

POMPTON LAKES SCHOOL DISTRICT

Advanced Placement Computer Science A

COURSE OF STUDY

Submitted by
The Business Department

Dr. Paul Amoroso, *Superintendent*
Mrs. Jayne Tanis, *Director of Curriculum*
Dr. Vincent Przybylinski, *Principal*
Mr. Anthony Mattera, *Vice Principal*

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Board Approved, 4/9/19

Introduction

AP Computer Science is an advanced placement course that introduces the student to the foundations of computer science with a focus on how computing powers the world. This course encourages self-expression by inspiring students to think, analyze, and apply computing to real-world problems. The student will learn to analyze data, create technology that has a practical impact, and gain a broader understanding of how computer science impacts people and society. Computer science is everywhere, from our smartphones and video games to music, medicine, and much more. AP Computer Science can benefit the student by helping them understand how computing and technology influence the world around them, and learn how to creatively address real-world issues while using the same tools and processes that artists, writers, computer scientists, and engineers use to bring ideas to life.

Unit Overview
Content Area: Technology
Unit Title: Unit 1: Introduction to Java Basics
Target Course/Grade Level: AP Computer Science A/Grades 10-12
Unit Summary: This unit reintroduces students to the basics of Java, and gives students practice writing Java programs to solve general problems. The unit will serve as an overview on some of the major themes and topics of study. This unit covers printing, variables, types, as well as how to use the basic control structures in the Java language.
Unit Rationale: Students will uniquely focus on creative problem solving and real-world applications, giving students the opportunity to explore several important topics of computing and using their ideas to problem solve, as well as be creative.
Student Learning Objectives
Students will be able to:
<ol style="list-style-type: none"> 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 Arithmetic Exception and Illegal Argument Exception 4. Write code that uses break, continue and the escape sequences <code>\"</code> <code>\\</code> and <code>\n</code> 5. Convert between bases 2, 8, 10, and 16
Career Readiness Practices
<ul style="list-style-type: none"> • 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.
NJSLS #- New Jersey Student Learning Standards
<ul style="list-style-type: none"> • 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- Understand the inverse relationship between exponents and logarithms. For exponential models, express as a logarithm the solution to $abct = d$ 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.

NJSLS#- New Jersey Student Learning 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 & 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 Essential Questions

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?

Unit Enduring Understandings

1. Coding is a natural extension of the way that we think and plan a solution to a problem.
2. The concept of arithmetic in 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.

Unit Learning Targets

Students will ...

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 Arithmetic Exception and Illegal Argument Exception
4. write code that uses break, continue and the escape sequences \” \\ and \n
5. convert between bases 2, 8, 10, and 16

Evidence of Learning

The content will be a mix of web-based and physical activities. Students will write and run code in the browser, create digital artifacts and engage in in-person collaborative exercises with classmates. Utilizing video, quizzes, example programs to explore written reinforcement exercises, and free response exercises, students will use the power of computing to create and develop an interest in computer science that will build upon each lesson completed. Through summative assessments, students will learn about the concepts and topics presented in this unit. Assessments will be given in various forms (i.e., tests, quizzes, worksheets, discussions).

Formative Assessments

- Quizzes
- Discussions
- Individual practice
- Explanation of examples
- Daily homework assignments
- Notes

Benchmark Assessments

- CodeHS tests
- Teacher created paper tests
- Required programming projects

Alternative Assessments

- Supplemental programming projects

Summative Assessments

- Amusement Park
- Strings

Lesson Plans

Lesson	Timeframe
Lesson 1 Basic Java (Introduction/Overview) Printing	4 days (class instructional time during 40-minute classes)
Lesson 2 Variables and Types	4 days (class instructional time during 40-minute classes)
Lesson 3 Input/Output Errors	5 days (class instructional time during 40-minute classes)
Lesson 4 Arithmetic Expressions (Booleans and Logical Operators)	5 days (class instructional time during 40-minute classes)
Lesson 5 Control Structures Loops (for, while) Conditional statements (if) Nested control structures	6 days (class instructional time during 40-minute classes)

Errors and debugging	
Lesson 6 Functions Return Values Top-Down Design Comments	6 days (class instructional time during 40-minute classes)
Lesson 7 Short-circuit Evaluation DeMorgan's Law Strings	4 days (class instructional time during 40-minute classes)
<p>Teacher Notes: Supplemental materials will be utilized for reinforcement of topics presented, using real-world examples for students. 1.) 26 days allocated for Basic Java</p>	
<p>Curriculum Development Resources <i>Online content, video tutorials, utilization of blended classroom approach, blending a mixture of content via web-based and physical activities. Reinforcement through projects, quizzes and tests.</i></p>	
<p>Unit Overview</p>	
<p>Content Area: Technology</p>	
<p>Unit Title: Unit 2: Classes & Object-Oriented Programming</p>	
<p>Target Course/Grade Level: AP Computer Science A/Grades 10-12</p>	
<p>Unit Summary: This unit teaches students the basics of Object-Oriented Programming in Java, which is a powerful programming paradigm. Students will learn how objects store data and interact with each other in Java programs. Students will design and implement classes and extend classes using inheritance.</p>	
<p>Unit Rationale: Students be introduced to classes and objects, as well as writing classes, class methods and class variables.</p>	
<p>Student Learning Objectives</p>	
<p>Students will be able to:</p>	
<ol style="list-style-type: none"> 1. Write code using the Java String 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. 	
<p>Career Readiness Practices</p>	
<ul style="list-style-type: none"> • 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. 	

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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- Understand the inverse relationship between exponents and logarithms. For exponential models, express as a logarithm the solution to $abct = d$ 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.

NJSLS#- New Jersey Student Learning 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 & 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.

<p>Unit Essential Questions</p> <ol style="list-style-type: none"> 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? 	<p>Unit Enduring Understandings</p> <ol style="list-style-type: none"> 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.
<p>Unit Learning Targets <i>Students will ...</i></p> <ol style="list-style-type: none"> 1. write code using the Java String 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. 	
<p>Evidence of Learning</p>	
<p>The content will be a mix of web-based and physical activities. Students will write and run code in the browser, create digital artifacts and engage in in-person collaborative exercises with classmates. Utilizing video, quizzes, example programs to explore written reinforcement exercises, and free response exercises, students will use the power of computing to create and develop an interest in computer science that will build upon each lesson completed.</p> <p>Through summative assessments, students will learn about the concepts and topics presented in this unit. Assessments will be given in various forms (i.e., tests, quizzes, worksheets, discussions).</p>	
<p>Formative Assessments</p> <ul style="list-style-type: none"> <li style="width: 50%;">• Quizzes <li style="width: 50%;">• Explanation of examples <li style="width: 50%;">• Discussions <li style="width: 50%;">• Daily homework assignments <li style="width: 50%;">• Individual practice <li style="width: 50%;">• Notes 	
<p>Benchmark Assessments</p> <ul style="list-style-type: none"> • CodeHS tests • Teacher created paper tests • Required programming projects 	<p>Alternative Assessments</p> <ul style="list-style-type: none"> • Supplemental programming projects <p>Summative Assessments</p> <ul style="list-style-type: none"> • Finding the perimeter • Fraction is comparable
<p>Lesson Plans</p>	
<p>Lesson</p> <p>Lesson 1</p>	<p>Timeframe</p> <p>2 days</p>

Introduction to Classes and Objects	(class instructional time during 40-minute classes)
Lesson 2 Classes versus Objects Using Classes as a Client	4 days (class instructional time during 40-minute classes)
Lesson 3 Writing Classes Writing Classes and Instance Methods	3 days (class instructional time during 40-minute classes)
Lesson 4 Getter and Setter Methods Class Methods and Class Variables	3 days (class instructional time during 40-minute classes)
Lesson 5 Method Overloading	2 days (class instructional time during 40-minute classes)
Lesson 6 Local Variables and Scope	4 days (class instructional time during 40-minute classes)
Lesson 7 Key Terms for Classes Objects versus Primitives	3 days (class instructional time during 40-minute classes)
<p>Teacher Notes: Supplemental materials will be utilized for reinforcement of topics presented, using real-world examples for students.</p> <p>1.) 21 days allocated for Classes and Object-Oriented Programming</p>	
<p>Curriculum Development Resources <i>Online content, video tutorials, utilization of blended classroom approach, blending a mixture of content via web-based and physical activities. Reinforcement through projects, quizzes and tests.</i></p>	
<p>Unit Overview</p>	
<p>Content Area: Technology</p>	
<p>Unit Title: Unit 3: Arrays and the Array List Class</p>	
<p>Target Course/Grade Level: AP Computer Science A/Grades 10-12</p>	
<p>Unit Summary: This method will introduce basic data structures in Java including arrays, ArrayLists, 2 dimensional arrays and HashMaps. Data structures will be used to design larger applications.</p>	
<p>Unit Rationale: An array data structure, or simply an array, is a data structure consisting of a collection of elements, each identified by at least one array index or key. An array is stored such that the position of each element can be computed from its index tuple by a mathematical formula. Students will be introduced to the concepts of arrays. Each object in an array is called an array element. Students will identify an array as a data structure used to store lists of information in programs.</p>	
<p>Student Learning Objectives</p>	
<p>Students will be able to:</p>	
<ol style="list-style-type: none"> 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 	

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.

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- HSF.LE.A.1- Distinguish between situations that can be modeled with linear functions and with exponential functions.
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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- Understand the inverse relationship between exponents and logarithms. For exponential models, express as a logarithm the solution to $abct = d$ 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.

NJSLS#- New Jersey Student Learning 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 & 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.

<ul style="list-style-type: none"> • 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. 	
<p>Unit Essential Questions</p> <ol style="list-style-type: none"> 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? 	<p>Unit Enduring Understandings</p> <ol style="list-style-type: none"> 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.
<p>Unit Learning Targets <i>Students will ...</i></p> <ol style="list-style-type: none"> 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 	
<p>Evidence of Learning</p>	
<p>The content will be a mix of web-based and physical activities. Students will write and run code in the browser, create digital artifacts and engage in in-person collaborative exercises with classmates. Utilizing video, quizzes, example programs to explore written reinforcement exercises, and free response exercises, students will use the power of computing to create and develop an interest in computer science that will build upon each lesson completed.</p> <p>Through summative assessments, students will learn about the concepts and topics presented in this unit. Assessments will be given in various forms (i.e., tests, quizzes, worksheets, discussions).</p>	
<p>Formative Assessments</p> <ul style="list-style-type: none"> • Quizzes • Discussions • Individual practice • Explanation of examples • Daily homework assignments • Notes 	
<p>Benchmark Assessments</p> <ul style="list-style-type: none"> • CodeHS tests • Teacher created paper tests • Required programming projects 	<p>Alternative Assessments</p> <ul style="list-style-type: none"> • Supplemental programming projects <p>Summative Assessments</p> <ul style="list-style-type: none"> • Binary translation • Word counts
<p>Lesson Plans</p>	
<p>Lesson</p>	<p>Timeframe</p>

Lesson 1 Data Structures	2 days (class instructional time during 40-minute classes)
Lesson 2 Introduction to Arrays	2 days (class instructional time during 40-minute classes)
Lesson 3 Using Arrays	4 days (class instructional time during 40-minute classes)
Lesson 4 ArrayList Methods	4 days (class instructional time during 40-minute classes)
Lesson 5 Arrays Vs. ArrayLists	3 days (class instructional time during 40-minute classes)
Lesson 6 The List Interface 2D Arrays (Matrices or Grids)	4 days (class instructional time during 40-minute classes)
Lesson 7 HashMaps Binary	4 days (class instructional time during 40-minute classes)

Teacher Notes:

1.) 23 days allocated for Arrays and ArrayList Classes

Curriculum Development Resources

Online content, video tutorials, utilization of blended classroom approach, blending a mixture of content via web-based and physical activities. Reinforcement through projects, quizzes and tests.

Unit Overview

Content Area: Technology

Unit Title: Unit 4: Recursion

Target Course/Grade Level: AP Computer Science A/Grades 10-12

Unit Summary: In this unit, students will be introduced to fundamental searching and sorting algorithms including sequential search, binary search, insertion sort, selection sort, and mergesort. Recursion is also introduced.

Unit Rationale: *Algorithms* are an unambiguous specification of how to solve a class of problems, and they can perform calculations, data processing, and automated reasoning tasks. *Recursion* in computer science is a method of solving a problem where the solution hinge on solutions to smaller occurrences of the same problem. The method can be applied to many types of problems, as recursion is one of the central ideas of computer science.

Student 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.

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.

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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- Understand the inverse relationship between exponents and logarithms. For exponential models, express as a logarithm the solution to $abct = d$ 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.

NJSLS#- New Jersey Student Learning 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 & Technical Education Content Area: 21st Century Life and Careers Standards

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<ul style="list-style-type: none"> • 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. 	
<p>Unit Essential Questions</p> <ol style="list-style-type: none"> 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? 	<p>Unit Enduring Understandings</p> <ol style="list-style-type: none"> 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.
<p>Unit Learning Targets <i>Students will ...</i></p> <ol style="list-style-type: none"> 1. analyze a recursive algorithm. 2. analyze recursive code to determine the output. 3. write code recursively. 4. solve mathematical examples using recursion. 	
<p>Evidence of Learning</p>	
<p>The content will be a mix of web-based and physical activities. Students will write and run code in the browser, create digital artifacts and engage in in-person collaborative exercises with classmates. Utilizing video, quizzes, example programs to explore written reinforcement exercises, and free response exercises, students will use the power of computing to create and develop an interest in computer science that will build upon each lesson completed. Through summative assessments, students will learn about the concepts and topics presented in this unit. Assessments will be given in various forms (i.e., tests, quizzes, worksheets, discussions).</p>	
<p>Formative Assessments</p> <ul style="list-style-type: none"> • Quizzes • Discussions • Individual practice • Explanation of examples • Daily homework assignments • Notes 	
<p>Benchmark Assessments</p> <ul style="list-style-type: none"> • CodeHS tests • Teacher created paper tests • Required programming projects 	<p>Alternative Assessments</p> <ul style="list-style-type: none"> • Supplemental programming projects <p>Summative Assessments</p> <ul style="list-style-type: none"> • Bacteria cultures • Merge sort
<p>Lesson Plans</p>	
<p>Lesson</p>	<p>Timeframe</p>

Lesson 1 What is an algorithm?	1 day (class instructional time during 40-minute classes)
Lesson 2 Linear Search	2 days (class instructional time during 40-minute classes)
Lesson 3 Binary Search	3 day (class instructional time during 40-minute classes)
Lesson 4 Selection Sort	2 days (class instructional time during 40-minute classes)
Lesson 5 Insertion Sort	3 days (class instructional time during 40-minute classes)
Lesson 6 Advanced: Recursion	3 days (class instructional time during 40-minute classes)
Lesson 7 Mergesort	2 days (class instructional time during 40-minute classes)

Teacher Notes:

1.) 16 days allocated for Recursion

Curriculum Development Resources

Online content, video tutorials, utilization of blended classroom approach, blending a mixture of content via web-based and physical activities. Reinforcement through projects, quizzes and tests

Unit Overview

Content Area: Technology

Unit Title: Unit 5: Inheritance and Polymorphism and Abstract Classes

Target Course/Grade Level: AP Computer Science A/Grades 10-12

Unit Summary: Students will learn how objects store data and interact with each other in Java programs. Students will design and implement classes and extend classes using inheritance.

Unit Rationale: In programming languages and type theory, *polymorphism* is an object-oriented programming concept that refers to the ability of a variable, function or object to take on multiple forms. *Inheritance* is a device where a new class is derived from an existing class. In Java, classes may inherit or obtain the properties and methods of other classes. A class resulting from another class is called a *subclass*, where the class from which a subclass is derived is called a *superclass*.

Student 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.

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.
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- 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- Understand the inverse relationship between exponents and logarithms. For exponential models, express as a logarithm the solution to $abct = d$ 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.

NJSLS#- New Jersey Student Learning 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 & 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.

<p>Unit Essential Questions</p> <ol style="list-style-type: none"> 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? 	<p>Unit Enduring Understandings</p> <ol style="list-style-type: none"> 1. Extending classes is a vital component of object oriented programming. 2. Abstract classes is one viable option when employing inheritance. 3. Late or dynamic binding is essential. 4. The difference between a “has-a” and a “is-a” relationship is key.
<p>Unit Learning Targets <i>Students will ...</i></p> <ol style="list-style-type: none"> 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. 	
<p>Evidence of Learning</p>	
<p>The content will be a mix of web-based and physical activities. Students will write and run code in the browser, create digital artifacts and engage in in-person collaborative exercises with classmates. Utilizing video, quizzes, example programs to explore written reinforcement exercises, and free response exercises, students will use the power of computing to create and develop an interest in computer science that will build upon each lesson completed. Through summative assessments, students will learn about the concepts and topics presented in this unit. Assessments will be given in various forms (i.e., tests, quizzes, worksheets, discussions).</p>	
<p>Formative Assessments</p> <ul style="list-style-type: none"> • Quizzes • Discussions • Individual practice • Explanation of examples • Daily homework assignments • Notes 	
<p>Benchmark Assessments</p> <ul style="list-style-type: none"> • CodeHS tests • Teacher created paper tests • Required programming projects 	<p>Alternative Assessments</p> <ul style="list-style-type: none"> • Supplemental programming projects <p>Summative Assessments</p> <ul style="list-style-type: none"> • Fun with solids • Clothing store
<p>Lesson Plans</p>	
<p>Lesson</p>	<p>Timeframe</p>
<p>Lesson 1 Inheritance Method overloading</p>	<p>2 days (class instructional time during 40-minute classes)</p>
<p>Lesson 2 Local variables and scope</p>	<p>3 days (class instructional time during 40-minute classes)</p>

Lesson 3 Comparing objects vs. primitive types	4 days (class instructional time during 40-minute classes)
Lesson 4 Abstract classes	4 days (class instructional time during 40-minute classes)
Lesson 5 Polymorphism	6 days (class instructional time during 40-minute classes)
Lesson 6 Interfaces Modifying classes to implement interfaces	6 days (class instructional time during 40-minute classes)
Lesson 7 <i>Object</i> is the superclass of all classes	5 days (class instructional time during 40-minute classes)

Teacher Notes:

1.) 30 days allocated for Inheritance and Polymorphism and Abstract Classes

Curriculum Development Resources

Online content, video tutorials, utilization of blended classroom approach, blending a mixture of content via web-based and physical activities. Reinforcement through projects, quizzes and tests

Unit Overview

Content Area: Technology

Unit Title: Unit 6: Computers and Their Appropriate Use and Ethics

Target Course/Grade Level: AP Computer Science A/Grades 10-12

Unit Summary: This unit explores the structure and design of the Internet, and how this design affects the reliability of network communication, the security of data, and personal privacy. Students will learn about the protocols and algorithms used in the Internet, and the importance of cybersecurity.

Unit Rationale: Building upon the utilization of structure and design of the Internet, students learn Internet etiquette (or “netiquette”) and how to keep themselves safe on the world wide web. Students gain an awareness of the potential effects of their digital footprint, how to protect their information from online risks, and the implications of cyberbullying. Students will also learn how to find and cite quality resources online.

Student 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.

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.

NJSLS #- New Jersey Student Learning 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- Understand the inverse relationship between exponents and logarithms. For exponential models, express as a logarithm the solution to $abct = d$ 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.

NJSLS#- New Jersey Student Learning 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 & 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 Essential Questions

1. Why is it important to ensure privacy and copyrights?
2. How can we ensure the privacy of information?

Unit Enduring Understandings

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.

<ol style="list-style-type: none"> 3. What is the difference between hardware and software? 4. What are some of the essential hardware components of a computer? 	<ol style="list-style-type: none"> 2. Access to private information must not be misused. 3. Computers are composed of hardware and software, and we must understand the difference.
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Unit Learning Targets

Students will ...

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.

Evidence of Learning

The content will be a mix of web-based and physical activities. Students will write and run code in the browser, create digital artifacts and engage in in-person collaborative exercises with classmates. Utilizing video, quizzes, example programs to explore written reinforcement exercises, and free response exercises, students will use the power of computing to create and develop an interest in computer science that will build upon each lesson completed.

Through summative assessments, students will learn about the concepts and topics presented in this unit. Assessments will be given in various forms (i.e., tests, quizzes, worksheets, discussions).

Formative Assessments

- Quizzes
- Discussions
- Individual practice
- Explanation of examples
- Daily homework assignments
- Notes

Benchmark Assessments

- CodeHS tests
- Teacher created paper tests
- Required programming projects

Alternative Assessments

- Supplemental programming projects
- Summative Assessments
- Self-drive cars

Lesson Plans

Lesson	Timeframe
Lesson 1 Digital Footprint and Reputation What is Your Digital Footprint?	2 days (class instructional time during 40-minute classes)
Lesson 2 Cyberbullying	2 days (class instructional time during 40-minute classes)
Lesson 3 Internet Safety	2 days (class instructional time during 40-minute classes)
Lesson 4 Privacy and Security	2 days (class instructional time during 40-minute classes)
Lesson 5 Information Literacy	3 days (class instructional time during 40-minute classes)
Lesson 6	3 days (class instructional time during 40-minute classes)

Creative Credit and Copyright	
Lesson 7 Hacking Ethics and Legality	2 days (class instructional time during 40-minute classes)
Teacher Notes: 1.) 14 days allocated for Computers and Their Appropriate Use and Ethics	
Curriculum Development Resources <i>Online content, video tutorials, utilization of blended classroom approach, blending a mixture of content via web-based and physical activities. Reinforcement through projects, quizzes and tests</i>	
Content Area: Technology	
Unit Title: Unit 7: AP Exam Review	
Target Course/Grade Level: AP Computer Science A/Grades 9-12	
Unit Summary: This unit gives students a review of the topics covered in the course and provides practice solving AP Exam style questions.	
Unit Rationale: The unit delves into review of the course content to provide a better understanding with various types of sample questions available for the student with immediate feedback. Feedback is important to students in their understanding of the concepts and topics presented and helps students gain a deeper, meaningful understanding of the concepts and topics presented in the course.	
Student Learning Objectives	
Students will be able to:	
<ol style="list-style-type: none"> 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. 	
Career Readiness Practices	
<ul style="list-style-type: none"> • 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. 	
NJSLS #- New Jersey Student Learning Standards	
<ul style="list-style-type: none"> • 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- Understand the inverse relationship between exponents and logarithms. For exponential models, express as a logarithm the solution to $abct = d$ 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.

NJSLS#- New Jersey Student Learning 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 & 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 Essential Questions

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?

Unit Enduring Understandings

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 multiple choice questions is very different.

Unit Learning Targets

Students will ...

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.

Evidence of Learning

The content will be a mix of web-based and physical activities. Students will write and run code in the browser, create digital artifacts and engage in in-person collaborative exercises with classmates. Utilizing video, quizzes, example programs to explore written reinforcement exercises, and free response exercises, students will use the power of computing to create and develop an interest in computer science that will build upon each lesson completed.

Through summative assessments, students will learn about the concepts and topics presented in this unit. Assessments will be given in various forms (i.e., tests, quizzes, worksheets, discussions).

Formative Assessments

- | | |
|---|--|
| <ul style="list-style-type: none"> • Quizzes • Discussions • Individual practice | <ul style="list-style-type: none"> • Explanation of examples • Daily homework assignments • Notes |
|---|--|

Benchmark Assessments

- CodeHS tests
- Teacher created paper tests
- Required programming projects

Alternative Assessments

- Supplemental programming projects

Summative Assessments

- AP Practice Exams

Lesson Plans

Lesson	Timeframe
Lesson 1 Objectives/Topics covered	5 days (class instructional time during 40-minute classes)
Lesson 2 Practice solving AP Exam type MC questions Practice solving AP Exam type free response questions	7 days (class instructional time during 40-minute classes)
Lesson 3 Cumulative Final AP Review with immediate feedback 4-part multipart free response questions with immediate feedback	8 days (class instructional time during 40-minute classes)

Teacher Notes:

- 1.) 20 days allocated for AP Test Practice

Curriculum Development Resources

Online content, video tutorials, utilization of blended classroom approach, blending a mixture of content via web-based and physical activities. Reinforcement through projects, quizzes and tests

Content Area: Technology
Unit Title: Unit 8: Capstone Project
Target Course/Grade Level: AP Computer Science A/Grades 10-12
Unit Summary: This unit allows students to choose and complete a project to reinforce and expand their computer programming skills
Unit Rationale: The unit gives the students an opportunity to apply their computer programming into new areas while enhancing their Java programming skills with a capstone project.
Student Learning Objectives
Students will be able to:
<ol style="list-style-type: none"> 1. Choose an existing project or design their own project. 2. Complete the project. 3. Present the project to their class.
Career Readiness Practices
<ul style="list-style-type: none"> • 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.
NJSLS #- New Jersey Student Learning Standards
<ul style="list-style-type: none"> • 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- Understand the inverse relationship between exponents and logarithms. For exponential models, express as a logarithm the solution to $abct = d$ 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.
NJSLS#- New Jersey Student Learning Standards- Technology
<ul style="list-style-type: none"> • 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 & 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 Essential Questions

1. How does Java relate to other computer languages?
2. How can Java be used to accelerate the understanding of learning to program a laser cutter or 3-D printer?

Unit Enduring Understandings

1. The fundamental concepts of Java are universal to other programming languages.
2. Machines such as a 3-D printer, laser cutter and robots utilize programming code.

Unit Learning Targets

Students will ...

1. Choose a capstone project.
2. Complete the capstone project.
3. Present the capstone project.

Evidence of Learning

The content will be a mix of web-based and physical activities. Students will write and run code in the browser, create digital artifacts and engage in in-person collaborative exercises with classmates. Utilizing video, quizzes, example programs to explore written reinforcement exercises, and free response exercises, students will use the power of computing to create and develop an interest in computer science that will build upon each lesson completed.

Through summative assessments, students will learn about the concepts and topics presented in this unit. Assessments will be given in various forms (i.e., tests, quizzes, worksheets, discussions).

Formative Assessments

- Daily Project Log
- Discussions

Summative Assessment

- Capstone Presentation

Benchmark Assessments <ul style="list-style-type: none"> • Capstone Project 		Alternative Assessments <ul style="list-style-type: none"> • Supplemental programming projects 	
Lesson Plans			
Lesson		Timeframe	
Lesson 1 Capstone Project		20 days (class instructional time during 40-minute classes)	
Teacher Notes: <ol style="list-style-type: none"> 1. 3 days allocated for capstone project presentations 2. Potential Student Capstone Projects: 3-D Printer, Laser Cutter, Robotics, Java Projects, Cybersecurity and additional computer language immersions (SQL, HTML, Python) 			
Curriculum Development Resources <i>CodeHS, Code.org and other online computer programming resources. 3-D Printer, Laser Cutter, and Robotics</i>			

Content Area Unit Name	Computer Science
Interdisciplinary Connections	Mathematics, Technology, and English Arts, Science
Core Instructional Materials including digital tools	Textbooks, Classroom Resources, Digital Tools
21st Century Themes and Skills	<p>For information related to the 12 Career Ready Practices follow the links below:</p> <p>http://www.state.nj.us/education/cccs/2014/career/CareerReadyPractices.pdf</p> <p>Personal Financial Literacy 9.1 http://www.state.nj.us/education/cccs/2014/career/91.pdf</p> <p>Career Awareness, Exploration, and Preparation 9.2 http://www.state.nj.us/education/cccs/2014/career/92.pdf</p> <p>Career and Technical Education 9.3 http://www.state.nj.us/education/cccs/2014/career/93.pdf</p>
<p>8.1 Educational Technology</p> <p>8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming</p>	<p>K-2: Navigate provided URL'S, Use basic word processing to create and illustrate a simple story, Work collaboratively with peers on project, Use digital tools to explore an issue and design solution for a problem, Identify how technology improves life, Use digital tools to design an approach to solving problems.</p> <p>3-5: Peers collaborate to produce text about current events; Understand the consequences for inappropriate use of technology and social media, Apply engineering designs to data collection and solutions, Understand how technology evolves based on need and cultural influences.</p> <p>6-8: Select appropriate technology and applications to create publication on global topic, Use technology and social media responsibly, Employ a wide range of digital resources to collect data and form solutions, Identify the forces that come into play for further development of technology; apply engineering design process to real world problems.</p> <p>9-12: Create and edit multi-page document for public presentation.</p>

Considerations for classified students:

Classroom Instruction:

- All instruction for classified students will be guided by the students' Individualized Education Plan (IEP).
- Regular education teachers will be responsible for differentiating instruction for classified students based on the instructional modifications listed in the IEP.
- In the case of General Education - Supported Instruction (GE-SI) Classes, the special education teacher will be responsible for support in modifying the curriculum for the students, informing the class room teacher of the modifications, and directing instructional aide(s) to provide support accordingly.
- Grading will be done collaboratively by the regular and special education teachers.

Modifications:

- Modifications include but are not limited to:
Extra time for assignments, modified classwork/homework assignments based on disability, preferential seating, study guides, copies of class notes, assistive technology and rewording/repeating or clarifying directions.

In-class Assessments:

- All assessments are to be in line with students' IEPs. In-class support teachers should modify tests for classified students. Tests may be given in the regular education classroom or completed with the inclusion teacher in another location with additional time. Students may be tested separately according to the IEP.
- Assessment grades may be modified based on a student's disability and in accordance with their IEP.

Considerations for English Language Learners (ELLs):

Classroom Instruction:

- Instruction for ESL students will be guided by their WIDA English Language Proficiency level. Teachers should receive this level from the ESL teacher assigned to the building.
- General education teachers will be responsible for differentiating instruction for ELLs with the assistance of the ESL teacher that promotes language, literacy and content learning.
- Sheltered Instruction Observation Protocol (SIOP)
<http://siop.pearson.com/about-siop/>

The following 8 components provide all teachers with lesson planning and instructional strategies that support language and learning goals for all students. This approach to teaching aligns with preparing students with college and career ready skills.

The SIOP Model components:

1. [Lesson Preparation](#)
2. Building Background
3. [Comprehensible Input](#)
4. [Strategies](#)
5. [Interaction](#)
6. [Practice and Application](#)
7. [Lesson Delivery](#)
8. [Review and Assessment](#)

- In the case of Content-Based ESL (CBE), the ESL teacher and the general education teacher will be responsible for identifying language objectives and additional instructional strategies that improve proficiency in English and academic success of ELLs. Instructional strategies and the necessary scaffolds to promote student learning will be shared with the general education teacher for daily lessons that are aligned to District Curricula, CCSS, and WIDA Standards. The general Education teacher and ESL teacher will be co-teachers for a pre-determined amount of classroom instruction.
- Grading will be done collaboratively by the regular and ESL teachers.

Modifications: The following are possible modifications but are not limited to this list –

- Direct instruction, small group or pullout, about the contrasting letter sound correspondences, syllabication patterns and morphology in English supported with connections to their native language, native language text and/or resources, graphic organizers, visuals, sentence starters/ sentence frames, cloze activities, modeling, working with a partner, timeline and phrase wall and adapted text (in English) or specific sections of the original text, highlighted/bold-faced words within text.
- Draw pictures instead of writing/speaking.
- Match drawings with new vocabulary that might correspond.
- Work in small group or pairs with their English Only (EOs) peers for authentic content language talk and grade level modeling.
- Write simple sentences instead of complex sentences that demonstrates an understanding of academic language particular to specific content.
- Match simple sentences with new vocabulary that might apply to edit sentences.
- Have students provide examples/explanations of main idea in simple sentences. Revisions show an attempt to improve Language Control by embedding academic content vocabulary and Linguistic Complexity by expanding and varying sentence structures and using correct punctuation.
- Draw pictures instead of writing/speaking about seasonal changes. Match drawings with new vocabulary (adjective word wall, content word walls) that might correspond.
- Provide multiple opportunities for authentic speech acts to practice language skills and develop English fluency.
- Total Physical Response (TPR) to model critical thinking skills like analyze and synthesize.
- Study Guides

In Class Assessments:

- All formative and summative assessments will include modifications that support student's English Proficiency level. ESL teachers will collaborate with regular education teachers to provide appropriate differentiation for assessing ELLs.

Considerations for At Risk Students:

- At Risk students are identified by the I&RS committee in each school. The committee works to understand the reasons behind the student's low performance level in school and to create and implement a plan that is carried out by a variety of staff members in the building.
- Teachers with At Risk students are notified by the I&RS committee and provided with a copy of the plan and a timeframe for assessing the growth of the student. There are academic as well as behavioral goals that are listed for the students with recommended strategies unique to each individual.
- Classroom teachers are to follow the plan using instructional strategies that will help the student improve his/her performance while applying appropriate behavioral strategies consistent with the needs of the student.
- Teachers will report student progress to the I&RS committee within the specified timeframe for the plan.

Classroom instruction:

- Teachers will use differentiated instruction for At Risk students as they do for all students in their class. The strategies would be guided by the I&RS plan and be consistent with the student's ability and learning modality.

Modifications:

- Clarify all assignments and place specific timeframes for completion. Provide student with opportunity for one on one time for clarification.
- Set clear expectations for all assignments, in and outside of class. Keep expectations within the framework of the I&RS plan.
- Use positive reinforcement for all successes. Hold student to defined consequences for not completing work.
- Provide time outside the normal class time for completion of work. Not completing assignments is unacceptable, all assignments will be completed.

In Class Assessments:

- At Risk students should receive any modifications listed in their I&RS plan.
- If necessary, students should be provided with extended time to complete assessments.

Considerations for Gifted Students:

- Teachers will use differentiated instruction for Gifted Students as they do for all students in their class.
- Assignments and assessments can be planned and implemented with input from the student.
- Gifted students will be provided with the opportunity to demonstrate their knowledge through a variety of platforms.
- Teachers will have the latitude to provide assignments with the individual student's ability in mind.