Fair Lawn
Public Schools
Fair Lawn, NJ

AP Computer Science

Adopted August

2015

Revised August 2015
Developed August 2012

The Advanced Placement Computer Science course has been designed for the student who has completed Visual Computer Programming and met the prerequisite of B- or higher.

AP Computer Science

Fair Lawn School District

Committee Credits
AP Computer Science Team

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AP Computer Science

I. Course Synopsis

AP Computer Science is a college level course that asks the student to design programs that are understandable, adaptable, and where appropriate, reusable. Students will write their own classes, modify existing classes and develop algorithms using standard data structures.

Throughout the course, mathematical concepts will be reinforced with an emphasis on enduring understandings, essential questions, real-world application, technology, and cross-curricular interaction.

II. Philosophy & Rationale

The purpose of the AP Computer Science course is to help students develop and enhance programming abilities, and to prepare to take the AP Computer Science exam. Students should be able to reason logically and apply programming skills to real-world activities.

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies" with longstanding importance in mathematics education. The first of these are the NCTM process standards of problem solving, reasoning and proof, communication, representation, and connections. The second are the strands of mathematical proficiency specified in the National Research Council's report Adding It Up: adaptive reasoning, strategic competence, conceptual understanding (comprehension of mathematical concepts, operations and relations), procedural fluency (skill in carrying out procedures flexibly, accurately, efficiently and appropriately), and productive disposition (habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy).

CCSS.MATH.PRACTICE.MP1 - Make sense of problems and persevere in solving them.
Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically

proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

CCSS.MATH.PRACTICE.MP2 - Reason abstractly and quantitatively.
Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to *decontextualize*—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to *contextualize*, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

CCSS.MATH.PRACTICE.MP3 - Construct viable arguments and critique the reasoning of others.
Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

CCSS.MATH.PRACTICE.MP4 - Model with mathematics.
Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify

important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

CCSS.MATH.PRACTICE.MP5 - Use appropriate tools strategically.
Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

CCSS.MATH.PRACTICE.MP6 - Attend to precision.
Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

CCSS.MATH.PRACTICE.MP7 - Look for and make use of structure.
Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7×8 equals the well-remembered $7 \times 5 + 7 \times 3$, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$, older students can see the 14 as 2×7 and the 9 as $2 + 7$. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 - 3(x - y)^2$ as 5 minus a positive number times a

square and use that to realize that its value cannot be more than 5 for any real numbers x and y.

CCSS.MATH.PRACTICE.MP8 - Look for and express regularity in repeated reasoning.
Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation $(y - 2)/(x - 1) = 3$. Noticing the regularity in the way terms cancel when expanding $(x - 1)(x + 1)$, $(x - 1)(x^2 + x + 1)$, and $(x - 1)(x^3 + x2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results

III. Scope & Sequence

Unit 1: Introduction to Eclipse and Java Basics (6 Weeks):

Review of basic programming concepts
Introduction to the Eclipse IDE
Proper format for submitting code
Number bases – 2, 8, 10 and 16
Declaring and using variables of type int, double, char and boolean
Arithmetic operators + - * / ++ -- %
Casting
Documentation including Javadoc
Categories of error messages including exceptions
Math class methods pow, abs, random, sqrt
Conditionals – if/else
Relational operators
Logical operators
Loops – while and for excluding for/each
Break and continue
Escape sequences
Lab assignments – labs include: Coins, Driving, 10000 Sum, Prime Factors

Unit 2: Classes (6 Weeks):

Static methods
Introduction to classes and objects
The Java String class – including methods substring, length, indexOf, compareTo, equals, charAt, and concatenation
String class labs – Palindrome, Letter Removal, Double Letter, Pig Latin, AcslVowels, DuplicateLetter
Creating your own class
Writing your own methods – method header, signature, return type, parameters
Constructors, accessor and mutator methods
Scope of a variable
Static and class variables
Lab assignments – Stapler, Marker, circle, Rational, BankAcct, Dates, Object, Integer and Double classes, and adaptations of previous labs using static methods

Unit 3: Arrays and the ArrayList Class (6 Weeks):

Single and double arrays and their use
Declaring and using an array
Array vs. ArrayList and the List interface
Introduction to analysis of algorithms using the methods of the ArrayList class
ArrayList methods – size, add, get, set, remove
Lab assignments – Poker, TelLocs, Flights, Expand, Life, CalculateModes as Well as additional labs requiring students to write their own interface
Sorting and searching – the linear and binary searches, the selection, insertion and merge sorts
Additional analysis of algorithms using the required sort routines as well as others that are not required
The for/each loop

Unit 4: Recursion (2 Weeks):

Explanation of the concept of recursion using mathematical examples
Tracing through recursive methods
Tower of Hanoi
Lab assignments – EraseObject, WriteWithCommas, ColorScreen
Analysis of recursive algorithms

Unit 5: Inheritance and Polymorphism and Abstract Classes (4 Weeks):

Definition of the concepts
Extending a class
Define hierarchy, "is-a" and "has-a" relationships
Overriding methods
Writing an abstract class
More on interfaces
Lab assignments – ClosedShapes, Instrument, Animal, Athlete

Unit 6: Computers and Their Appropriate Use and Ethics (1 Week):

Review of hardware and software components
Discussion of the legal, moral and social responsibilities associated with the use of computers

Unit 7: AP Exam Review (5 Weeks):

Writing old AP exam questions
Taking two sample full length exams
Completing problems from the Barrons and Litvin review books

IV. Unit Descriptions

Unit 1: Introduction to Eclipse and Java Basics

Enduring Understanding

1. Coding is a natural extension of the way that we think and plan a solution to a problem.
2. The concept of arithmetic is other number bases is the same as base 10.
3. The appropriate data type, operators, and looping structure must be carefully selected for each program.
4. Proper documentation will allow other programmers to understand and modify our code.
5. Diagnosing errors without teacher assistance is a good way to enhance coding skills.

Essential Question(s)

1. How do we choose the proper data type to use?
2. How do the primitive data types differ from each other?
3. How do you perform operations on the four primitive data types?
4. How do you incorporate repetition into your code?
5. How do you make a decision in your code?

Learning Objectives

Students will be able to:

1. Write properly documented code using the primitive data types and associated arithmetic operators
2. Write code using conditionals, for loops and while loops
3. Diagnose errors including being able to recognize ArithmeticException and IllegalArgumentException
4. Write code that uses break, continue and the escape sequences \" \\ and \n
5. Convert between bases 2, 8, 10, and 16

Common Core Curriculum Standards

- **HSF.LE.A.1** - Distinguish between situations that can be modeled with linear functions and with exponential functions.
- **HSF.LE.A.2** - Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
- **HSF.LE.A.3** - Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.

- **HSF.LE.A.4** - For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.
- **HSF.LE.B.5** - Interpret the parameters in a linear or exponential function in terms of a context.

Suggested Activities/Modifications

All lab assignments can be enhanced and/or modified. For example, the Prime Factors lab, which asks students to determine and print the prime factors of a given number, can be enhanced for gifted and talented students to print the prime factorization of the number as well as a list of all of the factors of the number. The same lab can be modified for at risk students, students with disabilities, and ELL students, to be done in stages. First, simply determine whether one number is a factor of another, and then write a second code segment to simply determine whether a number is prime.

1. Coins Lab
2. Driving Lab
3. 10000 Sum Lab
4. Prime Factors Lab

New Jersey Core Curriculum Standards - Technology

- 8.1.8.A.5 - Select and use appropriate tools and digital resources to accomplish a variety of tasks and to solve problems.
- 8.1.8.E.1 - Gather and analyze findings using data collection technology to produce a possible solution for a content-related or real-world problem.
- 8.2.12.E.1 Demonstrate an understanding of the problem-solving capacity of computers in our world.
- 8.2.12.E.2 Analyze the relationships between internal and external computer components.
- 8.2.12.E.3 Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).
- 8.2.12.E.4 Use appropriate terms in conversation (e.g., troubleshooting, peripherals, diagnostic software, GUI, abstraction, variables, data types and conditional statements).

Career Readiness Practices

- CRP2. Apply appropriate academic and technical skills.
- CRP4. Communicate clearly and effectively and with reason.
- CRP6. Demonstrate creativity and innovation.
- CRP7. Employ valid and reliable research strategies.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP11. Use technology to enhance productivity.

New Jersey Core Curriculum Standards –Career Awareness, Exploration, and Preparation

- See Technology & Career Readiness & 21st Century Skills Standards Curriculum Appendix

Career & Technical Education Content Area: 21st Century Life and Careers Standards

- 9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.
- 9.3.12.ED.1 - Apply communication skills with students, parents and other groups to enhance learning and a commitment to learning.
- 9.3.12.AR.4 Analyze the legal and ethical responsibilities required in the arts, audio/visual technology and communications workplace.
- 9.3.12.AR.5 Describe the career opportunities and means to achieve those opportunities in each of the Arts, A/V Technology & Communications Career Pathways.
- 9.3.12.AR.6 Evaluate technological advancements and tools that are essential to occupations within the Arts, A/V Technology & Communications Career Cluster.

Unit 2: Classes

Enduring Understanding

1. Classes and objects are an essential part of the Java programming experience.
2. The use of classes allows us to represent real world objects.
3. Public and private mean essentially the same as they do in real life – public is accessible, private is not, without going through the proper steps.
4. Breaking up an algorithm into methods allows for easier coding and error diagnosis.

Essential Question(s)

1. Why do we use classes and objects?
2. How do you determine the methods necessary to complete the task?
3. What is the scope of the variables used in the methods and the client code?
4. How do classes interact with each other?

Learning Objectives

Students will be able to:

1. Write code using the Java Sting class and its associated methods.
2. Write a class that includes a default constructor, accessor and mutator methods. Some methods will be public and others will be private
3. Write a class given the associated client code.
4. Write code using the Java Integer and Double classes.
5. Write multiple interacting classes.

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- **HSF.LE.A.4** - For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.
- **HSF.LE.B.5** - Interpret the parameters in a linear or exponential function in terms of a context.

Suggested Activities

All lab assignments can be enhanced and/or modified. For example, the Dates lab, which asks students to determine the date 10000 days after a given date, can be enhanced for gifted and talented students to determine the day of the week a given date fell on. The same lab can be modified for at risk students, students with disabilities, and ELL students, to be done in stages. First, simply determine the next day after a given date – excluding the last day of the month, and then step by step, upgrade to the original problem statement.

1. Stapler Class Lab
2. Marker Class Lab
3. Circle Class Lab
4. Rational Class Lab
5. BankAcct Class Lab
6. Dates Class Lab
7. Integer and Double Class Lab
8. Adaptations of previous labs using static methods

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- 8.2.12.E.1 Demonstrate an understanding of the problem-solving capacity of computers in our world.
- 8.2.12.E.2 Analyze the relationships between internal and external computer components.
- 8.2.12.E.3 Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).
- 8.2.12.E.4 Use appropriate terms in conversation (e.g., troubleshooting, peripherals, diagnostic software, GUI, abstraction, variables, data types and conditional statements).

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Unit 3: Arrays and the ArrayList Class

Enduring Understanding

1. An array and Arraylist differ in significant ways
2. Sorting and searching is a real life task that can be simulated in many different ways using code.
3. The proper choice must be made between data structures.

Essential Question(s)

1. How do we choose between an array and an ArrayList?
2. What differences are there in algorithm analysis when using an array as opposed to an ArrayList?
3. What is the purpose of an interface?
4. How do sort routines differ from one another and why would we choose one over the other?

Learning Objectives

Students will be able to:

1. Write code using single and double arrays.
2. Write code using an ArrayList and its associated methods.

3. Write an interface
4. Demonstrate various sort routines using given sample data.
5. Know the order of each search and sort that has been demonstrated

Common Core Curriculum Standards

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- **HSF.LE.A.3** - Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.
- **HSF.LE.A.4** - For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.
- **HSF.LE.B.5** - Interpret the parameters in a linear or exponential function in terms of a context.

Suggested Activities

All lab assignments can be enhanced and/or modified. For example, the Life lab, which asks students to write code to simulate a living environment, can be enhanced for gifted and talented students to determine an environment of organisms which will never result in the population dying off completely. The same lab can be modified for at risk students, students with disabilities, and ELL students, to be done in stages. The environment can have a border around it, making the processing of the matrix easier.

1. Poker
2. TelLocs and Flights
3. Expand
4. Life
5. CalculateModes

New Jersey Core Curriculum Standards - Technology

- 8.1.8.A.5 - Select and use appropriate tools and digital resources to accomplish a variety of tasks and to solve problems.
- 8.1.8.E.1 - Gather and analyze findings using data collection technology to produce a possible solution for a content-related or real-world problem.
- 8.2.12.E.1 Demonstrate an understanding of the problem-solving capacity of computers in our world.
- 8.2.12.E.2 Analyze the relationships between internal and external computer components.

- 8.2.12.E.3 Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).
- 8.2.12.E.4 Use appropriate terms in conversation (e.g., troubleshooting, peripherals, diagnostic software, GUI, abstraction, variables, data types and conditional statements).

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- 9.3.12.AR.6 Evaluate technological advancements and tools that are essential to occupations within the Arts, A/V Technology & Communications Career Cluster.

Unit 4: Recursion

Enduring Understanding

1. Recursion is a natural way to think of solving a large problem in terms of a smaller version of a smaller problem.
2. Recursive algorithms can greatly simplify some programming problems.
3. There are many classic recursive algorithms that are important to understand.

Essential Question(s)

1. When is recursion appropriate?
2. What happens when a method calls itself in terms of cloning?
3. How can we trace the levels of recursion?

Learning Objectives

Students will be able to:

1. Analyze a recursive algorithm.
2. Analyze recursive code to determine the output.

3. Write code recursively.
4. Solve mathematical examples using recursion.

Common Core Curriculum Standards

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- **HSF.LE.A.2** - Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
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- **HSF.LE.A.4** - For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.
- **HSF.LE.B.5** - Interpret the parameters in a linear or exponential function in terms of a context.

Suggested Activities

All lab assignments can be enhanced and/or modified. For example, EraseObject lab, which asks students to write code to "erase" part of a picture represented by a matrix, , can be enhanced for gifted and talented students to include more than two colors. The same lab can be modified for at risk students, students with disabilities, and ELL students, to be done in stages. Students can be given a skeleton of the code to fill in with the recursive calls.

1. Worksheet of mathematical examples
2. Worksheet to trace recursion in existing code
3. WriteWithCommas
4. ColorScreen
5. EraseObject
6. Tower of Hanoi

New Jersey Core Curriculum Standards - Technology

- 8.1.8.A.5 - Select and use appropriate tools and digital resources to accomplish a variety of tasks and to solve problems.
- 8.1.8.E.1 - Gather and analyze findings using data collection technology to produce a possible solution for a content-related or real-world problem.
- 8.2.12.E.1 Demonstrate an understanding of the problem-solving capacity of computers in our world.
- 8.2.12.E.2 Analyze the relationships between internal and external computer components.
- 8.2.12.E.3 Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).

- 8.2.12.E.4 Use appropriate terms in conversation (e.g., troubleshooting, peripherals, diagnostic software, GUI, abstraction, variables, data types and conditional statements).

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- 9.3.12.AR.6 Evaluate technological advancements and tools that are essential to occupations within the Arts, A/V Technology & Communications Career Cluster.

Unit 5: Inheritance and Polymorphism and Abstract Classes

Enduring Understanding

1. Extending classes is a vital component of object oriented programming.
2. Abstract classes is one viable option when employing inhetitance
3. Late or dynamic binding is essential.
4. The difference between a “has-a” and a “is-a” relationship is key

Essential Question(s)

1. When do we choose to use an abstract class?
2. What is late or dynamic binding?
3. What is the difference between overriding and overloading a method?
4. When do we choose to write an interface as opposed to an abstract class?

Learning Objectives

Students will be able to:

1. Write a complete superclass and multiple subclasses.
2. Trace code that uses multiple subclasses
3. Understand when to use an abstract class.

4. Write a complete abstract class.

Common Core Curriculum Standards

- **HSF.LE.A.1** - Distinguish between situations that can be modeled with linear functions and with exponential functions.
- **HSF.LE.A.2** - Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
- **HSF.LE.A.3** - Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.
- **HSF.LE.A.4** - For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.
- **HSF.LE.B.5** - Interpret the parameters in a linear or exponential function in terms of a context.

Suggested Activities

All lab assignments can be enhanced and/or modified. For example, the ClosedShapes, which asks students to write multiple classes, can be enhanced for gifted and talented students to include more classes, and implement the Comparable interface. The same lab can be modified for at risk students, students with disabilities, and ELL students, to be done in stages, or to include fewer interacting classes.

1. ClosedShapes
2. Instrument
3. Animal
4. Athlete
5. Book

New Jersey Core Curriculum Standards - Technology

- 8.1.8.A.5 - Select and use appropriate tools and digital resources to accomplish a variety of tasks and to solve problems.
- 8.1.8.E.1 - Gather and analyze findings using data collection technology to produce a possible solution for a content-related or real-world problem.
- 8.2.12.E.1 Demonstrate an understanding of the problem-solving capacity of computers in our world.
- 8.2.12.E.2 Analyze the relationships between internal and external computer components.
- 8.2.12.E.3 Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).
- 8.2.12.E.4 Use appropriate terms in conversation (e.g., troubleshooting, peripherals, diagnostic software, GUI, abstraction, variables, data types and conditional statements).

Career Readiness Practices

- CRP2. Apply appropriate academic and technical skills.
- CRP4. Communicate clearly and effectively and with reason.
- CRP6. Demonstrate creativity and innovation.
- CRP7. Employ valid and reliable research strategies.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP11. Use technology to enhance productivity.

New Jersey Core Curriculum Standards –Career Awareness, Exploration, and Preparation

- See Technology & Career Readiness & 21st Century Skills Standards Curriculum Appendix

Career & Technical Education Content Area: 21st Century Life and Careers Standards

- 9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.
- 9.3.12.ED.1 - Apply communication skills with students, parents and other groups to enhance learning and a commitment to learning.
- 9.3.12.AR.4 Analyze the legal and ethical responsibilities required in the arts, audio/visual technology and communications workplace.
- 9.3.12.AR.5 Describe the career opportunities and means to achieve those opportunities in each of the Arts, A/V Technology & Communications Career Pathways.
- 9.3.12.AR.6 Evaluate technological advancements and tools that are essential to occupations within the Arts, A/V Technology & Communications Career Cluster.

Unit 6: Computers and Their Appropriate Use and Ethics

Enduring Understanding

1. As citizens, it is our responsibility to be respectful of the privacy of others, and to not plagiarize or steal the ideas of others.
2. Access to private information must not be misused.
3. Computers are composed of hardware and software, and we must understand the difference.

Essential Question(s)

1. Why is it important to ensure privacy and copyrights?
2. How can we ensure the privacy of information?
3. What is the difference between hardware and software?
4. What are some of the essential hardware components of a computer?

Learning Objectives

Students will be able to:

1. Discuss the importance of privacy and legal implications of breaking privacy laws.
2. Discuss the importance of copyright laws.
3. Describe the various components of a computer.

Common Core Curriculum Standards

- **HSF.LE.A.1** - Distinguish between situations that can be modeled with linear functions and with exponential functions.
- **HSF.LE.A.2** - Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
- **HSF.LE.A.3** - Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.
- **HSF.LE.A.4** - For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where a, c,, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.
- **HSF.LE.B.5** - Interpret the parameters in a linear or exponential function in terms of a context.

Suggested Activities

All lab assignments can be enhanced and/or modified. All readings can be leveled appropriately for gifted and talented, at risk, disabled, and ELL students.

1. Readings on computer ethics and copyright infringement
2. Readings on privacy issues associated with the medical profession
3. Oral presentation on either or both of the above topics
4. Hands on presentation of computer components, including a tour of the display cabinets and the older equipment in them to see how far we have come

New Jersey Core Curriculum Standards - Technology

- 8.1.8.A.5 - Select and use appropriate tools and digital resources to accomplish a variety of tasks and to solve problems.
- 8.1.8.E.1 - Gather and analyze findings using data collection technology to produce a possible solution for a content-related or real-world problem.
- 8.2.12.E.1 Demonstrate an understanding of the problem-solving capacity of computers in our world.
- 8.2.12.E.2 Analyze the relationships between internal and external computer components.
- 8.2.12.E.3 Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).
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Unit 7: AP Exam Review

Enduring Understanding

1. The AP Computer Science exam is a challenging yet doable test.
2. Practice for the test is essential.
3. The skills for solving a programming problem, and answering mmultiple choice questions is very different.

Essential Question(s)

1. How can a student best prepare for the exam?
2. How can knowledge of three-dimensional objects help us understand the world around us?
3. How do I interpret my sample test score?
4. What other resources can I seek out for practice?

Learning Objectives

Students will be able to:

1. Code all old AP free response questions given.
2. Take two sample full length AP exams.
3. Understand the scoring of the test.
4. Describe and draw cross sections that result from slicing three-dimensional figures.

Common Core Curriculum Standards

- **HSF.LE.A.1** - Distinguish between situations that can be modeled with linear functions and with exponential functions.
- **HSF.LE.A.2** - Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
- **HSF.LE.A.3** - Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.
- **HSF.LE.A.4** - For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.
- **HSF.LE.B.5** - Interpret the parameters in a linear or exponential function in terms of a context.

Suggested Activities

All lab assignments can be enhanced and/or modified. For gifted and talented students, additional resources for practice are available. Several of them exceed the expectations of the exam. For at risk students, students with disabilities, and ELL students, there are free response practice problems broken down into parts, and multiple choice questions of all levels, complete with explanations of the answers. There is also a question bank on CD for students who prefer that method over pen and paper.

1. Practice from Barrons review book
2. Practice from Litvin review book
3. Old AP exam free response questions
4. Sample AP exam from the College Board
5. Teacher designed practice materials

New Jersey Core Curriculum Standards - Technology

- 8.1.8.A.5 - Select and use appropriate tools and digital resources to accomplish a variety of tasks and to solve problems.
- 8.1.8.E.1 - Gather and analyze findings using data collection technology to produce a possible solution for a content-related or real-world problem.
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V. Course Materials

Computing Concepts With Java Essentials – Fifth Edition by Cay Horstmann
Computing Concepts With Java Essentials Advanced Placement Study Guide – Fifth Edition by Fran Trees
and Cay Horstmann
Course Outline for AP Computer Science by The College Board
Quick Reference Guide for APCS AB Exam – by the College Board
Be Prepared for the AP Computer Science Exam In Java – Fourth Edition by Maria and Gary Litvin
Barrons AP Computer Science Review – Fifth Edition by Roselyn Teukolsky
Web site for the AP Computer Science Exam at apcentral.collegeboard.org

VI. Assessments

Tests
Oral presentations
Written homework
Class work
Laboratory programming assignments
Midterm exam
Final exam

VII. Cross Curricular Aspects

Programming problems relate to many different real world topics. Students can integrate concepts from science, business, art and any other subject they have an interest in. One of the most recent developments in computer science education is the concept that students should analyze "big ideas" and apply what they have learned to a myriad of topics and subjects.