

AP[®] Computer Science A

Syllabus

Overview of AP[®] Computer Science A

Texts

GridWorld Case Study. The College Board, 2006.

Litvin, Maria and Litvin, Gary. *Java Methods A & AB: Object Oriented Programming and Data Structures*. Skylight Publishing, 2006.

<http://www.skylight.com>

AP Computer Science “A” – Java

Course Objectives:

- Understand the main principles of object-oriented software design and programming
- Learn to code fluently in Java in a well-structured fashion and in good style; learn to pay attention to code clarity and documentation
- Learn to use Java library packages and classes within the scope of the AP/A Java subset
- Understand the concept of an algorithm; implement algorithms in Java using conditional and iterative control structures and recursion
- Learn common sorting and searching algorithms: Sequential Search and Binary Search, and Selection Sort, Insertion Sort, and Mergesort
- Understand one- and two-dimensional arrays and the `ArrayList` class
- Acquire skills in designing object-oriented software solutions to problems from various application areas
- Study the *GridWorld* case study and accompanying exercises and questions provided by The College Board
- Discuss ethical and social issues related to the use of computers
- Prepare for the A-level AP exam in computer science.

Teaching Strategies:

The course is taught in a manner which embodies the ideals behind the creation of AP courses. Students are encouraged to explore and discover concepts beyond the basic objectives of the course. Students are given projects which can be enhanced and developed to any extent the student pleases past the scope of the teacher’s requirements. Therefore, the course provides students of any ability a rewarding experience. Exceptional students will be challenged and non-traditional computer science students

will be afforded the opportunity to learn abstract concepts in an applied setting. Spiral learning is integrated into the program by assigning students applications which require the use of any previously learned skills. There is a general time line for each chapter but many of the concepts are applied through out the entirety of the course. Each topic is presented in a similar format. Students will preview the material through reading their text and outlining important content. Each topic will include a teacher directed coding sample similar to their assignment related topic. Each chapter of their text has exercises which will be teacher selected and assigned. Each chapter will also have labs which will be longer in nature than the sort exercises of the text. Many of the labs will be coded and then modified through out the course. Students will complete individual learning labs and be apart of cooperative work groups. The “GridWorld” case study will be dissected and applied through-out the entire course. Students will become familiar with the libraries and objects as the course progresses. The “black box” approach will be used through-out the entirety of the course. The fundamental theme for the entire course is to understand how objects communicate with each other. Many assignments will deal with multiple classes which will inherently help in their understanding of the case study. The course is taught in a lab setting where students can program on a daily basis which is necessary for the development of advanced programming skills. Every topic or chapter will have a written exam. Exams may consist of multiple choice, true or false, short answer or writing code by hand. The ultimate goal of the course is preparation for the Computer Science A-level exam. However the course is not considered to be complete at the time of the AP exam. After the AP exam, students will program a major project which will represent the accumulation of their skills

Syllabus- General Time Line

<i>General Topic</i>	<i>Chapter</i>	<i>Week of School Year</i>
Intro to Java	1,2,3,4,5	1-5
Data Types, Calculations	6	6-7
Decisions and Conditions	7	8-9
Iterative Statements	8	10-12
Implementing Classes	9	1-Final Exam
Strings	10	18-22
Class Hierarchies	11	18-22
Arrays and Array List	12	13-18
Searching and Sorting	13	19-22
Graphics	15	8-Final Exam
GUI Components	16	1-Final Exam
Images	17	8-Final Exam
“GridWorld” Case Study		11-15,24-27
Review		28-30
Final Project		31- Final Exam

Course Organization: Organized by topics

Topic: Introducing Java Chapters: 1, 2, 3, 4, 5

Course Planner: C4, C5, C6, C8 (see Appendix)

Objectives:

- Hardware Overview
- Software design overview
- Representation of Information in Computer Memory
- Recognizing the strengths of the Java programming language
- Understanding the uses of Java for applets and applications
- Use the import statement to incorporated Java Packages
- Classes and objects
- Creating the Applet Class
- Using comments to document code
- Declare and add components to an interface
- Running and Applet
- Locate and correct errors in Java applet.
- Planning a project
- Properties of Algorithms
- Iterations
- Recursion

Assignments/Labs

Outline Chapters 1, 2, 3, 4, 5

Selected exercises from each chapter- text provided problems

Hello-World

Mailing Label Program

Organizing components in a grid Layout

Topic: Data Types, Variables and Constants Chapter: 6

Course Planner: C6, C8

Objectives:

- Reserved Words
- Declaring Fields and Local Variables
- Primitive Data Types
- Scope of Variables
- Assignment Operators
- Use multiple forms of constructors
- Add buttons and text fields to an interface
- Use variables to store information
- Input data into a text field
- Display multiple lines of output in a text Area

- Capture user actions with a listener
- Add event handling for a button and a text field

Assignments/Labs

Outline Chapter 6

Selected exercises from chapter 6- text provided problems

Payroll Applet

Body Mass Index

Car Rental

Topic: Performing Calculations Chapter: 6

Course Planner: C6, C8

Objectives:

- Perform calculations using the arithmetic operators
- Calculate and assign the result using assignment operators
- Add and subtract using the increment and decrement operators
- Perform multiple calculations correctly based on the precedence of operators
- Braces and blocks
- Retrieve string data from the screen and convert to numeric for calculations
- Convert between data types both implicitly and explicitly
- Format output
- Catch input and calculation errors by using exception handling.
- Declare variables based on the numeric wrapper classes and perform operations using the methods of the classes

Assignments/Labs

Selected exercises from chapter 6- text provided problems

Payroll Applet

Body Mass Index

Car Rental

Book Sales Program

Leap Year Program

Test Score Program

Topic: Creating Classes, OOP Concepts and Design Chapters: 3, 11

Course Planner: C6, C8

Objectives:

- Understand more thoroughly the characteristics of object-oriented programming
- Know when to appropriately use public and private variables and methods
- Creating Classes
- Writing Methods that return values and accept input values
- Inheritance and class hierarchies
- Encapsulation and Information Hiding

- Polymorphism

Assignments/Labs

Outline Chapters 3, 11

Selected exercises from each chapter- text provided problems

Payroll Applet

Body Mass Index

Car Rental

Book Sales Program

Leap Year Program

Interest Applet /Lab

Test Score Program

T-Shirt program

Dice program

Topic: Decisions and Conditions Chapter: 7

Course Planner: C5

Objectives:

- Use if-else statements to control the flow of logic
- Boolean Expressions
- Understand and use nested ifs
- Evaluate conditions using the relational operators
- Combine conditions using the logical operators
- Perform validation on numeric fields
- Understand the precedence and relationship of assignment, arithmetic, logical and relational operators.
- Short-Circuit Evaluation
- Switch statement

Assignments/Labs

Outline Chapter 7

Selected exercises from chapter 7- text provided problems

Truth Table Assignment

Dice program

Craps Program

N! Program

Topic: Iterative Statements Chapter: 8

Course Planner: C4, C5

Objectives:

- Create program loops using do, while, and for statements
- Use the increment and decrement operators
- Break and return in loops
- Detect and correct common errors with iterative statements

- Creating task controlled loops
- Nested loops
- Preventing infinite loops
- Logic errors in loops

Assignments/Labs

Outline Chapter 8

Selected exercises from chapter 8- text provided problems

T-Shirt program

Dice program

Craps Program

N! Program

Shapes Program

Topic: Arrays and ArrayLists Chapter: 12

Course Planner: C3, C4, C5, C6

Objectives:

- One-dimensional arrays
- Establish an array of variables and refer to individual elements in the array with variable subscripts
- Use a “for” loop to step through an array.
- Use a loop to look up a matching value in an array.
- Accumulate totals using array elements.
- Store data in multi-dimensional arrays.
- Create and use an array of objects
- The ArrayList Class
- ArrayList’s Constructors and Methods

Assignments/Labs

Outline Chapter 12

Selected exercises from chapter 12- text provided problems

Histogram with test scores

Test Score Program re-done with Arrays

Aquarium Simulation 1-D

Tic-Tac-Toe 2-D

Aquarium Simulation 2-D

Knight’s Tour

String Program using string methods

Black Jack

Chess

Topic: Searching, Sorting and other Array algorithms

Chapter: 13

Course Planner: C3, C4, C5, C6

Objectives:

- Sequential and Binary Search
- Inserting a new element into an array
- Selection sort
- Insertion sort
- Mergesort

Assignments/Labs

Outline Chapter 13

Selected exercises from chapter 13- text provided problems

Palindrome sort

Fruit and vegetable merge and sort

Mailing Label Sort

Topic: Multimedia in Java Chapter: 15

Course Planner: C3, C6

Objectives:

- Load an image file into a project
- Create animation using multiple images and moving images
- Paint, paintComponent, repaint
- Coordinates
- Colors
- Drawing Shapes
- Keyboard Events

Assignments/Labs

Outline Chapter 15

Selected exercises from chapter 15- text provided problems

Slot Machine

Aquarium Simulation

Chess

Ball Bounce

Tank

Final Project Video Game

Topic: Interfaces Chapter: 11

Course Planner: C3, C4, C5

Objectives:

- Using interfaces
- Intercommunicating Object
- Inheritance

- Creating interfaces

Assignments/Labs

Outline Chapter 11

Selected exercises from chapter 11- text provided problems

GridWorld case study

Bouncing Ball Program

Topic: “GridWorld” Case Study Chapters: 9, 10, 11, 13, 14

Course Planner: C3, C4, C5, C7, C9

Objectives:

- Part 1 of GridWorld Case Study
- Creating projects and running the GridWorld Case Study
- Black-box testing
- Part 2 of GridWorld Case Study
- Intercommunicating objects
- Inheritance
- Interfaces (Comparable, Locatable) and Abstract classes
- Array basics
- Data structure design and selection

Assignments/Labs

Exercise sets in Part 1 of the GridWorld Case Study

Exercise sets in Part 2 of the GridWorld Case Study

Exercise sets in Parts 3 and 4 of the GridWorld Case Study

Selected labs for GridWorld

Appendix A Course Planner

C2— The course includes all of the topics listed in the “Computer Science A” column of the Topic Outline in the AP Computer Science Course Description

C3— The course teaches students to design and implement computer-based solutions to problems in a variety of application areas.

C4— The course teaches students to use and implement commonly used algorithms and data structures.

C5— The course teaches students to develop and select appropriate algorithms and data structures to solve problems.

C6 - The course teaches students to code fluently in an object-oriented paradigm using the programming language Java. The course teaches students to use standard Java library classes from the AP Java subset delineated in Appendices A and B of the *AP Computer Science Course Description*. (Note: Students who study a language other than Java in AP Computer Science must also be taught to use Java, as specified in the AP Java subset.)

C7— The course teaches students to read and understand a large program consisting of several classes and interacting objects, and enables students to read and understand the current *AP Computer Science Case Study* posted on AP Central®.

C8— The course teaches students to identify the major hardware and software components of a computer system, their relationship to one another, and the roles of these components within the system.

C9— The course teaches students to recognize the ethical and social implications of computer use.