



10, 11 & 12TH Grade AP Computer Science Principals Curriculum

Middle Township Public Schools
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Born On Date: February 15th, 2018

Course Title:	AP Computer Science Principles	Grade(s) 10-12
Unit Plan Title:	Unit 2: Introduction to Mobile Apps and Pair Programming (Creativity, Abstraction, Programming, & Impact)	
Overview/Rationale		
<p>Unit 2 provides an introduction to</p> <p>App Inventor programming platform and the course's first programming project, the I Have a Dream app, a sound board app. Students are introduced to App Inventor’s event-driven programming model. Students first work through a guided tutorial that plays an excerpt of a Martin Luther King speech and are then presented with several exercises that challenge them to extend their understanding by solving problems on their own, working in pairs. This is followed later in the unit by several creative mini projects where students are invited to express their own ideas by developing their own computational artifacts. Students are also introduced to several important CS Principles themes and topics. Two lessons focus on hardware and software concepts. The big idea of abstraction is introduced. Students get their first look at binary numbers learning how to count in binary and how to view number systems such as binary, hexadecimal and decimal, as instances of the higher order abstraction of a positional number system.</p>		
Standard(s) Number and Description		
<p>CSTA-3A-DA-09 - Translate between different bit representations of real-world phenomena, such as characters, numbers, and images</p> <p>CSTA-3A-AP-16 - Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue by using events to initiate instructions.</p> <p>CSTA-3A-AP-17 - Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects</p> <p>CSTA-3A-AP-21 - Evaluate and refine computational artifacts to make them more usable and accessible.</p> <p>CSTA-3A-AP-22 - Design and develop computational artifacts working in team roles using collaborative tools.</p> <p>CSTA-3B-AP-22 - Modify an existing program to add additional functionality and discuss intended and unintended implications (e.g., breaking other functionality).</p>		
Technology Standard(s) (Established Goals)		
<p>TECH.8.2.12.B.CS1 - [Content Statement] - The cultural, social, economic and political effects of technology</p> <p>TECH.8.2.12.B.3 - [Cumulative Progress Indicator] - Analyze ethical and unethical practices around intellectual property rights as influenced by human wants and/or needs.</p> <p>TECH.8.1.12.D.5 - [Cumulative Progress Indicator] - Analyze the capabilities and limitations of current and emerging technology resources and assess their potential to address personal, social, lifelong learning, and career needs.</p> <p>TECH.8.2.12.E.CS1 - [Content Statement] - Computational thinking and computer programming as tools used in design and engineering</p> <p>TECH.8.2.12.E - [Strand] - Computational thinking builds and enhances problem solving, allowing students to move beyond using knowledge to creating knowledge.</p> <p>TECH.8.2.12.E.CS1 - [Content Statement] - Computational thinking and computer programming as tools used in design and engineering.</p> <p>TECH.8.2.12.E.1 - [Cumulative Progress Indicator] - Demonstrate an understanding of the problem-solving capacity of computers in our world.</p> <p>TECH.8.2.12.E.2 - [Cumulative Progress Indicator] - Analyze the relationships between internal and external computer components.</p>		

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

Interdisciplinary Standard(s)

Enduring Understandings: (What are the big ideas? What specific understandings about them are desired? What misunderstandings are predictable?)

- **1 Creativity**
 - *1.2 Computing enables people to use creative development processes when using computing tools and techniques to create computational artifacts for creative expression of ideas or to solve a problem.*
- **2. Abstraction**
 - *2.1 A variety of abstractions built upon binary sequences can be used to represent all digital data.*
 - *2.2 Multiple levels of abstraction are used to write programs or to create other computational artifacts.*
- **4. Algorithms**
 - *4.1 Algorithms are precise sequences of instructions for processes that can be executed by a computer and are implemented using programming languages.*
- **5. Programming**
 - *5.1 Programs can be developed to solve problems (to help people, organizations, or society); for creative expression; to satisfy personal curiosity or to create new knowledge.*
 - *5.2 People write programs to execute algorithms.*
 - *5.4 Programs are developed, maintained, and used by people for different purposes.*
- **6. The Internet**
 - *6.1 The Internet is a network of autonomous systems.*
- **7. Global Impact**
 - *7.1 Computing enhances communication, interaction, and cognition.*
 - *7.3 Computing has global effects — both beneficial and harmful — on people and society.*

Essential Question(s) : (What provocative questions will foster inquiry, understanding, and transfer of learning?)

Guiding Questions:

- How does one use App Inventor and event-driven programming to build a mobile app?
- What are the various hardware and software abstractions that make up a modern digital computer?
- What is the binary number system that underlies all digital representation?

In this unit plan, the following 21st Century themes and skills are addressed:

Check all that apply.			Indicate whether these skills are <i>E-Encouraged</i> , <i>T-Taught</i> , or <i>A-Assessed</i> in this unit by marking <i>E</i> , <i>T</i> , <i>A</i> on the line before the appropriate skill.		
21 st Century Themes			21 st Century Skills		
		Global Awareness		T	Critical Thinking & Problem Solving
		Environmental Literacy		T	Creativity and Innovation
		Health Literacy		T	Collaboration, Teamwork and Leadership
	E	Civic Literacy		T	Cross-Cultural and Interpersonal Communication
	T,A	Financial, Economic, Business and Entrepreneurial Literacy		T,A	Communication and Media Fluency
				T,A	Accountability, Productivity and Ethics

In this unit plan, the following Career Ready Practices are addressed:

Indicate whether these skills are E-Encouraged, T-Taught, or A-Assessed in this unit by marking E, T, A on the line before the appropriate skill.

		CRP1. Act as a responsible and contributing citizen and employee
	T,A	CRP2. Apply appropriate academic and technical skills
		CRP3. Attend to personal health and financial well-being
		CRP4. Communicate clearly and effectively with reason
	E	CRP5. Consider the environmental, social and economic impacts of decisions
	T	CRP6. Demonstrate creativity and innovation
		CRP7. Employ valid and reliable research strategies
	T,A	CRP8. Utilize critical thinking to make sense of problems and persevere in solving them
		CRP9. Model integrity, ethical leadership and effective management
	E	CRP10. Plan education and career paths aligned to personal goals
	T,A	CRP11. Use technology to enhance productivity
	T	CRP12. Work productively in teams while using cultural global competence

Student Learning Goals/Objectives: (What key knowledge and skills will students acquire as a result of this unit? What should they eventually be able to do as a result of such knowledge and skill?)

Learning Objective 1.2.1 Create a computational artifact for creative expression.

Learning Objective 1.2.3 Create a new computational artifact by combining or modifying existing artifacts.

Learning Objective 2.1.1 Describe the variety of abstractions used to represent data.

Learning Objective 2.1.2 Explain how binary sequences are used to represent digital data.

Learning Objective 2.2.3 Identify multiple levels of abstractions that are used when writing programs.

Learning Objective 4.1.2 Express an algorithm in a language.

Learning Objective 5.1.1 Develop a program for creative expression, to satisfy personal curiosity, or to create new knowledge.

Learning Objective 5.2.1 Explain how programs implement algorithms.

Learning Objective 5.4.1 Evaluate the correctness of a program.

Learning Objective 6.1.1 Explain the abstractions in the Internet and how the Internet functions. (Exclusion statement: Specific devices used to implement the abstractions in the Internet are beyond the scope of this course and the AP Exam.)

Learning Objective 7.1.1 Explain how computing innovations affect communication, interaction, and cognition.

Learning Objective 7.3.1 Analyze the beneficial and harmful effects of computing.

Key Vocabulary and Terms:

Computational artifact - an object created by a human being that involves the use of computation in some way, for example a mobile app or a web page.

Event-driven programming - a programming approach whereby the program's behavior is controlled by writing code that responds to various events that occur, such as Button clicks.

Hardware - the large and small physical components that make up a computers such as the computer's keyboard or its processor.

Software - the computer programs that make up a computer system such as the mobile apps we will be creating in this course.

Abstraction - one of the seven big ideas of the CS Principles curriculum. An abstraction is a simplified and general representation of some complex object or process. One example --we'll encounter many in this course, including abstractions used in computer programming -- would be a Google map.

Binary number - a number written in the binary system, a system that uses only two digits, 0s and 1s.

bit: short for binary digit

blacklist: in internet terminology, a generic term for a list of email addresses or IP addresses that are origination with known spammers

character: any symbol that requires one byte of storage

cyberspace: a metaphor for describing the non-physical terrain created by computer systems

data: data is distinct information that is formatted in a special way. Data exists in a variety of forms, like text on paper or bytes stored in electronic memory

data center: are physical or virtual infrastructures used by enterprises to house computer, server and networking systems and components for the company's IT (information technology) needs

data network: a telecommunications network which allows computers to exchange data

disk drive: a randomly addressable and rewritable storage device

intellectual property: refers to any property that is created using original thought. Traditional intellectual property include patents, copyrights, and trademarks.

Moore's Law: The number of transistors per square inch on integrated circuits has doubled every year since the integrated circuit was invented.

network: a group of two or more computer systems linked together

processor: short for microprocessor or CPU

social networking: a social structure made of nodes that are generally individuals or organizations. A social network represents relationships and flows between people, groups, organizations, animals, computers, or other information/knowledge processing entities

whitelist: a generic name for a list of email address or IP addresses that are considered to be spam free

Assessment Evidence:

Performance Tasks: (Through what authentic performance tasks will students demonstrate the desired understandings? By what criteria will performances of understanding be judged?)

Completed Apps
End of Unit Practical Drills

Other Assessment Measures: (Through what other evidence (E.g. quizzes, tests, academic prompts, observations, homework, journals, etc.) will students demonstrate achievement of the desired results? How will students reflect upon and self-assess their learning?) *****Attach all**

Benchmarks

Portfolio Reflection
Self-Check Exercises
Student Discussion
Unit Test

Teaching and Learning Actions: (What learning experiences and instruction will enable students to achieve the desired results?)

Instructional Strategies and
Activities

D

Consider how will the design will:

W = Help the students know Where the unit is going and What is expected? Help the teacher know Where the students are coming from (prior knowledge and interests)?

H= Hook all students and Hold their interest?

E= Equip students, help the Experience the key ideas and Explore the issue?

R=Provide opportunities to Rethink and Revise their understandings and work?

E=Allow students to Evaluate their work and its implications?

T=be Tailored (personalized to the different needs, interests and abilities of learners?)

O=be Organized to maximize initial and sustained engagement as well as effective learning?

Resources

Online curriculum website
<http://teach.mobilecsp.org>

Online student website
<https://ram8647.appspot.com/mobileCSP/unit?unit=19>

Suggested Time Frame:

4 weeks (15 class periods)

D – Indicates differentiation at the Lesson Level (Identify Modifications for ELL, Gifted and Talented, Title 1, Special Education)

Course Title:	AP Computer Science Principles	Grade(s) 10-12
Unit Plan Title:	Unit 3: Creating Graphics & Images Bit by Bit (Creativity, Abstraction, Data and Information, Programming, & Impact)	
Overview/Rationale		
<p>Unit 3 extends the student’s mobile programming toolkit to several new App Inventor components and introduces a number of new programming concepts, including the concept of a variables, lists and data abstraction. The main app in this unit, The Paint Pot app, a computational version of finger painting, focuses on App Inventor's drawing and painting features and related topics from the CS Principles framework. The app is presented in four parts each of which is followed by a set of creative project exercises and challenges. This unit also introduces two other apps: Magic 8 Ball app, which provides a first introduction to lists, and Map Tour, which demonstrates how to incorporate external data into a mobile app. Unit 3 also extends the student’s understanding of binary number system and introduces students to the idea of a bit as the fundamental unit of data. Through a number of hands-on and interactive activities students explore how bits are used to represent images, and how redundant parity bits can be used to detect simple data transmission errors. These lessons are complemented nicely by a Blown to Bits reading that focuses on digital documents, including how information can be hidden inside images and other digital documents.</p>		
Standard(s) Number and Description		
<p>CSTA-3A-CS-01 - Explain how abstractions hide the underlying implementation details of computing systems embedded in everyday objects.</p> <p>CSTA-3A-CS-02 - Compare levels of abstraction and interactions between application software, system software, and hardware layers.</p> <p>CSTA-3A-CS-03 - Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors.</p> <p>CSTA-3A-DA-09 - Translate between different bit representations of real-world phenomena, such as characters, numbers, and images.</p> <p>CSTA-3A-AP-13 - Create prototypes that use algorithms to solve computational problems by leveraging prior student knowledge and personal interests.</p> <p>CSTA-3A-AP-14 - Use lists to simplify solutions, generalizing computational problems instead of repeatedly using simple variables.</p> <p>CSTA-3A-AP-16 - Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue by using events to initiate instructions</p> <p>CSTA-3A-AP-22 - Design and develop computational artifacts working in team roles using collaborative tools.</p>		
Technology Standard(s) (Established Goals)		
<p>TECH.8.1.12.B.2 - [Cumulative Progress Indicator] - Apply previous content knowledge by creating and piloting a digital learning game or tutorial.</p> <p>TECH.8.1.12.C.CS1 - [Content Statement] - Interact, collaborate, and publish with peers, experts, or others by employing a variety of digital environments and media.</p> <p>TECH.8.2.12.D.6 - [Cumulative Progress Indicator] - Synthesize data, analyze trends and draw conclusions regarding the effect of a technology on the individual, society, or the environment and publish conclusions.</p> <p>TECH.8.2.12.D.CS1 - [Content Statement] - Apply the design process.</p> <p>TECH.8.2.12.E.CS1 - [Content Statement] - Computational thinking and computer programming as tools used in design and engineering.</p> <p>TECH.8.2.12.E.3 - [Cumulative Progress Indicator] - Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).</p>		

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

TECH.8.1.12.F.CS2 - [Content Statement] - Plan and manage activities to develop a solution or complete a project.

Enduring Understandings: (What are the big ideas? What specific understandings about them are desired? What misunderstandings are predictable?)

- **1. Creativity**
 - *1.2 Computing enables people to use creative development processes when using computing tools and techniques to create computational artifacts for creative expression of ideas or to solve problems.*
- **2. Abstraction**
 - *2.1 A variety of abstractions built upon binary sequences can be used to represent all digital data.*
 - *2.2 Multiple levels of abstraction are used to write programs or to create other computational artifacts.*
 - *2.3 Models and simulations use abstraction to generate new understanding and knowledge.*
- **3. Data and Information**
 - *3.1 People use computer programs to process information to gain insight and knowledge.*
 - *3.2 Computing facilitates exploration and the discovery of connections in information.*
 - *3.3 There are trade-offs when representing information as digital data.*
- **5. Programming**
 - *5.1 Programs can be developed to solve problems (to help people, organizations, or society); for creative expression; to satisfy personal curiosity or to create new knowledge.*
 - *5.2 People write programs to execute algorithms.*
 - *5.3 Programming is facilitated by appropriate abstractions.*
 - *5.4 Programs are developed, maintained, and used by people for different purposes.*
 - *5.5 Programming uses mathematical and logical concepts.*
- **7. Global Impact**
 - *7.1 Computing enhances communication, interaction, and cognition.*
 - *7.3 Computing has global effects—both beneficial and harmful—on people and society.*

Essential Question(s) : (What provocative questions will foster inquiry, understanding, and transfer of learning?)

- Guiding Questions:
- How can binary numbers be used to represent all digital data?
- How can algorithms be used to compress data?
- How do variables of both simple and structured data, such as, lists, enable us manage the complexity of a programming?

In this unit plan, the following 21st Century themes and skills are addressed:

Check all that apply.

*Indicate whether these skills are **E**-Encouraged, **T**-Taught, or **A**-Assessed in this unit by marking **E**, **T**, **A** on the line before the appropriate skill.*

21 st Century Themes			21 st Century Skills		
		Global Awareness	T	Critical Thinking & Problem Solving	
		Environmental Literacy	T	Creativity and Innovation	
		Health Literacy	T	Collaboration, Teamwork and Leadership	
	E	Civic Literacy	T	Cross-Cultural and Interpersonal Communication	
	T,A	Financial, Economic, Business and Entrepreneurial Literacy	T,A	Communication and Media Fluency	
			T,A	Accountability, Productivity and Ethics	

In this unit plan, the following Career Ready Practices are addressed:

Indicate whether these skills are E-Encouraged, T-Taught, or A-Assessed in this unit by marking E, T, A on the line before the appropriate skill.

E	CRP1. Act as a responsible and contributing citizen and employee
T,A	CRP2. Apply appropriate academic and technical skills
	CRP3. Attend to personal health and financial well-being
E	CRP4. Communicate clearly and effectively with reason
E	CRP5. Consider the environmental, social and economic impacts of decisions
T	CRP6. Demonstrate creativity and innovation
	CRP7. Employ valid and reliable research strategies
E,T,A	CRP8. Utilize critical thinking to make sense of problems and persevere in solving them
E	CRP9. Model integrity, ethical leadership and effective management
E	CRP10. Plan education and career paths aligned to personal goals
	CRP11. Use technology to enhance productivity
T	CRP12. Work productively in teams while using cultural global competence

Student Learning Goals/Objectives: (What key knowledge and skills will students acquire as a result of this unit? What should they eventually be able to do as a result of such knowledge and skill?)

Learning Objective 1.2.2 Create a computational artifact using computing tools and techniques to solve a problem.

Learning Objective 1.2.4 Collaborate in the creation of computational artifacts.

Learning Objective 1.3.1 Use computing tools and techniques for creative expression.

Learning Objective 2.1.1 Describe the variety of abstractions used to represent data.

Learning Objective 2.1.2 Explain how binary sequences are used to represent digital data.

Learning Objective 2.2.1 Develop an abstraction when writing a program or creating other computational artifacts.

Learning Objective 2.2.2 Use multiple levels of abstraction to write programs.

Learning Objective 2.3.1 Use models and simulations to represent phenomena

Learning Objective 3.1.2 Collaborate when processing information to gain insight and knowledge.

Learning Objective 3.1.3 Explain the insight and knowledge gained from digitally processed data by using appropriate visualizations, notations, and precise language.

Learning Objective 3.2.1 Extract information from data to discover and explain connections, patterns, or trends.

Learning Objective 3.3.1 Analyze how data representation, storage, security, and transmission of data involve computational manipulation of information.

Learning Objective 4.1.2 Express an algorithm in a language

Learning Objective 5.1.1 Develop a program for creative expression, to satisfy personal curiosity, or to create new knowledge.

Learning Objective 5.1.2 Develop a correct program to solve problems.

Learning Objective 5.1.3 Collaborate to develop a program.

Learning Objective 5.2.1 Explain how programs implement algorithms.

Learning Objective 5.3.1 Use abstraction to manage complexity in programs.

Learning Objective 5.4.1 Evaluate the correctness of a program.

Learning Objective 5.5.1 Employ appropriate mathematical and logical concepts in programming.

Learning Objective 7.1.1 Explain how computing innovations affect communication, interaction, and cognition.

Learning Objective 7.3.1 Analyze the beneficial and harmful effects of computing.

Key Vocabulary and Terms:

algorithm: a formula or set of steps for solving a particular problem.

analog: a device or system that represents changing values as continuously variable physical quantities

ASCII: a code for representing English characters as numbers, with each letter assigned a number from 0 to 127

cloud computing: comparable to grid computing, cloud computing relies on sharing resources rather than having local servers handle applications.

cryptography: the art of protecting information by transforming it into an unreadable format, called cipher text

digital: any system based on discontinuous data or events. Computers are digital machines because at the basic level they can distinguish between just two values, 0 and 1.

digital signal processing: (DSP) refers to manipulating analog information

download: to copy data (usually an entire file) from a main source to a peripheral device

lossless compression: data compression techniques in which no data is lost.

lossy compression: data compression techniques in which some amount of data is lost. This technique attempts to eliminate redundant information.

megabyte: used to describe data storage, 1,048,576 bytes (abbreviated MB)

megapixel: one million pixels, used in reference to the resolution of a graphics device

modeling: process of representing a real-world object of phenomenon as a set of mathematical equations.

OCR: optical character recognition, the branch of computer science that involves reading text from paper and translating the images into a form that the computer can manipulate

pixel: short for a picture element, a single point in a graphic image

raster: the rectangular area of a display screen actually being used to display images

render: refers to the process of adding realism to a computer graphics by adding 3-D qualities, such as shadows and variations in color and shade.

spam:spam is electronic junk mail or junk newsgroup postings

steganography: the art and science of hiding information by embedding messages within other, seemingly harmless messages

upload: to transmit data from a computer to a bulletin board service, mainframe, or network.

Assessment Evidence:

Performance Tasks: *(Through what authentic performance tasks will students demonstrate the desired understandings? By what criteria will performances of understanding be judged?)*

Labs: Paint Pot 1 (App Inventor), Paint Pot 1 Projects (App Inventor), Paint Pot 2 (App Inventor), Paint Pot 2 Projects (App Inventor), Magic 8-Ball (Using App Inventor), Map Tour (App Inventor and Google Maps Activity Starter)
End of Unit Practical Drills

Other Assessment Measures: *(Through what other evidence (E.g. quizzes, tests, academic prompts, observations, homework, journals, etc.) will students demonstrate achievement of the desired results? How will students reflect upon and self- assess their learning?)* *****Attach all**

Benchmarks

Portfolio Reflection
Self-Check Exercises
Student Discussion
Unit Test

Teaching and Learning Actions: (What learning experiences and instruction will enable students to achieve the desired results?)

Instructional Strategies and Activities

D

Consider how will the design will:

W = Help the students know Where the unit is going and What is expected? Help the teacher know Where the students are coming from (prior knowledge and interests)?

H= Hook all students and Hold their interest?

E= Equip students, help the Experience the key ideas and Explore the issue?

R=Provide opportunities to Rethink and Revise their understandings and work?

E=Allow students to Evaluate their work and its implications?

T=be Tailored (personalized to the different needs, interests and abilities of learners?)

O=be Organized to maximize initial and sustained engagement as well as effective learning?

Resources

Online curriculum website

<http://teach.mobilecsp.org>

Online student website

<https://ram8647.appspot.com/mobileCSP/unit?unit=19>



Suggested Time Frame:	4 weeks (15 class periods)

D – Indicates differentiation at the Lesson Level (Identify Modifications for ELL, Gifted and Talented, Title 1, Special Education)

Course Title:	AP Computer Science Principles	Grade(s) 10-12
Unit Plan Title:	Unit 4: Animation, Simulation, and Modeling: Exploring the Impact of Computing (Creativity, Abstraction, Data and Information, Algorithms, Programming, & Impact)	
Overview/Rationale		
Unit 4 focuses on animation, simulation and modeling. The Android Mash app introduces the idea of computer simulation with a computational version of the traditional Whack-a-Mole game. The Coin Flip app, which extends over several lessons, introduces the concept of modeling. The activities in Unit 4 build toward EU 2.3 as students learn that models use abstractions, such as a pseudo random number generator (PRNG), to represent real word situations, in this case, the flipping of a coin; EU 3.3 as students learn how PRNG algorithms are used to model randomness inside a computer, such as with the Coin Flip app; EU 7.1 as students extend the app model to represent different types of coins, including a biased coin and a three--sided coin. This is followed by an experimental lesson where an app that repeatedly “flips” a coin is used to assess the quality of App Inventor’s PRNG; EU 7.3 as students learn how one’s privacy is impacted by developing technology and computing innovations; and EU 7.4 as students learn the economic, social and cultural effects of computing innovations, such as real world models of the weather and the solar system.		
Standard(s) Number and Description		
CSTA-3A-DA-12 - Create computational models that represent the relationships among different elements of data collected from a phenomenon or process		
CSTA-3A-IC-24 - Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices.		
CSTA-3B-DA-07 - Evaluate the ability of models and simulations to test and support the refinement of hypotheses.		
CSTA-3B-AP-14 - Construct solutions to problems using student-created components, such as procedures, modules and/or objects.		
CSTA-3B-AP-10 - Use and adapt classic algorithms to solve computational problems.		
CSTA-3B-AP-11 - Evaluate algorithms in terms of their efficiency, correctness, and clarity		
Technology Standard(s) (Established Goals)		
TECH.8.1.12.B.CS2 - [Content Statement] - Create original works as a means of personal or group expression.		
TECH.8.1.12.B.2 - [Cumulative Progress Indicator] - Apply previous content knowledge by creating and piloting a digital learning game or tutorial.		
TECH.8.1.12.D.CS1 - [Content Statement] - Advocate and practice safe, legal, and responsible use of information and technology.		
TECH.8.1.12.D.3 - [Cumulative Progress Indicator] - Compare and contrast policies on filtering and censorship both locally and globally.		
TECH.8.1.12.D.CS3 - [Content Statement] - Exhibit leadership for digital citizenship.		
TECH.8.1.12.D.4 - [Cumulative Progress Indicator] - Research and understand the positive and negative impact of one’s digital footprint.		
TECH.8.1.12.D.5 - [Cumulative Progress Indicator] - Analyze the capabilities and limitations of current and emerging technology resources and assess their potential to address personal, social, lifelong learning, and career needs.		
TECH.8.1.12.E.CS2 - [Content Statement] - Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.		
TECH.8.2.12.B - [Strand] - Knowledge and understanding of human, cultural and society values are fundamental when designing technology systems and products in the global society.		
TECH.8.2.12.B.CS1 - [Content Statement] - The cultural, social, economic and political effects of technology		
TECH.8.2.12.B.1 - [Cumulative Progress Indicator] - Research and analyze the impact of the design constraints (specifications and limits) for a product		

or technology driven by a cultural, social, economic or political need and publish for review.

TECH.8.2.12.B.CS2 - [Content Statement] - The effects of technology on the environment.

TECH.8.2.12.D.CS1 - [Content Statement] - Apply the design process.

TECH.8.2.12.D.CS2 - [Content Statement] - Use and maintain technological products and systems.

TECH.8.2.12.E.3 - [Cumulative Progress Indicator] - Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).

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

TECH.8.1.12.F.1 - [Cumulative Progress Indicator] - Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, persona l and or social needs.

Enduring Understandings: (What are the big ideas? What specific understandings about them are desired? What misunderstandings are predictable?)

- **1. Creativity**
 - *1.2 Computing enables people to use creative development processes when using computing tools and techniques to create computational artifacts for creative expression of ideas or to solve a problem.*
 - *1.3 Computing can extend traditional forms of human expression and experience.*
- **2. Abstraction**
 - *2.2 Multiple levels of abstraction are used to write programs or to create other computational artifacts.*
 - *2.3 Use models and simulations to represent phenomena.*
- **3. Data and Information**
 - *3.3 There are trade-offs when representing information as digital data.*
- **4. Algorithms**
 - *4.1 Algorithms are precise sequences of instructions for processes that can be executed by a computer and are implemented using programming languages.*
- **5. Programming**
 - *5.1 Programs can be developed to solve problems (to help people, organizations or society); for creative expression; to satisfy personal curiosity or to create new knowledge.*
 - *5.3 Programming is facilitated by appropriate abstractions.*
 - *5.5 Programming uses mathematical and logical concepts.*
- **7. Global Impact**
 - *7.1 Computing enhances communication, interaction, and cognition.*
 - *7.3 Computing has global effects — both beneficial and harmful — on people and society*
 - *7.4 Computing innovations influence and are influenced by the economic, social, and cultural contexts in which they are designed and used.*

Essential Question(s) : (What provocative questions will foster inquiry, understanding, and transfer of learning?)

Guiding Questions:

- How do computers use simulation and modeling to represent real world phenomena?
- Why is randomness important and how is it modeled inside a computer?
- In what ways does simulation and modeling extend our knowledge and benefit society?

In this unit plan, the following 21st Century themes and skills are addressed:

<i>Check all that apply.</i>			<i>Indicate whether these skills are E-Encouraged, T-Taught, or A-Assessed in this unit by marking E, T, A on the line before the appropriate skill.</i>		
21st Century Themes			21st Century Skills		
		Global Awareness		T	Critical Thinking & Problem Solving
		Environmental Literacy		T	Creativity and Innovation
		Health Literacy		T	Collaboration, Teamwork and Leadership
	E	Civic Literacy		T	Cross-Cultural and Interpersonal Communication
	T,A	Financial, Economic, Business and Entrepreneurial Literacy		T,A	Communication and Media Fluency
				T,A	Accountability, Productivity and Ethics

In this unit plan, the following Career Ready Practices are addressed:

*Indicate whether these skills are **E**-Encouraged, **T**-Taught, or **A**-Assessed in this unit by marking **E**, **T**, **A** on the line before the appropriate skill.*

	E	CRP1. Act as a responsible and contributing citizen and employee
	T,A	CRP2. Apply appropriate academic and technical skills
		CRP3. Attend to personal health and financial well-being
	E	CRP4. Communicate clearly and effectively with reason
	E	CRP5. Consider the environmental, social and economic impacts of decisions
	T	CRP6. Demonstrate creativity and innovation
		CRP7. Employ valid and reliable research strategies
	T,A	CRP8. Utilize critical thinking to make sense of problems and persevere in solving them
		CRP9. Model integrity, ethical leadership and effective management

		CRP10. Plan education and career paths aligned to personal goals
	T,A	CRP11. Use technology to enhance productivity
	T	CRP12. Work productively in teams while using cultural global competence
Student Learning Goals/Objectives: (What key knowledge and skills will students acquire as a result of this unit? What should they eventually be able to do as a result of such knowledge and skill?)		
<p>Learning Objective 1.3.1 Use computing tools and techniques for creative expression.</p> <p>Learning Objective 1.2.2 Create a computational artifact using computing tools and techniques to solve a problem.</p> <p>Learning Objective 1.2.4 Collaborate in the creation of computational artifacts.</p> <p>Learning Objective 2.2.1 Develop an abstraction when writing a program or creating other computational artifacts.</p> <p>Learning Objective 2.2.3 Identify multiple levels of abstractions that are used when writing programs.</p> <p>Learning Objective 2.3.1 Use models and simulations to represent phenomena</p> <p>Learning Objective 2.3.2 Use models and simulations to formulate, refine, and test hypotheses.</p> <p>Learning Objective 3.3.1 Analyze how data representation, storage, security, and transmission of data involve computational manipulation of information.</p> <p>Learning Objective 4.1.1 Develop an algorithm for implementation in a program.</p> <p>Learning Objective 4.1.2 Express an algorithm in a language</p> <p>Learning Objective 5.1.1 Develop a program for creative expression, to satisfy personal curiosity, or to create new knowledge.</p> <p>Learning Objective 5.1.2 Develop a correct program to solve problems.</p> <p>Learning Objective 5.1.3 Collaborate to develop a program.</p> <p>Learning Objective 5.3.1 Use abstraction to manage complexity in programs.</p> <p>Learning Objective 5.5.1 Employ appropriate mathematical and logical concepts in programming.</p> <p>Learning Objective 7.1.1 Explain how computing innovations affect communication, interaction, and cognition.</p> <p>Learning Objective 7.3.1 Analyze the beneficial and harmful effects of computing.</p> <p>Learning Objective 7.4.1 Explain the connections between computing and economic, social and cultural context.</p>		
Key Vocabulary and Terms:		
<p>ad hoc: when used to describe programming, it means a quick fix for a problem, not usually the best example that will sustain an issue.</p> <p>cloud computing: comparable to grid computing, cloud computing relies on sharing resources rather than having local servers handle applications.</p> <p>cookie: a small text file placed when you access a site and used by websites to track your activity on their site. A cookie allows the website to store and easily look up your records in their archive.</p> <p>database: a collection of information organized in such a way that a computer program can quickly selected the desired pieces of data. Often abbreviated DB</p> <p>data aggregation: process in which information is gathered and expressed in a summary form for purposes such as statistical analysis</p> <p>data mining: a class of database applications that look for hidden patterns in a group of data that could be used to predict future behavior</p> <p>data repository: generically refers to a general place where data is stored and maintained</p>		

data sources: name given to the connection setup from a database to a server. The name is commonly used when creating a query to the database

digital detritus: term used to describe unsightly debris that accrues as the result of the experience of digital living

dossier: a collection of documents about a person, event, or subject

EDR: event data recorder

encode: the phrase used to describe the method of preparing data for storage or transmission.

encryption: the translation of data into secret code

geotagging: the process of adding geographical information to various media in the form of metadata. The data usually consists of coordinates like latitude and longitude, but may even include bearing, altitude, distance and place names.

IP address: an identifier for devices on a TCP/IP network

ISP: Internet Service Provider

metadata: data about data; describes how and when and by whom a particular set of data was collected, and how data is formatted

PRISM: a secret program or tool that performs data collection for the NSA

query: a request for information from a database

RFID: radio frequency identification, similar to barcodes

server: a computer program or a device that provides functionality for other programs or devices, called "clients". A server can be used to share data or resources among multiple clients or to perform computations.

Assessment Evidence:

Performance Tasks: *(Through what authentic performance tasks will students demonstrate the desired understandings? By what criteria will performances of understanding be judged?)*

Completed App

Labs: Android Mash (App Inventor), Android Mash Projects (App Inventor), Coin Flip (App Inventor), Coin Flip Projects (App Inventor)
End of Unit Practical Drills

Other Assessment Measures: *(Through what other evidence (E.g. quizzes, tests, academic prompts, observations, homework, journals, etc.) will students demonstrate achievement of the desired results? How will students reflect upon and self-assess their learning?)* *****Attach all**

Benchmarks

Portfolio Reflection
Self-Check Exercises
Student Discussion
Unit Test

Teaching and Learning Actions: (What learning experiences and instruction will enable students to achieve the desired results?)

Instructional Strategies and Activities

D

Consider how will the design will:

W = Help the students know Where the unit is going and What is expected? Help the teacher know Where the students are coming from (prior knowledge and interests)?

H= Hook all students and Hold their interest?

E= Equip students, help the Experience the key ideas and Explore the issue?

R=Provide opportunities to Rethink and Revise their understandings and work?

E=Allow students to Evaluate their work and its implications?

T=be Tailored (personalized to the different needs, interests and abilities of learners?)

O=be Organized to maximize initial and sustained engagement as well as effective learning?

Resources	
Online curriculum website http://teach.mobilecsp.org Online student website https://ram8647.appspot.com/mobileCSP/unit?unit=19	
Suggested Time Frame:	3.5 weeks (12 class periods)

D – Indicates differentiation at the Lesson Level (Identify Modifications for ELL, Gifted and Talented, Title 1, Special Education)

Course Title:	AP Computer Science Principles	Grade(s) 10-12
Unit Plan Title:	Unit 5: Algorithms and Procedural Abstraction (Abstraction, Algorithms, Programming, & Impact)	
Overview/Rationale		
<p>In Unit 5, algorithms and procedures are examined in more detail. The Logo apps introduce the concept of procedural abstraction and students learn to define and use procedures -- named blocks of code that perform a specific task. By encapsulating the algorithms into named procedures and introducing parameters to help generalize the algorithms, students are led to see the advantages of procedural abstraction. In addition to designing and testing their own algorithms, students are also provided an introduction into the analysis of algorithms. Algorithm efficiency is examined for searching and sorting algorithms, which are analyzed both experimentally and through mathematical concepts such as functions and graphs. The impact section of this unit focuses on the impact that Web searching algorithms have had on our lives. The activities completed in Unit 5 build toward EU 2.2, EU 4.1, EU 4.2, EU 5.3 and EU 5.5 by focusing on abstraction, algorithms, and programming concepts.</p>		
Standard(s) Number and Description		
<p>CSTA-3A-AP-13 - Create prototypes that use algorithms to solve computational problems by leveraging prior student knowledge and personal interests.</p> <p>CSTA-3A-AP-22 - Design and develop computational artifacts working in team roles using collaborative tools.</p> <p>CSTA-3A-AP-17 - Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects</p> <p>CSTA-3A-AP-18 - Create artifacts by using procedures within a program, combinations of data and procedures, or independent but interrelated programs.</p> <p>CSTA-3B-AP-11 - Evaluate algorithms in terms of their efficiency, correctness, and clarity.</p> <p>CSTA-3B-AP-14 - Construct solutions to problems using student-created components, such as procedures, modules and/or objects.</p> <p>CSTA-3B-AP-16 - Demonstrate code reuse by creating programming solutions using libraries and APIs</p> <p>CSTA-3B-AP-22 - Modify an existing program to add additional functionality and discuss intended and unintended implications (e.g., breaking other functionality).</p>		
Technology Standard(s) (Established Goals)		
<p>TECH.8.1.12.A.CS1 - [Content Statement] - Understand and use technology systems.</p> <p>TECH.8.1.12.B.CS1 - [Content Statement] - Apply existing knowledge to generate new ideas, products, or processes.</p> <p>TECH.8.1.12.B.CS2 - [Content Statement] - Create original works as a means of personal or group expression.</p> <p>TECH.8.1.12.D.1 - [Cumulative Progress Indicator] - Demonstrate appropriate application of copyright, fair use and/or Creative Commons to an original work.</p> <p>TECH.8.1.12.D.5 - [Cumulative Progress Indicator] - Analyze the capabilities and limitations of current and emerging technology resources and assess their potential to address personal, social, lifelong learning, and career needs.</p> <p>TECH.8.2.12.A.CS2 - [Content Statement] - The core concepts of technology.</p> <p>TECH.8.2.12.A.CS3 - [Content Statement] - The relationships among technologies and the connections between technology and other fields of study.</p> <p>TECH.8.2.12.D.CS1 - [Content Statement] - Apply the design process</p> <p>TECH.8.2.12.E.3 - [Cumulative Progress Indicator] - Use a programming language to solve problems or accomplish a task (e.g., robotic functions,</p>		

website designs, applications, and games).

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

Enduring Understandings: (What are the big ideas? What specific understandings about them are desired? What misunderstandings are predictable?)

- **2. Abstraction**
 - *2.2 Multiple levels of abstraction are used to write programs or to create other computational artifacts.*
- **4. Algorithms**
 - *4.1 Algorithms are precise sequences of instructions for processes that can be executed by a computer and are implemented using programming languages.*
 - *4.2 Algorithms can solve many but not all problems.*
- **5. Programming**
 - *5.1 Programs can be developed to solve problems (to help people, organizations or society); for creative expression; to satisfy personal curiosity or to create new knowledge.*
 - *5.3 Programming is facilitated by appropriate abstractions.*
 - *5.4 Programs are developed, maintained, and used by people for different purposes.*
- **7. Global Impact**
 - *7.1 Computing enhances communication, interaction, and cognition.*

Essential Question(s) : (What provocative questions will foster inquiry, understanding, and transfer of learning?)

Guiding Questions:

- How are multiple levels of abstraction used to create computational artifacts?
- In what ways are some algorithms better than others?
- What limits do algorithms have?

In this unit plan, the following 21st Century themes and skills are addressed:

Check all that apply.		Indicate whether these skills are E -Encouraged, T -Taught, or A -Assessed in this unit by marking E , T , A on the line before the appropriate skill.	
21 st Century Themes		21 st Century Skills	
	Global Awareness	T,A	Critical Thinking & Problem Solving
	Environmental Literacy	T	Creativity and Innovation
	Health Literacy	T	Collaboration, Teamwork and Leadership
E	Civic Literacy	T	Cross-Cultural and Interpersonal Communication

T,A

Financial, Economic, Business and Entrepreneurial Literacy

T,A

Communication and Media Fluency

T

Accountability, Productivity and Ethics

In this unit plan, the following Career Ready Practices are addressed:

Indicate whether these skills are *E-Encouraged*, *T-Taught*, or *A-Assessed* in this unit by marking *E, T, A* on the line before the appropriate skill.

E,T,A

CRP1. Act as a responsible and contributing citizen and employee

CRP2. Apply appropriate academic and technical skills

CRP3. Attend to personal health and financial well-being

E

CRP4. Communicate clearly and effectively with reason

E

CRP5. Consider the environmental, social and economic impacts of decisions

T,A

CRP6. Demonstrate creativity and innovation

CRP7. Employ valid and reliable research strategies

T,A

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them

CRP9. Model integrity, ethical leadership and effective management

E

CRP10. Plan education and career paths aligned to personal goals

T,A

CRP11. Use technology to enhance productivity

T

CRP12. Work productively in teams while using cultural global competence

Student Learning Goals/Objectives: (What key knowledge and skills will students acquire as a result of this unit? What should they eventually be able to do as a result of such knowledge and skill?)

Learning Objective 2.2.1 Develop an abstraction when writing a program or creating other computational artifacts.

Learning Objective 2.2.2 Use multiple levels of abstraction to write programs.

Learning Objective 4.1.1 Develop an algorithm for implementation in a program.

Learning Objective 4.1.2 Express an algorithm in a language.

Learning Objective 4.2.2 Explain the difference between solvable and unsolvable problems in computer science. (Exclusion statement: Determining whether a given problem is solvable or unsolvable is beyond the scope of this course and AP Exam.)

Learning Objective 4.2.3 Explain the existence of undecidable problems in computer science.

Learning Objective 4.2.4 Evaluate algorithms analytically and empirically for efficiency, correctness, and clarity.

Learning Objective 5.1.2 Develop a correct program to solve problems.

Learning Objective 5.3.1 Use abstraction to manage complexity in programs.

Learning Objective 5.4.1 Evaluate the correctness of a program.

Learning Objective 7.1.1 Explain how computing innovations affect communication, interaction, and cognition.

Learning Objective 7.1.2 Explain how people participate in a problem-solving process that scales.

Key Vocabulary and Terms:

background: multitasking computers are capable of executing several tasks, or programs, at the same time

binary: pertaining to a number system that has just two unique digits

bot: short for robot, a computer program that runs automatically.

cache: a special high-speed storage mechanism

firewall: a part of a computer system or network that is designed to prevent unauthorized access to or from that network

foreground: in multiprocessing systems, the process that is currently accepting input from the keyboard or other input device

HTML: hypertext markup language, a standardized system for tagging text files to achieve font, color, graphic, and hyperlink effects on World Wide Web pages

URL: (uniform resource locator) it is the global address of documents and other resources on the World Wide Web

Assessment Evidence:

Performance Tasks: *(Through what authentic performance tasks will students demonstrate the desired understandings? By what criteria will performances of understanding be judged?)*

Completed App

Labs: Android Mash (App Inventor), Android Mash Projects (App Inventor), Coin Flip (App Inventor), Coin Flip Projects (App Inventor)

End of Unit Practical Drills

Other Assessment Measures: *(Through what other evidence (E.g. quizzes, tests, academic prompts, observations, homework, journals, etc.) will students demonstrate achievement of the desired results? How will students reflect upon and self- assess their learning?)* *****Attach all**

Benchmarks

Portfolio Reflection

Self-Check Exercises

Student Discussion

Unit Test

Teaching and Learning Actions: *(What learning experiences and instruction will enable students to achieve the desired results?)*

Instructional Strategies and Activities

D

Consider how will the design will:

W = Help the students know Where the unit is going and What is expected? Help the teacher know Where the students are coming from (prior knowledge and interests)?

H= Hook all students and Hold their interest?

E= Equip students, help the Experience the key ideas and Explore the issue?

R=Provide opportunities to Rethink and Revise their understandings and work?

E=Allow students to Evaluate their work and its implications?

T=be Tailored (personalized to the different needs, interests and abilities of learners?)

O=be Organized to maximize initial and sustained engagement as well as effective learning?

Resources	
Online curriculum website http://teach.mobilecsp.org Online student website https://ram8647.appspot.com/mobileCSP/unit?unit=19	
Suggested Time Frame:	4 weeks (14 class periods)

D – Indicates differentiation at the Lesson Level (Identify Modifications for ELL, Gifted and Talented, Title 1, Special Education)

Course Title:	AP Computer Science Principles	Grade(s) 10-12
Unit Plan Title:	Unit 6: Using and Analyzing Data and Information (Creativity, Data and Information, Programming, & Impact)	
Overview/Rationale		
Unit 6 focuses on various aspects of using and manipulating Data, both within mobile apps and on the Web and Internet. The App Inventor lessons in this unit focus on different types of programming data, including variables and structured data, such as lists and databases. Students build apps that involve persistent data, data that persists from one instance of the app to another, and learn how to share data online by using simple Application Programming Interfaces (APIs), such as the Google Fusion table API. This unit’s CS Principles lessons build toward EU 3.1, EU 3.2, EU 7.1, EU 7.2, and EU 7.5 by focusing on the concept of Big Data and its growing importance and its impact on society. Students are also introduced to the some of the algorithms for processing massive datasets.		
Standard(s) Number and Description		
CSTA-3A-DA-11 - Create interactive data visualizations using software tools to help others better understand real-world phenomena.		
CSTA-3A-IC-29 - Explain the privacy concerns related to the collection and generation of data through automated processes that may not be evident to users.		
CSTA-3B-DA-05 - Use data analysis tools and techniques to identify patterns in data representing complex systems.		
CSTA-3B-DA-06 - Select data collection tools and techniques to generate data sets that support a claim or communicate information.		
Technology Standard(s) (Established Goals)		
TECH.8.1.12 - [Standard] - All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.		
TECH.8.1.12.A - [Strand] - Students demonstrate a sound understanding of technology concepts, systems and operations		
TECH.8.1.12.A.5 - [Cumulative Progress Indicator] - Create a report from a relational database consisting of at least two tables and describe the process, and explain the report results.		
TECH.8.1.12.D.2 - [Cumulative Progress Indicator] - Evaluate consequences of unauthorized electronic access (e.g., hacking) and disclosure, and on dissemination of personal information.		
TECH.8.1.12.D.3 - [Cumulative Progress Indicator] - Compare and contrast policies on filtering and censorship both locally and globally.		
TECH.8.1.12.D.CS3 - [Content Statement] - Exhibit leadership for digital citizenship.		
TECH.8.1.12.D.4 - [Cumulative Progress Indicator] - Research and understand the positive and negative impact of one’s digital footprint.		
TECH.8.1.12.F.CS3 - [Content Statement] - Collect and analyze data to identify solutions and/or make informed decisions.		
TECH.8.2.12.A.CS2 - [Content Statement] - The core concepts of technology.		
TECH.8.2.12.B.CS3 - [Content Statement] - The role of society in the development and use of technology.		
TECH.8.2.12.B.3 - [Cumulative Progress Indicator] - Analyze ethical and unethical practices around intellectual property rights as influenced by human wants and/or needs.		
TECH.8.2.12.D.6 - [Cumulative Progress Indicator] - Synthesize data, analyze trends and draw conclusions regarding the effect of a technology on the individual, society, or the environment and publish conclusions.		
TECH.8.2.12.E.3 - [Cumulative Progress Indicator] - Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).		
TECH.8.2.12.E.4 - [Cumulative Progress Indicator] - Use appropriate terms in conversation (e.g., troubleshooting, peripherals, diagnostic software,		

GUI, abstraction, variables, data types and conditional statements).

Enduring Understandings: (What are the big ideas? What specific understandings about them are desired? What misunderstandings are predictable?)

- **1. Creativity**
 - *1.2 Computing enables people to use creative development processes when using computing tools and techniques to create computational artifacts for creative expression of ideas or to solve a problem.*
- **3. Data and Information**
 - *3.1 People use computer programs to process information to gain insight and knowledge.*
 - *3.2 Computing facilitates exploration and the discovery of connections in information.*
 - *3.3 There are trade-offs when representing information as digital data.*
- **5. Programming**
 - *5.1 Programs can be developed to solve problems (to help people, organizations or society); for creative expression; to satisfy personal curiosity or to create new knowledge.*
 - *5.2 People write programs to execute algorithms.*
 - *5.3 Programming is facilitated by appropriate abstractions.*
 - *5.5 Programming uses mathematical and logical concepts.*
- **7. Global Impact**
 - *7.1 Computing enhances communication, interaction, and cognition.*
 - *7.2 Computing enables innovation in nearly every field.*
 - *7.3 Computing has global effects — both beneficial and harmful — on people and society.*

Essential Question(s) : (What provocative questions will foster inquiry, understanding, and transfer of learning?)

Guiding Questions:

- How does continuous access to large amounts of data change how people and organizations make decisions?
- How do computers put things in order and find things in a list?
- What is the connection between data, information, knowledge, and wisdom?

In this unit plan, the following 21st Century themes and skills are addressed:

Check all that apply.		Indicate whether these skills are E -Encouraged, T -Taught, or A -Assessed in this unit by marking E , T , A on the line before the appropriate skill.	
21 st Century Themes		21 st Century Skills	
<input type="checkbox"/>	Global Awareness	<input type="checkbox"/>	Critical Thinking & Problem Solving
<input type="checkbox"/>	Environmental Literacy	<input type="checkbox"/>	Creativity and Innovation

	Health Literacy
E	Civic Literacy
T,A	Financial, Economic, Business and Entrepreneurial Literacy

T	Collaboration, Teamwork and Leadership
T	Cross-Cultural and Interpersonal Communication
T	Communication and Media Fluency
	Accountability, Productivity and Ethics

In this unit plan, the following Career Ready Practices are addressed:

Indicate whether these skills are E-Encouraged, T-Taught, or A-Assessed in this unit by marking E, T, A on the line before the appropriate skill.

E	CRP1. Act as a responsible and contributing citizen and employee
T,A	CRP2. Apply appropriate academic and technical skills
	CRP3. Attend to personal health and financial well-being
T	CRP4. Communicate clearly and effectively with reason
E	CRP5. Consider the environmental, social and economic impacts of decisions
T	CRP6. Demonstrate creativity and innovation
	CRP7. Employ valid and reliable research strategies
T,A	CRP8. Utilize critical thinking to make sense of problems and persevere in solving them
	CRP9. Model integrity, ethical leadership and effective management
	CRP10. Plan education and career paths aligned to personal goals
T	CRP11. Use technology to enhance productivity
	CRP12. Work productively in teams while using cultural global competence

Student Learning Goals/Objectives: (What key knowledge and skills will students acquire as a result of this unit? What should they eventually be able to do as a result of such knowledge and skill?)

Learning Objective 1.2.1 Create a computational artifact for creative expression.

Learning Objective 1.2.2 Create a computational artifact using computing tools and techniques to solve a problem.

Learning Objective 1.2.3 Create a new computational artifact by combining or modifying existing artifacts.

Learning Objective 3.1.1 Use computers to process information, find patterns, and test hypotheses about digitally processed information to gain insight and knowledge.

Learning Objective 3.1.2 Collaborate when processing information to gain insight and knowledge.

Learning Objective 3.1.3 Explain the insight and knowledge gained from digitally processed data by using appropriate visualizations, notations, and

precise language.

Learning Objective 3.2.1 Extract information from data to discover and explain connections, patterns, or trends.

Learning Objective 3.2.2 Use large data sets to explore and discover information and knowledge.

Learning Objective 3.3.1 Analyze how data representation, storage, security, and transmission of data involve computational manipulation of information.

Learning Objective 5.1.2 Develop a correct program to solve problems.

Learning Objective 5.3.1 Use abstraction to manage complexity in programs.

Learning Objective 5.5.1 Employ appropriate mathematical and logical concepts in programming.

Learning Objective 7.1.1 Explain how computing innovations affect communication, interaction, and cognition.

Learning Objective 7.2.1 Explain how computing has impacted innovations in other fields.

Learning Objective 7.3.1 Analyze the beneficial and harmful effects of computing.

Key Vocabulary and Terms:

centralized systems: collect files at a central computer for people to download

commons: a system of sharing that minimizes the need for fine-grained property restrictions

DRAM: dynamic random access memory

DRM: digital rights management

flooding: each computer in a file-sharing network maintains a list of other computers in the network.

gigabyte: 1,024 megabytes or 1,073,741,824 bytes

peer-to-peer architecture: a type of network in which each workstation has equivalent capabilities and responsibilities

piracy: the unauthorized use or reproduction of another's work

sealed storage: an application that lets you encrypt files in such a way that they can be decrypted only on particular computers that you specify.

TPM: trusted platform module

Assessment Evidence:

Performance Tasks: *(Through what authentic performance tasks will students demonstrate the desired understandings? By what criteria will performances of understanding be judged?)*

Completed App

Labs: Presidents Quiz (App Inventor), Presidents Quiz Projects (App Inventor), Lists of Lists (App Inventor), Data Persistence Projects (App Inventor), Fusion Table App (App Inventor and Google Fusion Tables)
End of Unit Practical Drills

Other Assessment Measures: *(Through what other evidence (E.g. quizzes, tests, academic prompts, observations, homework, journals, etc.) will students demonstrate achievement of the desired results? How will students reflect upon and self-assess their learning?)* *****Attach all**

Benchmarks

Portfolio Reflection
Self-Check Exercises
Student Discussion
Unit Test

Teaching and Learning Actions: *(What learning experiences and instruction will enable students to achieve the desired results?)*

Instructional Strategies and

Consider how will the design will:

W = Help the students know Where the unit is going and What is expected? Help the teacher know Where the

<p><i>D</i></p> <p><i>Activities</i></p>	<p>students are coming from (prior knowledge and interests)?</p> <p>H= Hook all students and Hold their interest?</p> <p>E= Equip students, help the Experience the key ideas and Explore the issue?</p> <p>R=Provide opportunities to Rethink and Revise their understandings and work?</p> <p>E=Allow students to Evaluate their work and its implications?</p> <p>T=be Tailored (personalized to the different needs, interests and abilities of learners?</p> <p>O=be Organized to maximize initial and sustained engagement as well as effective learning?</p>
<p>Resources</p>	
<p>Online curriculum website http://teach.mobilecsp.org Online student website https://ram8647.appspot.com/mobileCSP/unit?unit=19</p>	
<p>Suggested Time Frame:</p>	<p>4 weeks (14 class periods)</p>

D – Indicates differentiation at the Lesson Level (Identify Modifications for ELL, Gifted and Talented, Title 1, Special Education)

Course Title:	AP Computer Science Principles	Grade(s) 10-12
Unit Plan Title:	Unit 7: Communication Through The Internet (Creativity, Programming, The Internet, & Impact)	
Overview/Rationale		
Unit 7 focuses on the Internet, one of the big ideas in computer science. The App Inventor lessons in this unit show different ways to use the internet in apps, including the ability to send text messages over Wifi, finding directions via the Google Maps API. The CS Principles lessons focus on the Internet, how it works, how it enables innovation and collaboration, and security concerns for using it.		
Standard(s) Number and Description		
CSTA-3A-NI-04 -Evaluate the scalability and reliability of networks, by describing the relationship between routers, switches, servers, topology, and addressing.		
CSTA-3A-NI-05 -Give examples to illustrate how sensitive data can be affected by malware and other attacks.		
CSTA-3A-NI-06 -Recommend security measures to address various scenarios based on factors such as efficiency, feasibility, and ethical impacts.		
CSTA-3A-NI-07 -Compare various security measures, considering tradeoffs between the usability and security of a computing system.		
CSTA-3A-NI-08 -Explain tradeoffs when selecting and implementing cybersecurity recommendations		
CSTA-3B-NI-03 -Describe the issues that impact network functionality (e.g., bandwidth, load, delay, topology).		
Technology Standard(s) (Established Goals)		
TECH.8.1.12 - [Standard] - All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.		
TECH.8.1.12.A - [Strand] - Students demonstrate a sound understanding of technology concepts, systems and operations.		
TECH.8.1.12.A.CS1 - [Content Statement] - Understand and use technology systems.		
TECH.8.1.12.D.1 - [Cumulative Progress Indicator] - Demonstrate appropriate application of copyright, fair use and/or Creative Commons to an original work.		
TECH.8.1.12.D.CS2 - [Content Statement] - Demonstrate personal responsibility for lifelong learning.		
TECH.8.1.12.D.5 - [Cumulative Progress Indicator] - Analyze the capabilities and limitations of current and emerging technology resources and assess their potential to address personal, social, lifelong learning, and career needs.		
TECH.8.2.12.A.CS2 - [Content Statement] - The core concepts of technology.		
TECH.8.2.12.D.CS2 - [Content Statement] - Use and maintain technological products and systems.		
TECH.8.2.12.D.CS3 - [Content Statement] - Assess the impact of products and systems.		
TECH.8.2.12.E.3 - [Cumulative Progress Indicator] - Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).		
TECH.8.2.12.E.4 - [Cumulative Progress Indicator] - Use appropriate terms in conversation (e.g., troubleshooting, peripherals, diagnostic software, GUI, abstraction, variables, data types and conditional statements).		
TECH.8.2.12.E.CS1 - [Content Statement] - Computational thinking and computer programming as tools used in design and engineering.		
TECH.8.2.12.E.1 - [Cumulative Progress Indicator] - Demonstrate an understanding of the problem-solving capacity of computers in our world.		

Enduring Understandings: (What are the big ideas? What specific understandings about them are desired? What misunderstandings are predictable?)

- **1. Creativity**
 - *1.2 Computing enables people to use creative development processes when using computing tools and techniques to create computational artifacts for creative expression of ideas or to solve a problem.*
- **5. Programming**
 - *5.3 Programming is facilitated by appropriate abstractions.*
- **6. The Internet**
 - *6.1 The Internet is a network of autonomous systems.*
 - *6.2 Characteristics of the Internet influence the systems built on it.*
 - *6.3 Cybersecurity is an important concern for the Internet and the systems built on it.*
- **7. Global Impact**
 - *7.1 Computing enhances communication, interaction, and cognition.*
 - *7.3 Computing has a global affect - both beneficial and harmful - on people and society.*
 - *7.4 Computing innovations influence and are influenced by the economic, social, and cultural contexts in which they are designed and used.*

Essential Question(s) : (What provocative questions will foster inquiry, understanding, and transfer of learning?)

Guiding Questions:

- What is the Internet, how is it built, and how does it function?
- What aspects of the Internet's design and development have helped it scale and flourish?
- How is cybersecurity impacting the ever increasing number of Internet users?

In this unit plan, the following 21st Century themes and skills are addressed:

Check all that apply.		Indicate whether these skills are E -Encouraged, T -Taught, or A -Assessed in this unit by marking E , T , A on the line before the appropriate skill.	
21 st Century Themes		21 st Century Skills	
<input type="checkbox"/>	Global Awareness	<input type="checkbox"/>	Critical Thinking & Problem Solving
<input type="checkbox"/>	Environmental Literacy	<input type="checkbox"/>	Creativity and Innovation
<input type="checkbox"/>	Health Literacy	<input type="checkbox"/>	Collaboration, Teamwork and Leadership
<input type="checkbox"/>	Civic Literacy	<input type="checkbox"/>	Cross-Cultural and Interpersonal Communication
<input type="checkbox"/>	Financial, Economic, Business and Entrepreneurial Literacy	<input type="checkbox"/>	Communication and Media Fluency
		<input type="checkbox"/>	Accountability, Productivity and Ethics

In this unit plan, the following Career Ready Practices are addressed:

Indicate whether these skills are E-Encouraged, T-Taught, or A-Assessed in this unit by marking E, T, A on the line before the appropriate skill.

E	CRP1. Act as a responsible and contributing citizen and employee
T,A	CRP2. Apply appropriate academic and technical skills
	CRP3. Attend to personal health and financial well-being
T	CRP4. Communicate clearly and effectively with reason
T	CRP5. Consider the environmental, social and economic impacts of decisions
	CRP6. Demonstrate creativity and innovation
	CRP7. Employ valid and reliable research strategies
E	CRP8. Utilize critical thinking to make sense of problems and persevere in solving them
	CRP9. Model integrity, ethical leadership and effective management
	CRP10. Plan education and career paths aligned to personal goals
T,A	CRP11. Use technology to enhance productivity
T	CRP12. Work productively in teams while using cultural global competence

Student Learning Goals/Objectives: (What key knowledge and skills will students acquire as a result of this unit? What should they eventually be able to do as a result of such knowledge and skill?)

Learning Objective 1.2.2 Create a computational artifact using computing tools and techniques to solve a problem.

Learning Objective 5.2.1 Explain how programs implement algorithms.

Learning Objective 6.1.1 Explain the abstractions in the Internet and how the Internet functions. (Exclusion statement: Specific devices used to implement the abstractions in the Internet are beyond the scope of this course and the AP Exam.)

Learning Objective 6.2.1 Explain characteristics of the Internet and the systems built on it.

Learning Objective 6.2.2 Explain how the characteristics of the Internet influence the systems built on it.

Learning Objective 6.3.1 Identify existing cybersecurity concerns and potential options to address these issues with the Internet and the systems built on it.

Learning Objective 7.1.1 Explain how computing innovations affect communication, interaction, and cognition.

Learning Objective 7.3.1 Analyze the beneficial and harmful effects of computing.

Learning Objective 7.4.1 Explain the connections between computing and economic, social and cultural context.

Key Vocabulary and Terms:

AES: advanced encryption standard, a symmetric 128-bit block data encryption technique

certification authority: (CA), a trusted organization or company that issues digital certificates used to create digital signatures and public-private key pairs

cipher text: data that has been encrypted

DES: data encryption standard, a popular symmetric-key encryption method that uses a 56-bit key and uses a block cipher method which breaks text into 64-bit blocks and then encrypts them

decryption: the process of decoding data that has been encrypted into a secret format

encryption: the translation of data into secret code

packet: a piece of message transmitted over a packet-switching network

plain text: refers to textual data in ASCII format. Plain text is the most portable format because it is supported by nearly every application on every

Machine Router: a device that forwards data packets along networks. A router is connected to at least two networks are located at gateways

Assessment Evidence:

Performance Tasks: *(Through what authentic performance tasks will students demonstrate the desired understandings? By what criteria will performances of understanding be judged?)*

Labs: No Texting While Busy (App Inventor), My Directions (App Inventor and Google Maps APIs), Broadcast Hub (App Inventor)

Other Assessment Measures: *(Through what other evidence (E.g. quizzes, tests, academic prompts, observations, homework, journals, etc.) will students demonstrate achievement of the desired results? How will students reflect upon and self- assess their learning?)* *****Attach all**

Benchmarks

Portfolio Reflection
Self-Check Exercises
Student Discussion
Completed App

Teaching and Learning Actions: (What learning experiences and instruction will enable students to achieve the desired results?)

Instructional Strategies and Activities

D

Consider how will the design will:

W = Help the students know Where the unit is going and What is expected? Help the teacher know Where the students are coming from (prior knowledge and interests)?

H= Hook all students and Hold their interest?

E= Equip students, help the Experience the key ideas and Explore the issue?

R=Provide opportunities to Rethink and Revise their understandings and work?

E=Allow students to Evaluate their work and its implications?

T=be Tailored (personalized to the different needs, interests and abilities of learners?)

O=be Organized to maximize initial and sustained engagement as well as effective learning?

Resources

Online curriculum website

<http://teach.mobilecsp.org>

Online student website

<https://ram8647.appspot.com/mobileCSP/unit?unit=19>

Suggested Time Frame:

3 weeks (12 class periods)

D – Indicates differentiation at the Lesson Level (Identify Modifications for ELL, Gifted and Talented, Title 1, Special Education)