interface declarations Abstract classes Extend classes <p>Learning Objectives</p> <p>Students will learn how to write programs that work with several classes, how to extend a class to make a new class, how to write a class that implements an interface, and how to write a class that extends and abstract class.</p> <p>Students will use the ArrayList methods - set, get, remove, size, and clear.</p> <p>Students use the 11s lab to gain a better understanding how to work with a large program, modify existing code from a large provided program, and how to expand existing code.</p> <p><i>Materials : Labs, Slides, Worksheets, AP CS A Labs - Magpie and Elevens</i></p> <p><i>Labs : Design and create a game that uses lots of classes</i></p> <p><i>Labs : AP CS A Labs - Magpie and Elevens</i></p> <p><i>Labs: Lots of work with AP CS A Elevens - units 4-9</i></p> <p><i>Assessments : Labs, Quizzes, and Tests</i></p>
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<p>3 weeks</p>	<p>Matrices and Matrix Processing</p> <p>Course Topics Arrays [1D and 2D arrays] Traversals Insertions Deletions Test classes and libraries in isolation</p> <p>Learning Objectives Students will use arrays [1d arrays] and arrays of arrays [2d arrays], learn how to find a values in an array of arrays, print the values in an array of arrays [2d array], change the values in an array of arrays, and develop small and large algorithms that manipulate an array of arrays. Students use the Picture lab to gain a better understanding how to work with a large program, modify existing code from a large provided program, and how to expand existing code.</p> <p><i>Materials: Labs, Slides, Worksheets, PictureLab, etc.</i> <i>Labs: Sort the Matrix, Count a Value in the Matrix</i> <i>Labs: Picturelab - units 1 - 8</i> <i>Assessments : Labs, Quizzes, and Tests</i></p>
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<p>3 weeks</p>	<p>Recursion and Searching and Sorting</p> <p>Course Topics Recursion Searching - Sequential Search and Binary Search Sorting - Selection Sort, Insertion Sort, and Merge Sort Identify boundary cases and generate appropriate test data Perform integration testing Choose appropriate data representation and algorithms Analysis of algorithms Informal comparisons of running times Exact calculation of statement execution counts.</p> <p>Learning Objectives Students will learn to use recursion to solve problems, learn to use recursion to find values, and learn when and when not to use recursion. Students will learn about sorting and searching, learn all common sorts, learn all common sorts, learn to identify sorts and searches, learn to write all of sorts and searches, and learn when to use a particular search and sort for a specific situation.</p> <p><i>Materials: Labs, Slides, Worksheets, etc.</i> <i>Labs : Recursive value counter, AP CS A Labs - Elevens and Picture Lab</i> <i>Labs : Review all sorting algorithms, sort lots of stuff, codingbat</i> <i>Assessments : Labs, Quizzes, and Tests</i></p>
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<p>6 weeks</p>	<p>Review for the AP Computer Science Exam</p> <p><i>Core Review Topics</i></p> <ul style="list-style-type: none"> <i>Arrays - 1D and 2D arrays</i> <i>Lists - List interface and ArrayList class</i> <i>Inheritance and Classes</i> <i>Interfaces and Abstract classes</i> <i>AP CS A Labs - Magpie, Elevens, and Picture Lab</i> <p><i>Labs : Past year's free response and multiple choice questions</i></p> <p><i>Labs : AP CS A Labs - Magpie, Elevens, and Picture Lab</i></p> <p><i>Readings : Past year's free response and multiple choice questions</i></p> <p><i>Readings : Review book units</i></p>
	<p>End of Semester Two</p>

AP Computer Science A: Curricular Requirements

- CR1 The course teaches students to design and implement computer-based solutions to problems. [**Pages 2,3,4,5 and 6**]
- CR2a The course teaches students to use and implement commonly used algorithms. [**Pages 3,4 and 6**]
- CR2b The course teaches students to use commonly used data structures. [**Pages 3,4 and 6**]
- CR3 The course teaches students to select appropriate algorithms and data structures to solve problems. [**Pages 3,4 and 6**]
- CR4 The course teaches students to code fluently in an object-oriented paradigm using the programming language Java. [**Pages 2 and 5**]
- CR5 The course teaches students to use elements of the standard Java library from the AP Java subset in Appendix A of the AP Computer Science A Course Description. [**Pages 2,4,5 and 6**]
- CR6 The course includes a structured lab component comprised of a minimum of 20 hours of hands-on lab experiences. [**Pages 2,3,4,5, and 6**]
- CR7 The course teaches students to recognize the ethical and social implications of computer use. [**Page 2**]

Classroom Management

AP Computer Science should be taught in a computer lab where each student has access to a computer each and every day.

Each student will spend at least 20 hours in class on the computer writing programs and working with programming assignments / programming labs.

Each student in each class must have access to a PC during class, before school, and after school.

Each topic covered should allow for multiple programming opportunities. The new AP CS A Labs are quite helpful in this area. Codingbat is also a nice resource. The students should be allowed to work on programming assignments in groups or pairs when possible. Each student must be able to write programs, but group projects are beneficial.

Each student will spend at least 20 hours in class on the computer writing programs and working with programming assignments / programming labs.

The school ensures that each student has a college-level text for individual use inside and outside of the classroom and has access to the AP Computer Science A labs. The school ensures that each student has access to a computer for at least three hours a week; three hours are the bare minimum, additional time is desirable.

The computer system must contain appropriate software to create and edit programs and must allow programs comparable in size to the current AP Computer Science A labs to compile in seconds. Internet access is strongly encouraged.

Each student will spend at least 20 hours in class on the computer writing programs and working with programming assignments / programming labs.

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