

AP COMPUTER SCIENCE **A** SYLLABUS

Course Overview

AP Computer Science A is an introductory programming course. No previous computer experience is necessary to succeed in this course. Besides covering the skills necessary to program in an object oriented environment, this course teaches how to write good software using good programming skills, and prepares students to take the AP Computer Science A Exam.

Class Profile

AP Computer Science I - Classes meet five (5) days a week for 50 minutes each day. The computer lab is open for all students before school and after school.

Student Evaluation

Grading breakdown:

| | |
|----------------------------|-------|
| Daily homework | – 20% |
| lab assignments | – 20% |
| quizzes | –20% |
| Programming projects/tests | – 40% |

Major Texts

- Lambert, Kenneth, Martin Osborne. Fundamentals of Java. Thomson Course Technology. 2003.

Resource Materials

- Schram, Leon. Exposure Java, John L. Schram, Royse City, TX , 2008.
- Bergin, Joseph, Mark Stehlik, Jim Toberts, and Richard Pattis. A Gentle Introduction to the Art of Object
- Oriented Programming in Java. Dream Songs Press, 2005.
- The College Board's Grid World Case Study Manual.
- Schram, Leon. Multiple Choice and Free Response Questions in Preparation for the AP
- Computer Science Exam. Fifth Edition. Brooklyn, New York, D&S Marketing Systems, Inc., 2006.
- Teukolsky, R., Barron's How to Prepare for the AP Computer Science Exam. Second Edition.
- Hauppauge, NY, Barron's Educational Series Inc, 2003
- Springer, A. , Barron's AP Computer Science, 2007-2008, Third Edition. Hauppauge, NY,
- Barron's Educational Series Inc, 2006
- Dale, Nell, Daniel Joyce, Chip Weems. Object-Oriented Data Structures Using Java. Jones and Bartlett Publishers. 2002

First Six Weeks

Computer Systems and Java Basics

Topics: Java basics, using the compiler, output, History of Computers,

hardware, and software

Objectives:

- Students will understand terminology: compiler, IDE, JVM
- Students will understand how to edit, compile and run a simple program in Java
- Students will understand the different compile time errors, run time errors, and logic errors
- Students will understand the relationship between hardware and software
- Students will define various types of software: operating systems, applications, etc
- Students will identify basic computer hardware and explain what it does.
- Students will explore the binary, hexadecimal, and octal number systems: convert between bases and do simple arithmetic
- Students will describe how computers are connected together in networks to share information.
- Students will understand the importance of responsible use of the internet and the World Wide Web.

Assessments:

Labs: Copy Java programs that contain basic elements to practice using the editor, compiling, debugging, and executing.

Resources:

Textbook Chapter 1 – Exercises and programming projects

First Java Programs

Topics: Java basics including output using print and println, tracing programs, declaring variables and constants, assignment statements, math in Java.

Objectives:

- Students will understand how to use output with System.out and how to format their output using print and println
- Students will understand terminology: comments, variables, constants, reserved words, literals
- Students will understand how to declare, initialize, and use variables, constants, and objects in Java.
- Students will understand mathematical expressions in Java and their precedence
- Students will understand how to use casting to make their data more accurate
- Students will understand how to use the assignment operator correctly

Assessments:

Labs: Triangle, Rectangle, Square: Area, & perimeter program, cash register receipt, slope, distance formula, Pythagorean Theorem

Resources:

Textbook

Java software Solutions Chapter 1 – Exercises and programming projects

Exposure Java 2008

Second Six Weeks

Introduction to Object Oriented Programming

Topics: Introduce basic OOPS terminology using Math class, use Math class methods, classes, class methods, random numbers

Objectives:

- Students will understand and use the Math class.
- Students will be able to call a class method
- Students will be able trace and write user declared class methods.
- Students will be able to use static in reference to class variables.
- Students will be able to generate random numbers in a range.

Assessments:

Labs: Triangle, Rectangle, Square: Area, & perimeter program, cash register receipt, slope, distance formula, Pythagorean Theorem

Resources:

Textbook

Java software Solutions Chapter 1 – Exercises and programming projects

Exposure Java 2008

More Practice with Class Method and Input

Topics: using and understanding variables, comments, arithmetic expressions in Java programs, input, primitive data types and objects

- Students will understand how to use input using KeyboardReader
- Students will write more complex programs
- Students will debug more complex programs

Assessments:

Labs:

Area, volume, surface area, distance, slope

Resources:

Textbook

Java software Solutions chapter 2

Exposure Java 2008

Third Six Weeks

Conditionals and looping

Topics: if, if-else, extended if, switch, while, for, do-while, relational and conditional operators

Objectives:

- Students will understand terminology: control statements, counter, infinite loop, iteration, nested loops, logical operators, truth tables
- Students will understand basic program development steps.
- Students will understand how to construct a syntactically correct loop and conditional statement
- Students will understand the different errors that may occur when they use loops
- Students will understand how to use logical operators to make their programs more robust
- Students will understand how to construct truth tables
- Students will understand short circuit analysis
- Students will recognize deMorgan's law.

Assessments:

Labs:

Guess my number game, Euclidean algorithm program

Perimeter and area of rectangles using all combinations of certain range

Factors, Prime Numbers, GCF, Average

Birthday Program

Perfect/abundant/deficient Numbers Program

Estimate Pi

Resources:

Textbook

Java Software Solutions – Chapter 3, Exposure Java 2008– Chapter 10

Fourth Six Weeks

Introduction to classes and OOPs

Topics: Creating and using classes

Objectives:

- Students will understand terminology: constructor, accessor, mutator,
- instance variable, encapsulation, overloading, is-a, and has-a relationships, and more.
- Students will understand the difference between public and private access in a class.
- Students will be able to write their own classes from scratch.
- Students will define formal interfaces and their class implementations.
- Students will understand when to use the static modifier
- Students will understand passing object references as parameters

Assessments:

Labs: Student class, Patient class, Geometry class, Purse class, StampMachine class, Food Item Class, Car Class

Resources:

Textbook

Java Software Solutions - Chapter 4 and 5

The String class

Topics: Using and understanding methods from String class.

Objectives:

- Students will know how to instantiate String objects
- Students will understand that Strings are immutable
- Students will use appropriate String methods to solve problems (substring, length, replace, charAt, indexOf, etc)
- Students will understand String concatenation
- Students will be able to convert Strings using valueOf
- Students will be able to compare Strings

Assessments:

Labs:

LineEditor Class from AP sample free response (page 67)

Vertical letter output

Palindrome

Resources:

Textbook

Java Software Solutions Chapter 2, APlus – Unit 4

Exposure Java 2008

ArrayList

Topics: Using ArrayList class

Objectives:

- Students will understand how to use the ArrayList methods. (add, set remove, get clear, indexOf, size, isEmpty, contains)

Assessments:

AP Central: Free-response problems: WordList (2004 A 1)

http://apcentral.collegeboard.com/repository/ap04_frq_compsci_a_35988.pdf

Animal Class

Pump Class

Resources:

Java Software Solutions Chapter 6, APlus – Unit 21

Exposure Java 2008 – Chapter 20

Fifth Six Weeks

Arrays

Topics: declaring and initializing arrays, manipulate arrays with loops, create

parallel arrays, traverse arrays

Objectives:

- Students will understand terminology: array, element, index, logical size, physical size, parallel array
- Students will understand how to declare one dimensional arrays in Java
- Students will understand how to use initializer lists when they declare arrays
- Students will understand how to manipulate arrays using loops and array indices.
- Students will understand how to use the physical and logical size of an array together to guarantee they do not get out of bounds of their array
- Students will understand how parallel arrays can be useful when processing certain types of data.
- Students will understand how to work with arrays of simple data types as well as arrays of objects
- Students will understand how array and array elements are passed as parameters

Assessments:**Labs:**

For one-dimensional arrays, have them read in numbers and place them in either an even, odd, and/or a negative list depending on the number.

Mean, median, and mode

Create histograms

Matrices

Resources:

Java Software Solutions Chapter 6, APlus – Unit 14

Exposure Java 2008 – Chap 20

Searching and Sorting Arrays

Topics: Bubble, Selection, Insertion sorts and Sequential and Binary searches

Objectives:

- Students will understand how to write a method for searching an array.
- Students will understand how to perform insertions and deletions at given positions in arrays.
- Students will understand how to trace through sorting and searching algorithms
- Students will understand the algorithms behind each of the following searching and sorting techniques: bubble, selection, insertion, sequential search and binary search
- Students will understand the efficiency of each sort and search and when it is desirable to use each one.

Assessments:

Students can make their own “utility” class that includes all of these sorts and searches in it. Assign a program that will have them take in a fair amount of data and then illustrate each of their searches working. It is also beneficial to have the use their searches to find some data, once when the list is unsorted and then again on a sorted list. Have them output each comparison of the data in a search so they can see how many comparisons it will take to complete each search.

Resources:

Java Software Solutions Chapter 6

GridWorld (Chapters 1-4)

Topics: Experimenting with a large program, using classes,
modifying classes

Objectives:

- Students will run the case study and analyze output.
- Students will experiment with the Simulation.
- Students will understand the Location, Actor, Bug, Rock Class, and Grid Interface
- Students will be able to create new types of Actors.

Assessments:

Exercises and analysis from chapters 1 – 4 in the GridWorld

Case Study

Resources:

GridWorld Case Study – apcentral.collegeboard.com

Sixth Six Weeks

More on classes, inheritance, interfaces

Topics: Classes, inheritance, abstract classes, interfaces

Objectives:

- Students will understand inheritance by extending a class.
- Students will be able to add and modify methods in child classes
- Students will understand polymorphism and know when it is appropriate to override methods in a superclass.
- Students will be able to create and use an abstract class.
- Students will be able to create and implement an interface.

Assessments:

Create an abstract Shape class

AP Central: Free-response problems: Pet Parade (2004 A 2)

http://apcentral.collegeboard.com/repository/ap04_frq_compsci_a_35988.pdf

Java Software Solutions – Projects 7.1, 7.4

Resources:

Textbook

Exposure Java 2008

Java Software Solutions – Chapter 7

Recursion (and the Merge Sort)

Topics: Recursion and Merge Sort

Objectives:

- Students will create a recursive method to solve a problem.
- Students will understand the difference between recursive and iterative solutions to a problem.
- Students will understand and use the Merge Sort.
- Students will explain when recursion should and should not be used

Assessments:

Factorial program

Re-write loop programs with recursion

Resources:

Textbook

Java Software Solutions – Chapter 8

Exposure Java 2008

AP Exam Review

Topics: Review AP Computer Science A topics

Objectives:

- Students will prepare for the AP CS A exam by reviewing material and taking practice exams.

Assessments:

Practice exams

Free Response questions

Resources:

Previous free response questions from apcentral.collegeboard.com

Barron's How to Prepare for the AP Computer Science Java Version

Multiple Choice and Free Response Questions