

# AP<sup>®</sup> Computer Science A Syllabus

## Course Texts and Required Information

*A Guide to Programming Using Java, Second Edition* Beth Brown, 2007, Lawrenceville Press

*A Guide to Programming Using Java, Second Edition Teacher Resource Materials* Beth Brown, 2007, Lawrenceville Press

Supplements from <http://www.Lpdatafiles.com>

[AP<sup>®</sup> GridWorld Case Study](#) The College Board, 2009

AP Computer Science Quick Reference Guide, Appendix A and B, Standard Java Library Methods Required for AP CS A (Java Subset) – AP Course Description from CollegeBoard

**Course Facility** - Our classroom is a fully equipped computer lab complete with a teaching video projector, key software for AP computer instruction, and is available before school, during lunch and after school.

## Topics Covered for AP Computer Science A

<p><b>Object-Oriented Program Design</b>-The overall goal for designing a piece of software (a computer program) is to correctly solve the given problem. At the same time, this goal should encompass specifying and designing a program that is understandable, can be adapted to changing circumstances, and has the potential to be reused in whole or in part. The design process needs to be based on a thorough understanding of the problem to be solved.</p>	<p>Program Design Class Design</p>
<p><b>Program Implementation</b> - The overall goals of program implementation parallel those of program design. Classes that fill common needs should be built so that they can be reused easily in other programs. Object-oriented design is an important part of program implementation.</p>	<p>Implementation techniques Programming constructs Java library classes (included in the AP Java subset)</p>
<p><b>Program Analysis</b> - The analysis of programs includes examining and testing programs to determine whether they correctly meet their specifications. It also includes the analysis of programs or algorithms in order to understand their time and space requirements when applied to different data sets.</p>	<p>Testing Debugging Understand and modify existing code Extend existing code using inheritance Understand error handling Reason about programs Analysis of algorithms Numerical representations and limits</p>
<p><b>Standard Data Structures</b> - Data structures are used to represent information within a program. Abstraction is an important theme in the development and application of data structures.</p>	<p>Simple data types (int, boolean, double) Classes Lists Arrays</p>
<p><b>Standard Algorithms</b> - Standard algorithms serve as examples of good solutions to standard problems. Many are intertwined with standard data structures. These algorithms provide examples for analysis of program efficiency.</p>	<p>Operations on data structures previously listed Searching Sorting</p>
<p><b>Computing in Context</b> - An awareness of the ethical and social implications of computing systems is necessary for the study of computer science. These topics need not be addressed in detail but should be considered throughout the course.</p>	<p>System reliability Privacy Legal issues and intellectual property Social and ethical ramifications of computer use</p>

<b>Unit 1 (week 1)</b>
<b>Topic and APCS A Topic Outline Correlation- An Introduction to Computers</b> Single-user systems, Peripherals Processors, Primary and secondary memory, Operating systems, Language translators/compiler, Networks, Representations of numbers in different bases, Limitations of finite representations (e.g., integer bounds, imprecision of floating-point representations, and round-off error) Privacy, Legal issues and intellectual property, System reliability, Social and ethical ramifications of computer use
<b>Projects and Assessment</b> Introduction to class and computer lab, Research the classroom computer network, Research ergonomics and Carpal Tunnel Syndrome, Explore emerging technologies and their impact on individuals and businesses, Review Questions, Test 1, Watching video Two Million Minutes
<b>Resources and Supporting Materials (Text Workbook projects or others)</b> Classroom networks, number system conversions, protecting computer systems, ergonomics, Operating Systems and video <i>Two Million Minutes</i>
<b>Unit 2 (week 2)</b>
<b>Topic and APCS A Topic Outline Correlation- Introducing Java</b> Introduce the concept of object-oriented development, Introduce the concept of encapsulation, Introduce identifying reusable components from existing code using classes and class libraries, Sequential programming constructs, Virtual machines, Console output (System.out.print/println)
<b>Projects and Assessment</b> BinaryNumbers (reinforce the representations of numbers in different bases), RockPaperScissors-Rules, Java Terminology , Simple applications to reinforce concepts, Critical Thinking, Test 2
<b>Resources and Supporting Materials (Text Workbook projects)</b> Text book
<b>Unit 3 (weeks 3, 4)</b>
<b>Topic and APCS A Topic Outline Correlation - Variables and Constants</b> Primitive types vs. objects, Variable declarations, Classes (abstract data type), Constant declarations, Simple data types (int, boolean, double), Identify reusable components from existing code using classes and class libraries, Categorize errors: compile-time, run-time, logic, Identify and correct errors, Understand run-time exceptions, Read and understand a problem description, purpose, and goals
<b>Projects and Assessment</b> CollegeCalculator, Java Terminology (modify existing code), GallonConverter, SimpleInterest, Project (time spent designing, coding, debugging, and testing an application), Simple applications to reinforce concepts
<b>Resources and Supporting Materials (Text Workbook projects)</b> Text, Primitive Data Types in Java PDF, Syntax and Logic Errors PDF, Java Packages PDF
<b>Unit 4 (weeks 5, 6)</b>
<b>Topic and APCS A Topic Outline Correlation - Conditional Control Structures</b> Conditional control structures, The Math class (Math.random()), The Math class (Math.abs(), Math.pow(), Math.sqrt()), Understand and modify existing code
<b>Projects and Assessment</b> GuessingGame, QuadraticEquation, CarPayment, Simple applications to reinforce concepts, RPS Case Study, Modify existing RPS code, Critical Thinking 1-8 (p 121), Test 4
<b>Resources and Supporting Materials (Text Workbook projects)</b> Text, Worksheet 1 Boolean logic, Worksheet 2 DeMorgan's Laws, Java Operator Precedence Rules PDF
<b>Unit 5 (weeks 7, 8)</b>

<p><b>Topic and APCS A Topic Outline Correlation- Loop Structures and Strings</b> Iteration, Identify and correct errors, Employ techniques such as using a debugger, adding extra output statements, or hand-tracing code , The String class</p>
<p><b>Projects and Assessment</b> PrimeNumber , GuessingGame (introduce the concept of binary search), Hailstone , Chaos, CountVowels, Simple applications to reinforce concepts, WordGuess Case Study, Modify existing WordGuess code, Critical Thinking 1-14, Test 5</p>
<p><b>Resources and Supporting Materials (Text Workbook projects)</b> Text, The JCreator Debugger PDF</p>
<p><b>Unit 6 (weeks 9, 10, 11)</b></p>
<p><b>Topic and APCS A Topic Outline Correlation - Methods</b> Methods, Top-down development, Procedural abstraction, Method declarations, Parameter declarations, Pre- and post-conditions, Assertions, Identify boundary cases and generate appropriate test data, Perform integration testing</p>
<p><b>Projects and Assessment</b> AddCoins, HiLo, Nim, GuessingGame (modify), Simple applications to reinforce concepts, GradeConverter Case Study, Modify existing GradeConverter code, Critical Thinking, Test 6</p>
<p><b>Resources and Supporting Materials (Text Workbook projects)</b> Text, writing methods, base conversions</p>
<p><b>Unit 7 (weeks 12, 13, 14, 15)</b></p>
<p><b>Topic and APCS A Topic Outline Correlation - Classes and Object-Oriented Programming</b> Classes, Apply data abstraction and encapsulation, Design and implement a class, Apply functional decomposition, Choose appropriate data representation and algorithms, Class declarations, Encapsulation and information hiding, The Object class, Introduce the concept of inheritance, Read and understand class specifications and relationships among the classes (has-a relationship), Object-oriented development, Identify reusable components from existing code using classes and class libraries, Test classes and libraries in isolation</p>
<p><b>Projects and Assessment</b> MySavings, DiceRollGame, Nim2, Bowling, Simple applications to reinforce concepts, RPS2 Case Study, Modify existing RPS2 code, Critical Thinking, Test 7</p>
<p><b>Resources and Supporting Materials (Text Workbook projects)</b> Text, code reusability, testing a class in isolation and integration testing, using the keyword this to pass an object to a method</p>
<p><b>Week 16</b></p>
<p><b>Topic and APCS A Topic Outline Correlation - GridWorld case study</b> Chapter 1 (Part 1) of the GridWorld case study</p>
<p><b>Unit 8 (weeks 17. 18)</b></p>
<p><b>Topic and APCS A Topic Outline Correlation - Inheritance and Polymorphism</b> Read and understand class specifications and relationships among the classes (is-a relationship), Understand and implement a given class hierarchy, Extend a given class using inheritance, Extend existing code using inheritance, Interface declarations, The Comparable interface</p>
<p><b>Projects and Assessment</b> UEmployee, Vehicle, Account, Simple applications to reinforce concepts, SalesCenter Case Study, Modify existing SalesCenter code, Critical Thinking, Test 8</p>
<p><b>Resources and Supporting Materials (Text Workbook projects)</b> Text, dynamic binding</p>
<p><b>Unit 9 (weeks 19, 20, 21)</b></p>
<p><b>Topic and APCS A Topic Outline Correlation- Arrays</b> One-dimensional arrays, Traversing an array, Iteration, Array element insertions and deletions, Sequential search, Introduction to algorithm analysis, The ArrayList class, The Integer class, The Double class</p>

<p><b>Projects and Assessment</b> Mastermind, SortedArray (introduce Selection sort), Inventory, Simple applications to reinforce concepts, LocalBank Case Study, Modify existing LocalBank code, Critical Thinking, Test 9</p>
<p><b>Resources and Supporting Materials (Text Workbook projects)</b> Text, hard-coded data, array insertions and deletions, ArrayList exercise</p>
<p><b>Week 22</b></p>
<p><b>GridWorld case study</b> Chapter 2 (Part 2) of the GridWorld case study</p>
<p><b>Unit 10 (weeks 23, 24, 25)</b></p>
<p><b>Topic and APCS A Topic Outline Correlation - Recursion and Advanced Algorithms</b> Selection sort, The Comparable interface, Insertion sort, Mergesort, Recursion, Binary search, Informal comparisons of running times, Exact calculation of statement execution counts</p>
<p><b>Projects and Assessment</b> Knapsack, Simple applications to reinforce concepts, Critical Thinking, Test 10</p>
<p><b>Resources and Supporting Materials (Text Workbook projects)</b> Text, Flash Movie Files sorting and searching animations</p>
<p><b>Unit 11 (weeks 26, 27, 28)</b></p>
<p><b>Topic and APCS A Topic Outline Correlation - GridWorld case study</b> Chapters 3 and 4 (Parts 3 and 4) of the GridWorld case study</p>
<p><b>Weeks 29, 30</b></p>
<p><b>Topic and APCS A Topic Outline Correlation- Exam preparation</b> Sample multiple-choice questions and free-response questions</p>
<p><b>Unit 12 (weeks 31, 32)</b></p>
<p><b>Topic and APCS A Topic Outline Correlation - Files and Exception Handling</b> Files, Handling exceptions with try-catch-finally, File streams, Processing numeric data, Object serialization</p>
<p><b>Projects and Assessment</b> WordCount, MadLib, HTMLViewer, WordGuess, MySavings, Life, Simple applications to reinforce concepts, LocalBank2 Case Study, Modify existing LocalBanks2 code, Critical Thinking, Test 12</p>
<p><b>Resources and Supporting Materials (Text Workbook projects)</b> Text</p>
<p><b>Unit 13 (weeks 33, 34)</b></p>
<p><b>Topic and APCS A Topic Outline Correlation - GUIs and Event-Driven Programming</b> Graphical user interfaces, The Swing Package, Event-driven applications, GUI layout and controls, Nested classes</p>
<p><b>Projects and Assessment</b> PhotoAlbum, Clacker, LifeGUI, Simple applications to reinforce concepts, BreakAPlate Case Study, Critical Thinking, Test 13</p>
<p><b>Resources and Supporting Materials (Text Workbook projects)</b> Text, Dialog Boxes, GUI components, additional listeners</p>
<p><b>Unit 14 (week 35)</b></p>
<p><b>Topic and APCS A Topic Outline Correlation- Data Structures</b> Stacks, Queues Linked lists</p>
<p><b>Projects and Assessment</b> ParentChecker, Stats, DoublyLinkedList, Simple applications to reinforce concepts, Critical Thinking, Test 14</p>
<p><b>Resources and Supporting Materials (Text Workbook projects)</b> Text</p>