Computer Science A: AP Java Programming

Class Syllabus

COURSE DESCRIPTION:

The major emphasis of this course is to teach the students object-oriented development and coding. At the same time the students will be given an overall understanding of the entire software development process.

At all times the student will be challenged to look at what they are doing from the customer perspective. A software solution only has worth if it solves the customer's challenge. Therefore selection of objects, classes, methods, algorithms, etc. have to make sense not only in the fact that the code works, but issues such as:

- Testing
- Reuse
- Maintenance
- Budget
- Efficiency
- Error Handling
- Intuitiveness of the Customer Interface
- Programmer skill set

and other issues are discussed and debated. One of the biggest challenges young programmers have is that they have not been taught the overall "big picture" of software development. It is not just coding their one little piece, but it is solving the customer's challenge. This course will show them how the modern object-oriented language, Java, can be used to solve the real-life challenges happening in the business world today.

COMPUTER FACILITIES:

The computer lab is our classroom. Students will have access to a computer at all times during the course. Students will also have the ability to work during lunch and after school.

TEXTS:

College Board. *AP GridWorld Case Study.* New York College Entrance Examination Board, 2006.

Lambert and Osborne. *Fundamentals of Java: Comprehensive*, Second Edition, Boston, MA: Thomson Course Technology 2003.

COURSE PLANNER: [C2]

Week	Topic	Programming Projects (Lambert &Osborne Text)	Tests / Large-Scale Projects
1	• History of Computers • Hardware & Software • Programming Languages • Top-down Development • Basics of Object Oriented programming • Why the Java Programming Language? • Representation of Numbers in different bases • Limitations of finite representations • Console Output (System.out.print/println)	• p. 25: Hardware & software components of a computer system • Law & Ethics • Languages and Networks • p. 30: 1st program – "Hello World"	**[C8]** **[C9]**
2	• Simple Data Types • Variable Declarations • Constant Declarations • Methods • Parameter declarations • Basic Java Syntax • Procedural Abstraction • Ethics - Hacking	• p. 38: "Temperature Converter" • p. 88: Project 3.2 – "All about a sphere"	**Test 1** Major Topics * Basic I/O * HW & SW * Java * Code Edit, Compile, Execution **[C4] [C5] [C6]**
3	• From customer challenge to software delivery • Compile-time, run-time, & logic errors • Identify and correct errors • Debugging techniques • Ethics - Viruses	• p. 72: CS1 – "Income Tax Calculator" • p. 88: Project 3.5 – "Employee Pay"	**Test 2** Major Topics * Language Elements * Syntax & Semantics * Errors * Debugging
4	• Standard Classes and Methods • Class declarations • Control – If Then/Else • Control – While • Control – For • Testing control statements	• p. 112: CS2 – "The Folly of Gambling" • p. 123: Project 4.3 – "Telephone Calling Card" • p. 124: Project 4.8 – "Teacher Salary Schedule"	
5	• Defining classes • Design &	• p. 146: CS3 – "Student Test	**Test 3** Major Topics * Standard

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

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.

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 Appendixes A and B of the *AP Computer Sciences Course Description*.

	Implementation of classes • Functional Decomposition • Encapsulation & Information Hiding • Interface declarations • Primitive types, reference types, and objects • Formal & Actual Parameters • Scope & Lifetime	Scores" • p. 167: Project 5.2 – "Validate Student Data"	classes * Control Statements **[C6]**
6	• Testing Classes • Logical Operators	• p. 161: CS4 – "Smiling Faces" • p. 168: Project 5.5 – "The Car"	**Test 4** <u>Major Topics</u> * User-defined classes * Variables * Graphics
7	• Quality Assurance • Boundary Conditions • Switch statement (p. B-4) • Errors in If statements • Integration Testing	• p. 176: CS5 – "Compute weekly pay" • p. 184: Artificial Intelligence, Robots, and Softbots • p. 200: Project 6.1 – "Guessing Numbers"	**Test 5** <u>Major Topics</u> * Logical Operators * Multiple **If** statements * Nested Loops
8	• User Interface (terminal & graphic) • Java library classes	• p. 195: CS6 – "Fibonacci Numbers" • p. 226: Project 7.3 – "Newton's Square Root Computing"	
9	• Window Objects & Methods • Formatted Output • Applets • Interface Testing	• p. 220: CS7 – "A Sales Table" • p. 227: Project 7.6 – "The Tidbit Computer Store"	**Mid-Term Exam**
10	• Introduction to Arrays	• p. 231: Project U2.2 – "The Game of Craps" • p. 265: Project 8.1 – "Integer Array List"	
11	• Arrays Cont'd • Arrays & Methods • Array Testing	• p. 253: CS8 – "Student Test Scores Again" • p. 266: Projects 8.3 & 8.4 – "Median & Mode"	**[C3]**
12	• Arrays & Objects • Grid World Case Study	• p. 266: Project 8.6 – "The Remarkable Square" • Grid World Overview	

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

13	• Grid World Case Study • Static Variables and Methods • Java Interfaces • Code reuse through inheritance • Class Hierarchy	• Grid World Part 1 • p. 312: Project 9.1 – "The Animal Kingdom"	**Test 6** Major Topics * Arrays
14	• Inheritance and Abstract Classes	• p. 295: CS9 – "Compute Weekly Pay Revisited"	
15	• Error Handling with Classes • Preconditions & Postconditions • Assertions • Exception Handling	• p. 313: Project 9-6: Write an essay on interesting design ideas among Java's classes.	
16	• String operations • Searching (Sequential & Binary) • Sorting (Selection, Insertion, and Merge) • Testing Sort Algorithms • Traversals, Insertions & Removals • Polymorphism • Casting	• p. 344: CS10 – "Student Test Scores Yet Again" • p. 358: Project 10.1 – "Sort the Array" • p. 359: Project 10.8 – "Analyze and Clear"	**Test 7** Major Topics * Java Interfaces * Inheritance * Error Handling * Reference types **[C3] [C4] [C5] [C6]**
17	• Recursion • Complexity Analysis • Binary Search • Quicksort	• p. 389: CS11 – "Comparing Sort Algorithms" • p. 395: Project 11.6 – "Towers of Hanoi"	**Test 8** Major Topics * String Operations * Searching * Sorting
18	• GridWorld Case Study • O-O Analysis & Design • *Is-a, has-a,* and *knows-a* relationships	• GridWorld Part 2 • GridWorld Part 3	**[C7]**
19	• Grid World Case Study	• GridWorld Project 1 – "Design class based on GridWorld Part 3" • GridWorld Part 4	**Test 9** Major Topics * Recursion * Complexity Analysis * Object-Oriented Analysis & Design
20	• Review for AP Exam • Work on Final Projects	• AP Exam • Work on Final Projects	
21	• Final Exam	• Final Exam	**Final Exam**

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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.

Teaching Strategies

With every new topic, I provide the students with a customer challenge. They must describe how they would solve the customer's challenge in words. This provides students who have never been on a computer a less intimidating introduction into

the world of coding. For students who like to start coding before they know how their solution would work, it forces them to slow down and truly explain what they are doing.

I believe in giving examples to the students, so they can get "their feet wet" on some code that works to help alleviate any initial frustration with trying something new. Students who are a little more advanced are able to tweak the examples, while I can spend extra time working with the students who are new to coding. Also, I encourage students who are a little further along to assist their peers in the class. Many times students learn from their peers quicker than they learn from the teacher.

I also separate students into different "business organizations" where they compete against other "businesses" in the class to win the "customer contract." Bonuses are provided for the winning organization. This promotes collaboration, leadership, in-class learning, and competition.