

This AP® Audit approved AP® Computer Science A syllabus is provided courtesy of A+ Computer Science.

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All labs, tests, quizzes, slides, and worksheets referenced on this syllabus are included in the A+ Computer Science Curriculum packages.

AP[®] Computer Science A

Course Overview

I teach AP[®] Computer Science as a three year sequence and as a two year sequence. An introductory Computer Science course, which introduces many AP Computer Science A topics, is recommended, but not required as the first course in our sequence. Students can take AP Computer Science A after the introductory Computer Science course or take AP Computer Science A as their first Computer Science course. Students who have completed the AP Computer Science A course have the option to continue on and take the AP Computer Science AB course. Our 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*. This course concentrates on Object Oriented Design and the building of a strong logic foundation, including heavy concentration on the AP Computer Science GridWorld Case Study. All students taking AP courses are encouraged to take the AP exam.

Lab Setup / Lab Usage

As with many other schools, we teach AP Computer Science in a computer lab. We have all PCs set against the outer wall of the room. The students work on lab assignments individually and collaboratively as the particular assignment dictates. Each student in each of my classes has access to a PC during class, before school, and after school. For each unit of coverage, I have multiple computer-based programming lab assignments. I have found that students do best when given many differing lab assignment options. The more options the students can choose from the higher the rate of student success. During new topic discussions, students open sample programs on the computer to see the topics in code form. Students are instructed to make changes to the sample programs and then run the programs to test the changes. Students have many opportunities to use computers. The word lab is used below in the syllabi to identify a computer programming assignment.

| TIME | TOPICS |
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| 3 days | <p>Unit 0A – Computer Science, Computer Lab, and Objects Introduction</p> <p>AP Topics – Test classes and libraries in isolation; Identify and correct errors : compile-time, run-time, logic; Categorize error: compile-time, run-time, logic; Employ techniques such as using a debugger, adding extra output statements, or hand-tracing code; Understand and modify existing code; Inheritance; Object-oriented development; Top-down development; Encapsulation & information hiding.</p> <p>Student Objectives - Students will learn what Computer Science is, how a computer lab works, how to use the computer, how the network is setup, and how to use the labs and the network in an acceptable/ethical manner. Students will learn the basic syntax for Java and how to debug a program, the difference between a compile error and a syntax error, how to identify and correct errors, how to add to and remove from existing code. Students gain experience working with a large program, modifying existing code of a large program, and expanding and extending existing code.</p> <p><i>Guided Practice : Topic discussion, Example program analysis and modification, Worksheets</i> <i>Readings : Labs, Slides, Worksheets, etc.</i> <i>Labs : AP CS GridWorld Case Study</i> <i>Assessments : Labs, Quizzes, and Tests(m/c)</i></p> |
| 2 days | <p>Unit 0B - Computers</p> <p>AP Topics – Primary and secondary memory; processors; peripherals; language translators/compilers; virtual machines; operating systems; networks; single-user systems; networks; system reliability; privacy; legal issues and intellectual property; social and ethical ramifications of computer use.</p> <p>Student Objectives – Students will learn all of the fundamental components of a computer, how a computer works, hardware, software, compilers, programming languages, basic computer operations, integrity, and responsible use of the computer.</p> <p><i>Guided Practice : Topic discussion, Example program analysis and modification, Worksheets</i> <i>Readings : Slides, Worksheets, etc.</i> <i>Labs : AP CS GridWorld Case Study / Jeroo (basics and if and loop introduction)</i> <i>Assessments : Quizzes and Tests(m/c)</i></p> |
| 1 week | <p>Units A and B – Output and Variables</p> <p>AP Topics – Primitive types vs. Objects; Constant declarations; Variable declarations; Console output; Java library classes; Simple data types(int, boolean, double); Classes; Representations of numbers in different bases; Limitations of finite representations; GridWorld Case Study.</p> <p>Student Objectives – Students will learn what a variable is, how to define a variable, how to assign values to a variable, the difference between a primitive type and a reference, and how to print/println values to the console window. GridWorld will be used to teach the concepts in context.</p> <p><i>Guided Practice : Topic discussion, Example program analysis and modification, Worksheets</i> <i>Readings : Labs, Slides, Worksheets, etc.</i> <i>Labs : AP CS GridWorld Case Study, ASCII Art, Area of a Triangle, Area of a Square</i> <i>Assessments : Labs, Quizzes, and Tests(m/c)</i></p> |

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| <p>1 week</p> | <p>Units C and 1 – Input and Methods</p> <p>AP Topics – Variable declarations; Console output; Java library classes; Simple data types(int, boolean, double); Classes; Method declarations, Class declarations; Parameter declarations.</p> <p>Student Objectives – Students will learn how to perform basic input operations, write methods, define and pass parameters, and use graphics to make shapes and pictures.</p> <p><i>Guided Practice : Topic discussion, Example program analysis and modification, Worksheets</i> <i>Readings : Labs, Slides, Worksheets, etc.</i> <i>Labs : Smiley Face, House, Robot</i> <i>Assessments : Labs, Quizzes, and Tests(m/c)</i></p> |
| <p>1 week</p> | <p>Units 2 and 3 – Classes, OOP, Math Operations</p> <p>AP Topics – Object Oriented development; Top-down development; Encapsulation and information hiding; Procedural abstraction; Read and understand a problem description, purpose, and goals; Class design; Method declarations; Parameter declarations; Class declarations.</p> <p>Student Objectives – Students will learn how to declare a class, class methods, and parameters, the difference between constructors, accessors, and modifiers, learn how to read and understand a problem description, purpose, and goals. Students will learn to solve problems using mathematical operators(+,-,/,*,%), mathematical formulas, and Math class methods.</p> <p><i>Guided Practice : Topic discussion, Example program analysis and modification, Worksheets</i> <i>Readings : Labs, Slides, Worksheets, etc.</i> <i>Labs : Area of Triangle, Area of Square, Heron’s Formula, Miles Per Hour, Quadratic Formula</i> <i>Assessments : Labs, Quizzes, and Tests(m/c)</i></p> |
| <p>2 days</p> | <p>Unit 4 - Strings and OOP</p> <p>AP Topics – Object Oriented development; Read and understand a problem description, purpose, and goals; Class design; Method declarations; Parameter declarations; Class declarations.</p> <p>Student Objectives – Students will learn how to instantiate a String, more about references, how to create a reference to a String, perform String input and output, how to use String methods(length, substring, indexOf, charAt), how to write return methods(toString), and how to create more sophisticated classes.</p> <p><i>Guided Practice : Topic discussion, Example program analysis and modification, Worksheets</i> <i>Readings : Labs, Slides, Worksheets, etc.</i> <i>Labs : Concatenation, FirstLastLetter, StringRipper, Name</i> <i>Assessments : Labs, Quizzes, and Tests(m/c)</i></p> |

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| <p>8 days</p> | <p>Units 5-7 – Conditionals – If, If else, If else if, Switch Case</p> <p>AP Topics – Conditional; Object Oriented development; Read and understand a problem description, purpose, and goals; Class design; Method declarations; Parameter declarations; Class declarations.</p> <p>Student Objectives – Students learn how to use if, if else, if else if, and switch case to test conditions and add decision making to their programs, and Boolean conditions and variables. Students learn how to use relational operators(>, <, >=, <=, !).</p> <p><i>Guided Practice : Topic discussion, Example program analysis and modification, Worksheets</i> <i>Readings : Labs, Slides, Worksheets, etc.</i> <i>Labs : OddEven, Animated Car, Distance, SocialSecurity#, Grade, HexToBinary, Number Compare, String Equality, String Length, Morse Code, Mouse Button Tester</i> <i>Assessments : Labs, Quizzes, and Tests(m/c)</i></p> |
| <p>7 days</p> | <p>Units 8-9 – Iteration – For Loop and While Loop</p> <p>AP Topics – Iteration; Object Oriented development; Read and understand a problem description, purpose, and goals; Class design; Method declarations; Parameter declarations; Class declarations.</p> <p>Student Objectives – Students learn how to use for loops, use while loops, add iterative processes to their programs, and use Boolean conditions and variables. Students learn the different parts of a loop and when to use a particular type of loop. Students will learn when to use Integer.MAX_VALUE and Integer.MIN_VALUE.</p> <p><i>Guided Practice : Topic discussion, Example program analysis and modification, Worksheets</i> <i>Readings : Labs, Slides, Worksheets, etc.</i> <i>Labs : Greatest Common Divisor, Prime, MutliplicationTable, Binary To Ten, Perfect, BackWards String, Box Word, Factorial, Decreasing Word, Divisors, Reverse Num</i> <i>Assessments : Labs, Quizzes, and Tests(m/c)</i></p> |
| <p>4 days</p> | <p>Unit 10 - Boolean Logic and Boolean Laws</p> <p>AP Topics – Boolean; Object Oriented development; Read and understand a problem description, purpose, and goals; Class design; Method declarations; Parameter declarations; Class declarations.</p> <p>Student Objectives – Students learn boolean laws, truth tables, logical operators(&&, , !, ^), how to use do while loops, how to use boolean logic to solve problems, and how to use Random and Math.random() to generate random numbers.</p> <p><i>Guided Practice : Topic discussion, Example program analysis and modification, Worksheets</i> <i>Readings : Labs, Slides, Worksheets, etc.</i> <i>Lab : Password Checker, BiggestDouble, BiggestString, Guessing Game</i> <i>Assessments : Labs, Quizzes, and Tests(m/c)</i></p> |

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| <p>4 days</p> | <p>Unit 11 - Iteration – Nested Loops</p> <p>AP Topics – Iteration; Object Oriented development; Read and understand a problem description, purpose, and goals; Class design; Method declarations; Parameter declarations; Class declarations.</p> <p>Student Objectives – Students learn how to use nested loops, add iterative processes to their programs, and use Boolean conditions and variables. Students learn how to use nested for and nested while loops.</p> <p><i>Guided Practice : Topic discussion, Example program analysis and modification, Worksheets</i> <i>Readings : Labs, Slides, Worksheets, etc.</i> <i>Labs : TriangleLetter, BoxWords, TriangleWords, RandomColoredBoxes, Triples</i> <i>Assessments : Labs, Quizzes, and Tests(m/c)</i></p> |
| <p>1 day</p> | <p>Units 12-13 – Chopping Strings and File Input (Optional Topics)</p> <p>AP Topics – Object Oriented development; Read and understand a problem description, purpose, and goals; Class design; Method declarations; Parameter declarations; Class declarations.</p> <p>Student Objectives – Students learn how to use Scanner to chop up Strings, to read data from data files, to instantiate Objects using the data extracted from files. Students learn more about constructor overloading and using a single class for multiple purposes.</p> <p><i>Guided Practice : Topic discussion, Example program analysis and modification, Worksheets</i> <i>Readings : Labs, Slides, Worksheets, etc.</i> <i>Labs : Prime, Box, Biggest Number, Average, GCD, Dog Food, Line Breaker, Pig Latin</i> <i>Assessments : Labs, Quizzes, and Tests(m/c)</i></p> |
| <p>2 weeks</p> | <p>Units 14-15 - One dimensional arrays</p> <p>AP Topics – One-dimensional arrays; Traversals; Insertions; Deletions; Object Oriented development; Read and understand a problem description, purpose, and goals; Class design; Method declarations; Parameter declarations; Class declarations.</p> <p>Student Objectives – Students will learn how to instantiate a one-dimensional array, add items to a one-dimensional array, delete items from a one-dimensional array, and use a one-dimensional array to solve problems. Students will learn the differences between arrays of primitives and arrays of references.</p> <p><i>Guided Practice : Topic discussion, Example program analysis and modification, Worksheets</i> <i>Readings : Labs, Slides, Worksheets, etc.</i> <i>Labs : Biggest, Histogram, GraphicTree, Fibonacci, WordSorter, StringArrays</i> <i>Assessments : Labs, Quizzes, and Tests(m/c and free response)</i></p> |

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| <p>3 weeks</p> | <p>Unit 16 - ArrayList / Critter</p> <p>AP Topics – One-dimensional arrays; Traversals; Insertions; Deletions; Object Oriented development; Searching; Sorting; Test classes and libraries in isolation; Identify boundary cases and generate appropriate test data; Perform integration testing; Choose appropriate data representation and algorithms.</p> <p>Student Objectives – Students will learn how to add to, delete from, sort, search, and perform all types of manipulations on an ArrayList. Students will learn about the java.util.List interface. Students gain experience working with a large program, modifying existing code of a large program, and expanding and extending existing code.</p> <p><i>Guided Practice : Topic discussion, Example program analysis and modification, Worksheets</i> <i>Readings : Labs, Slides, Worksheets, AP CS GridWorld Case Study, etc.</i> <i>Labs : GradeBook, Histogram, Map, AP CS GridWorld Case Study</i> <i>Assessments : Labs, Quizzes, and Tests(m/c and free response)</i></p> |
| <p>4 days</p> | <p>Unit 17 – References / Parameters</p> <p>AP Topics – Object Oriented development; Read and understand a problem description, purpose, and goals; Class design; Method declarations; Parameter declarations; Class declarations.</p> <p>Student Objectives – Students will learn more about references and parameter passing. Students will learn the differences between passing primitives and references as parameters.</p> <p><i>Guided Practice : Topic discussion, Example program analysis and modification, Worksheets</i> <i>Readings : Labs, Slides, Worksheets, etc.</i> <i>Labs : ArrayTools, WordPrinter, LetterBoxes, TwoDRay, ThreeDRay</i> <i>Assessments : Labs, Quizzes, and Tests(m/c)</i></p> |
| <p>3 days</p> | <p>Unit 18 - Interfaces / OOP</p> <p>AP Topics – Object Oriented development; Read and understand a problem description, purpose, and goals; Class design; Method declarations; Parameter declarations; Class declarations; Interface declarations.</p> <p>Student Objectives – Students will learn how to design and implement a class; apply data abstraction and encapsulation; and implement an interface and learn why interfaces are useful. Students will learn how interfaces are used to build hierarchies. Students gain experience working with a large program, modifying existing code of a large program, and expanding and extending existing code.</p> <p><i>Guided Practice : Topic discussion, Example program analysis and modification, Worksheets</i> <i>Readings : Labs, Slides, Worksheets, etc.</i> <i>Labs : Monster, SortByVowels, RomanNumerals</i> <i>Labs : GridWorld Case Study</i> <i>Assessments : Labs, Quizzes, and Tests(m/c and free response)</i></p> |

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| 3 days | Unit 19 – Array of References AP Topics – One-dimensional arrays; Traversals; Insertions; Deletion; Object Oriented development; Read and understand a problem description, purpose, and goals; Class design; Method declarations; Parameter declarations; Class declarations. Student Objectives – Students will learn more about storing references in arrays. Students will learn the difference between arrays of primitives and arrays of references. <i>Guided Practice : Topic discussion, Example program analysis and modification, Worksheets</i> <i>Readings : Labs, Slides, Worksheets, etc.</i> <i>Labs : Winter Scene, AP CS GridWorld Case Study, GradeBook, TicTacToe</i> <i>Assessments : Labs, Quizzes, and Tests(m/c and free resposne)</i> |
| | END OF SEMESTER ONE |

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| <p>2 weeks</p> | <p>Unit 20 - Inheritance</p> <p>AP Topics – Object Oriented development; Read and understand a problem description, purpose, and goals; Class design; Method declarations; Parameter declarations; Class declarations; Interface declarations; Read and understand class specifications and relationships among the classes("is-a", "has-a" relationships); Understand and implement a class hierarchy; Identify reusable components from existing code using classes and class libraries; Choose appropriate data representation and algorithms.; Extend a class using inheritance.</p> <p>Student Objectives – Students will learn how to extend a given class using inheritance, design and implement a class hierarchy, write a multi-tiered game with graphics and animation. Students will learn how to build a new class from an existing class using extends and super calls. Students will learn how to use static variables. Students gain experience working with a large program, modifying existing code of a large program, and expanding and extending existing code.</p> <p><i>Guided Practice : Topic discussion, Example program analysis and modification, Worksheets</i> <i>Readings : Labs, Slides, Worksheets, AP CS GridWorld Case Study, etc.</i> <i>Labs : Pong(Block, Ball, Paddle, Game)</i> <i>Labs : AP CS GridWorld Case Study (TicTacToe, SlidingPuzzle)</i> <i>Assessments : Labs, Quizzes, and Tests(m/c and free response)</i></p> |
| <p>2 weeks</p> | <p>Unit 21 - Recursion</p> <p>AP Topics – Recursion; Object Oriented development; Read and understand a problem description, purpose, and goals; Class design; Class declarations.</p> <p>Student Objectives – Students will learn how to use recursion to solve problems, the benefits of using recursion, when to use recursion, and the negative effects of using recursion. Students gain experience working with a large program, modifying existing code of a large program, and expanding and extending existing code.</p> <p><i>Guided Practice : Topic discussion, Example program analysis and modification, Worksheets</i> <i>Readings : Labs, Slides, Worksheets, etc.</i> <i>Labs : RecursiveCircles, MazeSolver, TrashCollector</i> <i>Labs : GridWorld Case Study</i> <i>Assessments : Labs, Quizzes, and Tests(m/c and free response)</i></p> |

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| <p>2 weeks</p> | <p>Unit 22 - Advanced Sorting and Searching / Comparable</p> <p>AP Topics – One-dimensional arrays; Traversals; Insertions; Deletions; Object Oriented development; Searching; Sequential Search; Binary Search; Sorting; Selection Sort; Insertion Sort; Merge Sort; Test classes and libraries in isolation; 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>Student Objectives – Students will learn to identify all sorting and searching algorithms, code all sorting and searching algorithms, and to select the appropriate sorting and searching algorithm for the appropriate situation. Students will learn where to use a particular sort/search and the benefits of using a particular type of sort/search.</p> <p><i>Guided Practice : Topic discussion, Example program analysis and modification, Worksheets</i> <i>Readings : Labs, Slides, Worksheets, etc.</i> <i>Labs : Insertion Sort, QuickSort, MergeSort</i> <i>Assessments : Labs, Quizzes, and Tests(m/c and free response)</i></p> |
| <p>2 weeks</p> | <p>Unit 23 - Abstract Classes</p> <p>AP Topics – Object Oriented development; Read and understand a problem description, purpose, and goals; Class design; Method declarations; Parameter declarations; Class declarations; Interface declarations; Read and understand class specifications and relationships among the classes("is-a", "has-a" relationships); Understand and implement a class hierarchy; Identify reusable components from existing code using classes and class libraries; Choose appropriate data representation and algorithms; Extend a class using inheritance.</p> <p>Student Objectives – Students will learn how to design and implement an abstract class, extend an abstract class to make sub classes, and implement an interface. Students will learn to compare and contrast a class, an interface, and an abstract class. Students will learn when to use an interface, when to use an abstract class, and when to use static variables.</p> <p><i>Guided Practice : Topic discussion, Example program analysis and modification, Worksheets</i> <i>Readings : Labs, Slides, Worksheets, AP CS GridWorld Case Study, etc.</i> <i>Labs : BlackJack(Card, Deck, Player, Dealer, Game), AP CS GridWorld Case Study</i> <i>Assessments : Labs, Quizzes, and Tests(m/c and free response)</i></p> |

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| <p>2 weeks</p> | <p>Unit 24 – Matrices</p> <p>AP Topics – One-dimensional arrays; Two-dimensional arrays; Traversals; Insertions; Deletions; Object Oriented development; Class design; Method declarations; Parameter declarations; Class declarations; Top-down development; Encapsulation & information hiding.</p> <p>Student Objectives – Students will learn how to instantiate a one-dimensional and two-dimensional array, add items to a one-dimensional and two-dimensional array, and delete items from a one-dimensional and two-dimensional array.</p> <p><i>Guided Practice : Topic discussion, Example program analysis and modification, Worksheets</i> <i>Readings : Labs, Slides, Worksheets, etc.</i> <i>Labs: Pascal's Triangle, 3DArray, Tic Tac Toe</i> <i>Assessments : Labs, Quizzes, and Tests(m/c and free response)</i></p> |
| <p>8 weeks</p> | <p>AP Review Time</p> <p><i>Guided Practice : Review topics, AP CS GridWorld Case Study</i> <i>Guided Practice : Past year's free response and multiple choice questions</i> <i>Guided Practice : Slides, AP CS GridWorld Case Study</i> <i>Readings : Past year's free response and multiple choice questions</i> <i>Readings : Review book units</i></p> |
| | <p>End of Semester Two</p> |

Teaching Strategies

Topics are broken down into manageable pieces. Each topic is introduced and discussed in a group setting. Sections of each topic are discussed and then reinforced using example computer programs. Students run the example programs, make changes to the programs, and ask questions about the programs. Students are presented with many examples and explanations for all topics presented. Worksheets are provided that enhance the discussions and provide students the opportunity to practice the concepts without having to use the computer. Students are encouraged to use the computer to test their answers on the worksheets. Lab time is provided so that each student has the opportunity to apply the concepts in a hands-on situation using a PC. For each topic, there are many computer-based programming lab assignments so that each student has the opportunity to practice the topic in different ways. Quizzes are given to provide feedback and to gain information about the learning process. Tests are given in multiple-choice and free response format in a way that models what students will see on the AP test.

Teacher Resources

Armstrong, Stacey. *A+ Computer Science: Computer Science Curriculum Solutions*.
<http://apluscompsci.com>, 2011

The College Board. *AP GridWorld Case Study*. New York: College Entrance Examination Board, 2011.

Teukolsky, Roselyn. *Barron's AP Computer Science Levels A and AB 2007*, 3rd ed. Hauppauge, N.Y.: Barron's Educational Series, 2010.

LIST ANY MORE RESOURCES/BOOKS THAT YOU USE

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