Exploring Computer Science

Curriculum Mapping to Learning Standards

State Standards Edition

Draft Version 0.1 | SRI International

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Day by Day Mapping to State Learning Standards

UNIT 1. HUMAN COMPUTER INTERACTION

Instructional Days: 1-2

Topic: Explore the concepts of computer and computing:

- Students identify computers in the room.
- Students classify the computes into computing groups.
- Students define the terms computer and computing.
- Students are introduced to the Compute Buying Project assignment.

ECS Focus

1.1 Hardware components

Computational Practices

- Analyze the characteristics of hardware components.

Standards

California Standards
• None

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ 2.3 Interpret verbal [and nonverbal] communications and respond appropriately.
  ○ 10.1 Interpret and explain terminology [and practices] specific to the Information and Communication Technologies sector.
• Potentially Implied
  ○ 2.4 Demonstrate elements of written [and electronic] communication such as accurate spelling, grammar, and format.
  ○ 2.7 Use technical writing and communication skills to work effectively with diverse groups of people.
  ○ 2.8 Understand the principles of a customer-oriented service approach to users.
  ○ 9.2 Identify the characteristics of successful teams, including leadership, cooperation, collaboration, and effective decision-making skills as applied in groups, teams, and career technical student organization activities.
  ○ 9.3 Understand the characteristics and benefits of teamwork, [leadership, and citizenship] in the school, community, and workplace setting.
  ○ A2.1 Identify and list the criteria [and processes] for evaluating the functions of information systems.

Common Core Standards

- Anchor Standards
  - CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.

CSTA K-12 Computer Science Standards

- CD.L2-02: Identify a variety of electronic devices that contain computational processors.
- CD.L2-04: Use developmentally appropriate, accurate terminology when communicating about technology.

ISTE National Educational Technology Standards (NETS)

- 6a. Understand and use technology systems.

UNIT 1. HUMAN COMPUTER INTERACTION

Instructional Days: 3-4

Topic: "Demystify" and learn the function of the parts of a personal computer. Learn the terminology of hardware components necessary for the purchase of a home computer:

- Student groups work to choose one of the interviews from the previous day, research four options and give advice on which computer to buy.
- Student groups present their findings to the class.
- Students reason as to why something is or is not a computer.
- Students classify computers
- Students interview a family member of friend to find out what features that person would like to have if they were buying a new personal computer

ECS Focus

1.1 Hardware components
1.3 Software components
1.3 Interaction of appropriate components

Computational Practices

- Work effectively in teams
- Communicate thought processes and results

Standards

California Standards
• None

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ 10.1 Interpret and explain terminology [and practices] specific to the Information and Communication Technologies sector.
  ○ 10.5 Understand the major [software and] hardware components of a computer [and a network and how they relate to each other].
  ○ 10.6 Understand data sizes of various types of information (text, pictures, sound, video, etc.) and data capacity of various forms of media.
• Potentially Implied
  ○ 2.3 Interpret verbal [and nonverbal] communications and respond appropriately.
  ○ 2.4 Demonstrate elements of written [and electronic] communication such as accurate spelling, grammar, and format.
  ○ 2.7 Use technical writing and communication skills to work effectively with diverse groups of people.

- 2.8 Understand the principles of a customer-oriented service approach to users.
- 4.1 Use [electronic] reference materials to gather information and produce products and services.
- 7.4 Practice time management and efficiency to fulfill responsibilities.
- 7.5 Apply high-quality techniques to product or presentation design and development.
- 9.2 Identify the characteristics of successful teams, including leadership, cooperation, collaboration, and effective decision-making skills as applied in groups, teams, and career technical student organization activities.
- 9.3 Understand the characteristics and benefits of teamwork, [leadership, and citizenship] in the school, community, and workplace setting.
- 9.7 Participate in interactive teamwork to solve real Information and Communication Technologies sector issues and problems.
- A2.1 Identify and list the criteria [and processes] for evaluating the functions of information systems.
- A2.2 Investigate, evaluate, select, and [use] major types of [software, services, and] vendors.

Common Core Standards

- Anchor Standards
  - CCSS.ELA-Literacy.CCRA.W.8 Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.
  - CCSS.ELA-Literacy.CCRA.SL.2 Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.
  - CCSS.ELA-Literacy.CCRA.SL.4 Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.
  - CCSS.ELA-Literacy.CCRA.L.6 Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when encountering an unknown term important to comprehension or expression.

CSTA K-12 Computer Science Standards

- CPP.L2-08: Demonstrate dispositions amenable to open- ended problem solving and programming (e.g., comfort with complexity, persistence, brainstorming, adaptability, patience, propensity to tinker, creativity, accepting challenge).
- CL.L2-02: Collaboratively design, develop, publish, and present products (e.g., videos, podcasts, websites) using technology resources that demonstrate and communicate curriculum concepts.
- CL.L2-03: Collaborate with peers, experts, and others using collaborative practices such

as pair programming, working in project teams, and participating in group active learning activities.
- CL.L2-04: Exhibit dispositions necessary for collaboration: providing useful feedback, integrating feedback, understanding and accepting multiple perspectives, socialization.
- CD.L3A-02: Develop criteria for purchasing or upgrading computer system hardware.
- CD.L3A-03: Describe the principal components of computer organization (e.g., input, output, processing, and storage).
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ISTE National Educational Technology Standards (NETS)

- 2b. Communicate information and ideas effectively to multiple audiences using a variety of digital environments and media.
- 2d. Contribute to project teams to produce original works or solve problems.
- 3b. Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.
- 4b. Plan and manage activities to develop a solution or complete a project.
- 6a. Understand and use technology systems.

UNIT 1. HUMAN COMPUTER INTERACTION

Instructional Days: 5-7

Topic: Explore the World Wide Web and search engines. Experiment with a variety of search techniques, Internet resources, and Web 2.0, applications. Evaluate websites:

- Students perform searches and explain how to refine searches to retrieve better information by completing an Internet Scavenger Hunt.
- Students identify resources for finding information in addition to ranking based search engines.
- Students differentiate between ranking based search engines and social bookmarking (collaborative) search engines.
- Use a variety of Web 2.0 applications in a jigsaw activity.
- Students share their experience with Web2.0 applications like delicious.com, stumbleupon.com, word cloud sites, and list creation sites with class.
- Develop and use a rubric to evaluate websites.

ECS Focus

1.5 Search Engine Fundamentals
1.7 Evaluating Websites

Computational Practices

- Analyze the effects of developments in Computing

Standards

California Standards
• None

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ 4.4 Discern the quality and value of information collected using digital technologies, and recognize bias and intent of the associated sources.
  ○ 10.12 Know appropriate search procedures for different types of information, sources, and queries.
  ○ 10.13 Evaluate the accuracy, relevance, and comprehensiveness of retrieved information.
  ○ A3.5 Use multiple online search techniques and resources to acquire information.
• Potentially Implied
  ○ 2.3 Interpret verbal [and nonverbal] communications and respond appropriately.
  ○ 2.4 Demonstrate elements of written [and electronic] communication such as accurate spelling, grammar, and format.

- 2.6 [Advocate and] practice safe, [legal,] and responsible use of digital media information and communications technologies.
- 9.2 Identify the characteristics of successful teams, including leadership, cooperation, collaboration, and effective decision-making skills as applied in groups, teams, and career technical student organization activities.
- 9.3 Understand the characteristics and benefits of teamwork, [leadership, and citizenship] in the school, community, and workplace setting.
- 9.7 Participate in interactive teamwork to solve real Information and Communication Technologies sector issues and problems.

Common Core Standards

- Anchor Standards
  - CCSS.ELA-Literacy.CCRA.W.8 Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.
  - CCSS.ELA-Literacy.CCRA.R.2 Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
  - CCSS.ELA-Literacy.CCRA.W.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.
  - CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
- Mathematical Practice
  - CCSS.Math.Practice.MP5 Use appropriate tools strategically.

CSTA K-12 Computer Science Standards

- CI.L2-04: Evaluate the accuracy, relevance, appropriateness, comprehensiveness, and bias of electronic information sources concerning real-world problems.
- CI.L2-05: Describe ethical issues that relate to computers and networks (e.g., security, privacy, ownership, and information sharing).
- CPP.L3A-09: Explain the principles of security by examining encryption cryptography, and authentication techniques. MARIE DISAGREES
- CI.L3A-05: Describe strategies for determining the reliability of information found on the Internet.
- CI.L3A-10: Describe security and privacy issues that relate to computer networks.

ISTE National Educational Technology Standards (NETS)

- 3b. Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.
- 3c. Evaluate and select information sources and digital tools based on the appropriateness to specific tasks.

UNIT 1. HUMAN COMPUTER INTERACTION

Instructional Days: 8-9

Topic: Examine the implications of data on society and how computers are used for communications

- Students identify communication mechanisms.
- Students work in pairs to complete a Communication Methods Chart in which they look at different ways to communicate with each other.
- Students reflect on the impact of changes to communication on society.
- Students work in groups to do a scenario based activity to analyze legal and privacy issues with private online data and make class presentations.

ECS Focus

7.1 Legal and ethical concerns
7.3 Privacy and cyber security
7.4 Exploitation of information
7.7 Cultural influence

Computational Practices

- Analyze the effects of developments in Computing

Standards

California Standards
• None

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ 8.8 Identify legal and ethical issues that have proliferated with increased technology adoption, including [hacking, scamming, and] breach of privacy.
• Potentially Implied
  ○ 2.1 Recognize the elements of communication using a sender–receiver model.
  ○ 2.3 Interpret verbal [and nonverbal] communications and respond appropriately.
  ○ 2.4 Demonstrate elements of written [and electronic] communication such as accurate spelling, grammar, and format.
  ○ 2.6 [Advocate and] practice safe, [legal,] and responsible use of digital media information and communications technologies.
  ○ 9.2 Identify the characteristics of successful teams, including leadership, cooperation, collaboration, and effective decision-making skills as applied in groups, teams, and career technical student organization activities.
  ○ 9.3 Understand the characteristics and benefits of teamwork, [leadership, and

citizenship] in the school, community, and workplace setting.
    - 9.5 Understand that the modern world is an international community and requires an expanded global view.

Common Core Standards

- Anchor Standards
    - CCSS.ELA-Literacy.CCRA.W.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.
    - CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.

CSTA K-12 Computer Science Standards

- CI.L2-02: Demonstrate knowledge of changes in information technologies over time and the effects those changes have on education, the workplace, and society.
- CD.L3A-09: Describe how the Internet facilitates global communication.
- CI.L3A-04: Compare the positive and negative impacts of technology on culture (e.g., social networking, delivery of news and other public media, and intercultural communication).

ISTE National Educational Technology Standards (NETS)

- 4b. Plan and manage activities to develop a solution or complete a project.
- 5a. Advocate and practice safe, legal, and responsible use of information technology.

UNIT 1. HUMAN COMPUTER INTERACTION

Instructional Days: 10

Topic: Tell a story with data

- Students work in groups and learn how different views of data can tell a different story.
- Students learn that data is an incomplete record of reality.
- Students describe the limits of measurement (what can and can't be captured in data).

ECS Focus

6.3 Patterns, trends, and discoveries

Computational Practices

- Work effectively in teams
- Communicate thought processes and results

Standards

California Standards
• Geometry California Standards Test - Logic and Geometric Proofs Cluster: Students construct and judge the validity of a logical argument and give counterexamples to disprove a statement. (3.0)

California CTE Standards – Information and Communication Technologies

• Potentially Implied
  ○ 2.3 Interpret verbal [and nonverbal] communications and respond appropriately.
  ○ 2.4 Demonstrate elements of written [and electronic] communication such as accurate spelling, grammar, and format.

Common Core Standards

• Anchor Standards
  ○ CCSS.ELA-Literacy.CCRA.W.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.
  ○ CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
  ○ CCSS.ELA-Literacy.CCRA.SL.2 Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.

CSTA K-12 Computer Science Standards
• CT.L2-07: Represent data in a variety of ways including text, sounds, pictures, and

numbers

- CT.L3B-05: Use data analysis to enhance understanding of complex natural and human systems.
- CL.L3A-03: Describe how computing enhances traditional forms and enables new forms of experience, expression, communication, and collaboration.

ISTE National Educational Technology Standards (NETS)
• 3d. Process data and report results.

UNIT 1. HUMAN COMPUTER INTERACTION

Instructional Days: 11-14

Topic: Explore how computers are used as a tool for visualizing data, modeling and design, and art in the context of culturally situated design tools:

- Students learn to use computers as a tool for visualizing data, modeling and design, and art in the context of culturally situated design tools.
- Students identify mathematical connections in the output of the design tools.
- Students use Photoshop or other image editing tools to edit their image.
- Students work in groups to make creative designs using the tools presented in the class.
- Students present their designs and describe the cultural and mathematical connections to the class.

ECS Focus

1.2 Software components

Computational Practices

- Design and implement creative solutions and artifacts.
- Work effectively in teams.
- Communicate thought processes and results.
- Connect computation with other disciplines.

Standards

California Standards
• California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3)

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ 2.5 Communicate information and ideas effectively [to multiple audiences] using a variety of media and formats.
  ○ 2.7 Use [technical writing and] communication skills to work effectively [with diverse groups of people.]
  ○ 10.9 Use common industry-standard software and their applications including [word processing, spreadsheets, databases, and] multimedia software.
  ○ C6.3 Use media design and editing software: [keyframe animation,] drawing software, image editors, [and three-dimensional design.]
  ○ C6.7 Create and/or capture professional-quality media, images, [documents, audio, and video clips].

- Potentially Implied
  - 2.2 Identify barriers to accurate and appropriate communication.
  - 2.3 Interpret verbal and nonverbal communications and respond appropriately.
  - 2.4 Demonstrate elements of written and electronic communication such as accurate spelling, grammar, and format.
  - 7.4 Practice time management and efficiency to fulfill responsibilities.
  - 7.5 Apply high-quality techniques to product or presentation design and development.
  - 9.3 Understand the characteristics and benefits of teamwork, leadership, and citizenship in the school, [community, and workplace setting.]

Common Core Standards

- Anchor Standards
  - CCSS.ELA-Literacy.CCRA.R.1 Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
  - CCSS.ELA-Literacy.CCRA.R.2 Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
  - CCSS.ELA-Literacy.CCRA.W.6 Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.
  - CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
  - CCSS.ELA-Literacy.CCRA.SL.2 Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.
- Mathematical Practice
  - CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them.
  - CCSS.Math.Practice.MP4 Model with mathematics.
  - CCSS.Math.Practice.MP5 Use appropriate tools strategically.

CSTA K-12 Computer Science Standards

- CL.L2-02: Collaboratively design, develop, publish, and present products (e.g., videos, podcasts, websites) using technology resources that demonstrate and communicate curriculum concepts.
- CL.L2-03: Collaborate with peers, experts, and others using collaborative practices such as pair programming, working in project teams, and participating in group active learning activities.
- CL.L2-04: Exhibit dispositions necessary for collaboration: providing useful feedback, integrating feedback, understanding and accepting multiple perspectives, socialization.
- CT.L2-09: Interact with content-specific models and simulations (e.g., ecosystems, epidemics, molecular dynamics) to support learning and research.
- CT.L2-14: Examine connections between elements of mathematics and computer science including binary numbers, logic, sets and functions.

- CT.L3A-08: Use modeling and simulation to represent and understand natural phenomenon.
- CT.L2-15: Provide examples of interdisciplinary applications of computational thinking.
- CPP.L2-03: Design, develop, publish, and present products (e.g., webpages, mobile applications, animations) using technology resources that demonstrate and communicate curriculum concepts.
- CPP.L2-08: Demonstrate dispositions amenable to open- ended problem solving and programming (e.g., comfort with complexity, persistence, brainstorming, adaptability, patience, propensity to tinker, creativity, accepting challenge).
- CL.L3A-03: Describe how computing enhances traditional forms and enables new forms of experience, expression, communication, and collaboration.
- CT.L3A-11: Describe how computation shares features with art and music by translating human intention into an artifact.

ISTE National Educational Technology Standards (NETS)

- 1a. Apply existing knowledge to generate new ideas, products, or processes.
- 1b. Create original works as a means of personal or group expression.
- 2b. Communicate information and ideas effectively to multiple audiences using a variety of digital environments and media.
- 2d. Contribute to project teams to produce original works or solve problems.
- 4b. Plan and manage activities to develop a solution or complete a project.
- 6b. Select and use applications effectively and productively.
- 6d. Transfer current knowledge to learning new technologies

UNIT 1. HUMAN COMPUTER INTERACTION

Instructional Days: 15-16

Topic: Introduce the concept of a computer program as a set of instructions:

- Students model "following directions" by taking a short Following Directions quiz.
- Students perform an activity in which each student first writes down the instructions for a computer to make a peanut butter and jelly sandwich and then they carry out the written instructions literally.
- Students learn the importance of precise and unambiguous instructions and hence a need for a better "language" other than English for describing instructions.

ECS Focus

2.2 Computers vs. humans

Computational Practices

- Design and implement creative solutions and artifacts.

Standards

California Standards
• California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3)

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ 10.1 Interpret and explain terminology [and practices] specific to the Information and Communication Technologies sector. --> what is a computer program?
• Potentially Implied
  ○ 2.2 Identify barriers to accurate and appropriate communication.

Common Core Standards

• Anchor Standards
  ○ CCSS.ELA-Literacy.CCRA.R.1 Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
  ○ CCSS.ELA-Literacy.CCRA.W.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

CSTA K-12 Computer Science Standards
• CD.L2-01: Recognize that computers are devices that execute programs.

ISTE National Educational Technology Standards (NETS)
• 1c. Use models and simulations to explore complex systems and issues.

UNIT 1. HUMAN COMPUTER INTERACTION

Instructional Days: 17-19

Topic: Explore the idea of intelligence—especially as it relates to computers. Explore what it means for a machine to "learn". Discuss whether computers are intelligent or whether they only behave intelligently:

- Students learn about The Turing Test through an activity.
- Students test various online Chatterbots to see if they pass The Turing Test.

ECS Focus

2.1 What is intelligence?
2.2 Computers vs. humans

Computational Practices

- Apply abstractions and models.

Standards

California Standards
• Geometry California Standards Test - Logic and Geometric Proofs Cluster: Students construct and judge the validity of a logical argument and give counterexamples to disprove a statement. (3.0) • Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Formulate explanations by using logic and evidence (ESIE1.d)

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ 5.4 Interpret information and draw conclusions, based on the best analysis, to make informed decisions.
  ○ 10.1 Interpret and explain terminology [and practices] specific to the Information and Communication Technologies sector.
  ○ C10.1 Describe models of intelligent behavior and what distinguishes humans from machines.
• Potentially Implied
  ○ 2.4 Demonstrate elements of written [and electronic] communication such as accurate spelling, grammar, and format.
  ○ 5.1 Identify and ask significant questions that clarify various points of view to solve problems.

Common Core Standards
• Anchor Standards

- CCSS.ELA-Literacy.CCRA.W.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.
- CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.

CSTA K-12 Computer Science Standards

- CD.L2-07: Describe what distinguishes humans from machines focusing on human intelligence versus machine intelligence and ways we can communicate.
- CD.L3B-05: Explain the notion of intelligent behavior through computer modeling and robotics.

ISTE National Educational Technology Standards (NETS)

- 6a. Understand and use technology systems.

UNIT 2. PROBLEM SOLVING

Instructional Days: 1-2

Topic: Introduce data collection and problem solving

- Students share their Communication Methods and Data Chart from Unit 1.
- Students are able to recognize various forms of communication as data exchange.
- Students learn the implications of data exchange on social interactions.
- Students consider the privacy of data that they create.
- Students explain the difference between data used for making a case and data that forms a discovery.
- Students begin work on their unit 2 project by collecting data related to where they go after school and how long it takes them to get from one location to the next.

ECS Focus

6.2 Methods for data collection and generation
7.3 Privacy and cyber security
7.4 Exploitation of information
7.6 Limits on information access

Computational Practices

- Analyze the effects of developments in Computing
- Communicate thought processes and results.

Standards

California Standards
• Geometry California Standards Test - Logic and Geometric Proofs Cluster: Students construct and judge the validity of a logical argument and give counterexamples to disprove a statement. (3.0) • California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Evaluate the accuracy and reproducibility of data (8SIE9.b) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions (BIIE1.c.) • Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry:

Formulate explanations by using logic and evidence (ESIE1.d)

California CTE Standards – Information and Communication Technologies

- Explicitly Covered
  - 2.3 Interpret verbal and nonverbal communications and respond appropriately.
  - 5.1 Identify and ask significant questions that clarify various points of view to solve problems.
  - 8.8 Identify legal and ethical issues that have proliferated with increased technology adoption, including [hacking, scamming, and] breach of privacy.
  - 5.4 Interpret information and draw conclusions, based on the best analysis, to make informed decisions.
- Potentially Implied
  - 2.4 Demonstrate elements of written [and electronic] communication such as accurate spelling, grammar, and format.
  - 4.4 Discern the quality and value of information collected using digital technologies, and recognize bias and intent of the associated sources.

Common Core Standards

- Anchor Standards
  - CCSS.ELA-Literacy.CCRA.W.7 Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.
  - CCSS.ELA-Literacy.CCRA.W.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.
  - CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.

CSTA K-12 Computer Science Standards

- None

ISTE National Educational Technology Standards (NETS)

- 3a. Plan strategies to guide inquiry.
- 3b. Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.
- 4c. Collect and analyze data to identify solutions and/or make informed decisions.

UNIT 2. PROBLEM SOLVING

Instructional Days: 3

Topic: Introduce the four steps of the problem solving process:

- Students do a group activity to introduce the problem solving process.
- Students discuss their solutions.
- Students write down the approach used to solve the given problem.
- Students learn about the four steps of the problem solving process.
- Students generalize their solution.
- Students are introduced to the term - "algorithm".

ECS Focus

3.2 Exploring problems: problem solving heuristics and strategies

Computational Practices

- Apply abstractions and models.
- Communicate thought processes and results
- Work effectively in teams.

Standards

California Standards
• Geometry California Standards Test - Logic and Geometric Proofs Cluster: Students construct and judge the validity of a logical argument and give counterexamples to disprove a statement. (3.0) • Algebra II California Standards Test - Series, Combinatorics, and Probability and Statistics Clusters: Students apply the method of mathematical induction to prove general statements about the positive integers (21.0) • California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1) • California High School Exit Exam -- Math - Mathematical Reasoning: Make and test conjectures by using both inductive and deductive reasoning (2.4) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3)

California CTE Standards – Information and Communication Technologies
• Explicitly Covered   ○ 2.3 Interpret verbal and nonverbal communications and respond appropriately.

- Potentially Implied
  - 2.4 Demonstrate elements of written [and electronic] communication such as accurate spelling, grammar, and format.
  - 2.5 Communicate information and ideas effectively [to multiple audiences using a variety of media and formats.]
  - 5.2 Solve predictable and unpredictable work-related problems using various types of reasoning (inductive, deductive) as appropriate. [what is a 'work-related' problem?]
  - 5.4 Interpret information and draw conclusions, based on the best analysis, to make informed decisions.
  - 5.5 Use a logical and structured approach to [isolate and identify the source of problems and to] resolve problems. [I wonder if this refers more to debugging?]
  - 9.3 Understand the characteristics and benefits of teamwork, [leadership, and citizenship] in the school, [community, and workplace setting.]

Common Core Standards

- Anchor Standards
  - CCSS.ELA-Literacy.CCRA.W.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
  - CCSS.ELA-Literacy.CCRA.W.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.
  - CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
- Mathematical Practice
  - CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them.
  - CCSS.Math.Practice.MP2 Reason abstractly and quantitatively.
  - CCSS.Math.Practice.MP3 Construct viable arguments and critique the reasoning of others.
  - CCSS.Math.Practice.MP4 Model with Mathematics.
- Mathematical Content
  - CCSS.Math.Content.HSF-BF.A.1a Building Functions - Write a function that describes a relationship between two quantities: Determine an explicit expression, a recursive process, or steps for calculation from a context.

CSTA K-12 Computer Science Standards

- CT.L2-03: Define an algorithm as a sequence of instructions that can be processed by a computer.
- CT.L2-08: Use visual representations of problem states, structures, and data (e.g., graphs, charts, network diagrams, flowcharts).

- CPP.L2-04: Demonstrate an understanding of algorithms and their practical application.
- CPP.L3A-04: Apply analysis, design, and implementation techniques to solve problems (e.g., use one or more software life cycle models).

ISTE National Educational Technology Standards (NETS)

- 2d. Contribute to project teams to produce original works or solve problems.
- 4b. Plan and manage activities to develop a solution or complete a project.

UNIT 2. PROBLEM SOLVING

Instructional Days: 4-6

Topic: Apply the problem solving process. Use different strategies to plan and carry out the plan to solve several problems

- Students do group activities to solve problems by applying the problem solving process.
- Students express a solution using standard design tools.
- Students find a general solution to the given problems.
- Students present their solutions to the class.
- Students determine if a given solution successfully solves a stated problem.

ECS Focus

3.1 Understanding the Problem
3.2 Exploring problems: problem solving heuristics and strategies
3.3 Design creation and representation
3.5 Solution Accuracy
3.6 Design Re-evaluation and refinement
3.7 Decompose the complex
3.8 Communicate results

Computational Practices

- Apply abstractions and models.
- Communicate thought processes and results.
- Work effectively in teams.

Standards

California Standards
• Geometry California Standards Test - Logic and Geometric Proofs Cluster: Students construct and judge the validity of a logical argument and give counterexamples to disprove a statement. (3.0) • Algebra II California Standards Test - Series, Combinatorics, and Probability and Statistics Clusters: Students apply the method of mathematical induction to prove general statements about the positive integers (21.0) • California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1) • California High School Exit Exam -- Math - Mathematical Reasoning: Make and test conjectures by using both inductive and deductive reasoning (2.4) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new

problem situations (3.3)

California CTE Standards – Information and Communication Technologies

- Explicitly Covered
  - 2.3 Interpret verbal and nonverbal communications and respond appropriately.
  - 5.7 Work out problems iteratively and recursively.
  - 5.5 Use a logical and structured approach to [isolate and identify the source of problems and to] [re]solve problems.
- Potentially Implied
  - 5.1 Identify and ask significant questions that clarify various points of view to solve problems.
  - 5.2 Solve predictable and unpredictable work-related problems using various types of reasoning (inductive, deductive) as appropriate.

Common Core Standards

- Anchor Standards
  - CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
- Mathematical Practice
  - CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them.
  - CCSS.Math.Practice.MP2 Reason abstractly and quantitatively.
  - CCSS.Math.Practice.MP3 Construct viable arguments and critique the reasoning of others.
  - CCSS.Math.Practice.MP4 Model with Mathematics
- Mathematical Content
  - CCSS.Math.Content.HSF-BF.A.1a Building Functions - Build a function that models a relationship between two quantities - Write a function that describes a relationship between two quantities: Determine an explicit expression, a recursive process, or steps for calculation from a context.

CSTA K-12 Computer Science Standards

- CT.L2-01: Use the basic steps in algorithmic problem-solving to design solutions (e.g., problem statement and exploration, examination of sample instances, design, implementing a solution, testing, evaluation).
- CT.L2-08: Use visual representations of problem states, structures, and data (e.g., graphs, charts, network diagrams, flowcharts).
- CPP.L2-04: Demonstrate an understanding of algorithms and their practical application.
- CPP.L3A-04: Apply analysis, design, and implementation techniques to solve problems (e.g., use one or more software life cycle models).
-

ISTE National Educational Technology Standards (NETS)
• 2d. Contribute to project teams to produce original works or solve problems. • 4b. Plan and manage activities to develop a solution or complete a project.

UNIT 2. PROBLEM SOLVING

Instructional Days: 7-9

Topic: Reinforce the four steps of the problems solving process:

- Students work in groups on a cornrow braiding project to create their own designs.
- Students use Cornrow Curves design tool to make their designs.
- Students implement the four steps of the problem solving process.
- Students use mathematical concepts of iteration, dilation, translation, symmetry, etc. in their designs.
- Students determine if a given solution successfully solves a stated problem.

ECS Focus

3.1 Understanding the Problem
3.2 Exploring problems: problem solving heuristics and strategies
3.3 Design creation and representation
3.5 Solution Accuracy
3.7 Decompose the complex

Computational Practices

- Apply abstractions and models.
- Communicate thought processes and results.
- Work effectively in teams.
- Connect computation with other disciplines.

Standards

California Standards
• Geometry California Standards Test - Logic and Geometric Proofs Cluster: Students construct and judge the validity of a logical argument and give counterexamples to disprove a statement. (3.0) • California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1) • California High School Exit Exam -- Math - Mathematical Reasoning: Make and test conjectures by using both inductive and deductive reasoning (2.4) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3)

California CTE Standards – Information and Communication Technologies
• Explicitly Covered

- 2.3 Interpret verbal and nonverbal communications and respond appropriately.
- 2.5 Communicate information and ideas effectively [to multiple audiences] using a variety of media and formats.
- C6.3 Use media design and editing software: keyframe animation, drawing software, image editors, and three-dimensional design.

- Potentially Implied
  - 5.1 Identify and ask significant questions that clarify various points of view to solve problems.
  - 5.2 Solve predictable and unpredictable work-related problems using various types of reasoning (inductive, deductive) as appropriate.
  - 5.7 Work out problems iteratively and recursively.
  - 7.4 Practice time management and efficiency to fulfill responsibilities.
  - 7.5 Apply high-quality techniques to product or presentation design and development.
  - 9.6 Respect individual [and cultural] differences and recognize the importance of diversity [in the workplace].

Common Core Standards

- Anchor Standards
  - CCSS.ELA-Literacy.CCRA.R.1 Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
  - CCSS.ELA-Literacy.CCRA.R.2 Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
  - CCSS.ELA-Literacy.CCRA.W.6 Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.
  - CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
  - CCSS.ELA-Literacy.CCRA.SL.2 Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.
- Mathematical Practice
  - CCSS.Math.Practice.MP3 Construct viable arguments and critique the reasoning of others.
  - CCSS.Math.Practice.MP4 Model with mathematics.

CSTA K-12 Computer Science Standards

- CT.L2-01: Use the basic steps in algorithmic problem-solving to design solutions (e.g., problem statement and exploration, examination of sample instances, design, implementing a solution, testing, evaluation).
- CT.L2-08: Use visual representations of problem states, structures, and data (e.g., graphs, charts, network diagrams, flowcharts).
- CT.L2-14: Examine connections between elements of mathematics and computer

science including binary numbers, logic, sets and functions.

- CT.L2-15: Provide examples of interdisciplinary applications of computational thinking.
- CPP.L2-03: Design, develop, publish, and present products (e.g., webpages, mobile applications, animations) using technology resources that demonstrate and communicate curriculum concepts.
- CPP.L2-04: Demonstrate an understanding of algorithms and their practical application.
- CT.L3A-03: Explain how sequence, selection, iteration, and recursion are building blocks of algorithms.
- CT.L3A-11: Describe how computation shares features with art and music by translating human intention into an artifact.
- CPP.L3A-04: Apply analysis, design, and implementation techniques to solve problems (e.g., use one or more software life cycle models).

ISTE National Educational Technology Standards (NETS)

- 1a. Apply existing knowledge to generate new ideas, products, or processes.
- 1b. Create original works as a means of personal or group expression.
- 2d. Contribute to project teams to produce original works or solve problems.

UNIT 2. PROBLEM SOLVING

Instructional Days: 10-12

Topic: Count in the binary number system. Convert between binary and decimal numbers in the context of topics that are important to computer science:

- Students do an activity to learn the binary number system.
- Students learn the importance of binary numbers in Computer Science.
- Students use binary digits to code and decode messages.

ECS Focus

4.2 Binary Number System

Computational Practices

- Connect computation with other disciplines
- Communicate thought processes and results

Standards

California Standards
• Geometry California Standards Test - Logic and Geometric Proofs Cluster: Students construct and judge the validity of a logical argument and give counterexamples to disprove a statement. (3.0) • California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3)

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ 5.11 Understand the concept of base systems, including binary [and hexadecimal].
• Potentially Implied
  ○ 2.4 Demonstrate elements of written [and electronic] communication such as accurate spelling, grammar, and format.
  ○ 2.5 Communicate information and ideas effectively [to multiple audiences using a variety of media and formats.]

Common Core Standards

- Anchor Standards
  - CCSS.ELA-Literacy.CCRA.W.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.
  - CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
- Mathematical Practice
  - CCSS.Math.Practice.MP3 Construct viable arguments and critique the reasoning of others.
- Mathematical Content
  - CCSS.Math.Content.HSF-BF.A.1a Building Functions - Build a function that models a relationship between two quantities - Write a function that describes a relationship between two quantities: Determine an explicit expression, a recursive process, or steps for calculation from a context.

CSTA K-12 Computer Science Standards

- CT.L2-14: Examine connections between elements of mathematics and computer science including binary numbers, logic, sets and functions.
- CPP.L2-04: Demonstrate an understanding of algorithms and their practical application.

ISTE National Educational Technology Standards (NETS)

- 1c. Use models and simulations to explore complex systems and issues.
- 4b. Plan and manage activities to develop a solution or complete a project.

UNIT 2. PROBLEM SOLVING

Instructional Days: 13-14

Topic: Introduce the linear and binary search algorithms:

- Students do an activity to learn about binary search.
- Students compare linear and binary search.

ECS Focus

3.1 Understanding the Problem
3.2 Exploring problems: problem solving heuristics and strategies
3.7 Decompose the complex
3.9 Algorithm efficiency

Computational Practices

- Apply abstractions and models.
- Communicate thought processes and results.

Standards

California Standards
• Geometry California Standards Test - Logic and Geometric Proofs Cluster: Students construct and judge the validity of a logical argument and give counterexamples to disprove a statement. (3.0) • Algebra II California Standards Test - Series, Combinatorics, and Probability and Statistics Clusters: Students apply the method of mathematical induction to prove general statements about the positive integers (21.0) • California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1) • California High School Exit Exam -- Math - Mathematical Reasoning: Make and test conjectures by using both inductive and deductive reasoning (2.4) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3)

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ 5.5 Use a logical and structured approach to [isolate and identify the source of problems and to] [re]solve problems.
  ○ 5.7 Work out problems iteratively and recursively.
  ○ 5.8 Create and use algorithms and solve problems.

- C4.10 Create and know the comparative advantages of various [queue, sorting, and] searching algorithms.
- Potentially Implied
  - 2.5 Communicate information and ideas effectively [to multiple audiences using a variety of media and formats.]

Common Core Standards

- Anchor Standards
  - CCSS.ELA-Literacy.CCRA.W.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.
  - CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
- Mathematical Practice
  - CCSS.Math.Practice.MP3 Construct viable arguments and critique the reasoning of others.
-
  - CCSS.Math.Content.HSF-BF.A.1a Building Functions - Build a function that models a relationship between two quantities - Write a function that describes a relationship between two quantities: Determine an explicit expression, a recursive process, or steps for calculation from a context.

CSTA K-12 Computer Science Standards

- CT.L2-05: Act out searching and sorting algorithms.
- CT.L2-06: Describe and analyze a sequence of instructions being followed (e.g., describe a character's behavior in a video game as driven by rules and algorithms).
- CPP.L2-04: Demonstrate an understanding of algorithms and their practical application.
- CT.L3A-03: Explain how sequence, selection, iteration, and recursion are building blocks of algorithms.
- CT.L2-04: Evaluate ways that different algorithms may be used to solve the same problem.
-

ISTE National Educational Technology Standards (NETS)

- 1c. Use models and simulations to explore complex systems and issues.
- 4b. Plan and manage activities to develop a solution or complete a project.

UNIT 2. PROBLEM SOLVING

Instructional Days: 15-16

Topic: Explore sorted and unsorted lists and various sorting algorithms:

- Students do a group activity to learn different sorting algorithms.
- Students compare the different sorting algorithms.

ECS Focus

3.9 Algorithm efficiency

Computational Practices

- Apply abstractions and models.
- Communicate thought processes and results.
- Work effectively in teams.

Standards

California Standards
• Geometry California Standards Test - Logic and Geometric Proofs Cluster: Students construct and judge the validity of a logical argument and give counterexamples to disprove a statement. (3.0) • California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3)

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ 2.5 Communicate information and ideas effectively [to multiple audiences using a variety of media and formats.]
  ○ 5.8 Create and use algorithms and solve problems.
  ○ C4.10 Create and know the comparative advantages of various [queue], sorting, [and searching] algorithms.
• Potentially Implied
  ○ 2.4 Demonstrate elements of written [and electronic] communication such as accurate spelling, grammar, and format.
  ○ 9.3 Understand the characteristics and benefits of teamwork, [leadership, and citizenship] in the school, [community, and workplace setting.]

Common Core Standards

- Anchor Standards
  - CCSS.ELA-Literacy.CCRA.W.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.
  - CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
- English Language Arts:
  - CCSS.ELA-Literacy.RST.9-10.3 Reading Standards for Literacy in Science and Technical Subjects 6-12 - Grades 9-10 students: Follow precisely a complex multi step procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exception defined in the text.
- Mathematical Practice
  - CCSS.Math.Practice.MP3 Construct viable arguments and critique the reasoning of others.

CSTA K-12 Computer Science Standards

- CT.L2-05: Act out searching and sorting algorithms.
- CT.L2-06: Describe and analyze a sequence of instructions being followed (e.g., describe a character's behavior in a video game as driven by rules and algorithms).
- CPP.L2-04: Demonstrate an understanding of algorithms and their practical application.
- CT.L3A-03: Explain how sequence, selection, iteration, and recursion are building blocks of algorithms.
- CT.L2-04: Evaluate ways that different algorithms may be used to solve the same problem.

ISTE National Educational Technology Standards (NETS)

- 1c. Use models and simulations to explore complex systems and issues.

UNIT 2. PROBLEM SOLVING

Instructional Days: 17

Topic: Introduce minimal spanning trees and how graphs can be used to help solve problems:

- Students do a group activity to learn minimal spanning trees.
- Students learn to draw and use graphs to solve problems.
- Students share their solutions and do a follow-up discussion.

ECS Focus

3.1 Understanding the Problem
3.2 Exploring problems: problem solving heuristics and strategies
3.3 Design creation and representation
3.9 Algorithm efficiency
4.6 Graphs

Computational Practices

- Apply abstractions and models.
- Communicate thought processes and results.

Standards

California Standards
• Geometry California Standards Test - Logic and Geometric Proofs Cluster: Students construct and judge the validity of a logical argument and give counterexamples to disprove a statement. (3.0) • California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1) • California High School Exit Exam -- Math - Mathematical Reasoning: Make and test conjectures by using both inductive and deductive reasoning (2.4) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3) • Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Formulate explanations by using logic and evidence (ESIE1.d)

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ 2.5 Communicate information and ideas effectively [to multiple audiences] using a variety of media and formats. [graphs]
  ○ 5.10 Use [multiple layers of] abstraction.

- C8.8 Analyze and display data to assist with decision making using methods like [cross tabulations,] graphs, and charts.
- Potentially Implied
  - 5.8 Create and use algorithms and solve problems.

Common Core Standards

- Mathematical Practice
  - CCSS.Math.Practice.MP2 Reason abstractly and quantitatively.

CSTA K-12 Computer Science Standards

- CPP.L2-04: Demonstrate an understanding of algorithms and their practical application.

ISTE National Educational Technology Standards (NETS)

- 4b. Plan and manage activities to develop a solution or complete a project.

UNIT 2. PROBLEM SOLVING

Instructional Days: 18-21

Topic: Final projects and presentation:

- Student groups use data collected about their after school activities to determine the shortest routes in terms of mileage and time if they were to car pool on a particular day.

ECS Focus

3.1 Understanding the Problem
3.2 Exploring problems: problem solving heuristics and strategies
3.3 Design creation and representation
3.5 Solution Accuracy
3.6 Design Re-evaluation and refinement
3.7 Decompose the complex
3.8 Communicate results

Computational Practices

- Apply abstractions and models.
- Communicate thought processes and results.
- Work effectively in teams.

Standards

California Standards
• Geometry California Standards Test - Logic and Geometric Proofs Cluster: Students construct and judge the validity of a logical argument and give counterexamples to disprove a statement. (3.0) • California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1) • California High School Exit Exam -- Math - Mathematical Reasoning: Make and test conjectures by using both inductive and deductive reasoning (2.4) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3) • Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Formulate explanations by using logic and evidence (ESIE1.d)

California CTE Standards – Information and Communication Technologies
• Explicitly Covered   ○ 2.4 Demonstrate elements of written [and electronic] communication such as

accurate spelling, grammar, and format.
    - 5.4 Interpret information and draw conclusions, based on the best analysis, to make informed decisions.
    - C8.8 Analyze and display data to assist with decision making using methods like cross tabulations, graphs, and charts.
- Potentially Implied
    - 2.3 Interpret verbal and nonverbal communications and respond appropriately.
    - 2.5 Communicate information and ideas effectively [to multiple audiences] using a variety of media and formats.
    - 5.8 Create and use algorithms and solve problems.
    - 7.4 Practice time management and efficiency to fulfill responsibilities.
    - 7.5 Apply high-quality techniques to product or presentation design and development.
    - 9.3 Understand the characteristics and benefits of teamwork, leadership, [and citizenship] in the school, [community, and workplace setting.]

Common Core Standards

- Anchor Standards
    - CCSS.ELA-Literacy.CCRA.W.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
    - CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
    - CCSS.ELA-Literacy.CCRA.SL.4 Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.

CSTA K-12 Computer Science Standards

- CT.L2-01: Use the basic steps in algorithmic problem-solving to design solutions (e.g., problem statement and exploration, examination of sample instances, design, implementing a solution, testing, evaluation).
- CL.L2-02: Collaboratively design, develop, publish, and present products (e.g., videos, podcasts, websites) using technology resources that demonstrate and communicate curriculum concepts.
- CL.L2-033: Collaborate with peers, experts, and others using collaborative practices such as pair programming, working in project teams, and participating in group active learning activities.
- CL.L2-04: Exhibit dispositions necessary for collaboration: providing useful feedback, integrating feedback, understanding and accepting multiple perspectives, socialization.
- CPP.L2-08: Demonstrate dispositions amenable to open- ended problem solving and programming (e.g., comfort with complexity, persistence, brainstorming, adaptability,

patience, propensity to tinker, creativity, accepting challenge).

ISTE National Educational Technology Standards (NETS)
• 2b. Communicate information and ideas effectively to multiple audiences using a variety of digital environments and media. • 2d. Contribute to project teams to produce original works or solve problems. • 4b. Plan and manage activities to develop a solution or complete a project.

UNIT 3. WEB DESIGN

Instructional Days: 1-2

Topic: Explore issues of social responsibility in web use as well as the relative merits of the influence of the web on society, personal lives, and education:

- Students learn to set up a blog.
- Students participate in a discussion of online security issues.
- Students watch a video "Growing Up Online".
- Students identify web applications which influence society and education.

ECS Focus

1.6 Collaborative tools
1.7 Evaluating websites
7.3 Privacy and cyber security

Computational Practices

- Analyze the effects of developments in computing.
- Communicate thought processes and results.

Standards

California Standards

- None

California CTE Standards – Information and Communication Technologies

- Potentially Implied
  - 2.4 Demonstrate elements of written and electronic communication such as accurate spelling, grammar, and format.
  - 2.6 Advocate and practice safe, [legal, and responsible] use of digital media information and communications technologies.
  - 10.8 Understand security concepts including authorization, [rights, and encryption.]

Common Core Standards

- **Anchor Standards**
  - CCSS.ELA-Literacy.CCRA.W.6 Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

CSTA K-12 Computer Science Standards

- CI.L3A-01: Compare appropriate and inappropriate social networking behaviors.
- CI.L3A-04: Compare the positive and negative impacts of technology on culture (e.g.,

social networking, delivery of news and other public media, and intercultural communication).

- CI.L2-03: Analyze the positive and negative impacts of computing on human culture.

ISTE National Educational Technology Standards (NETS)
• 5a. Advocate and practice safe, legal, and responsible use of information and technology.

UNIT 3. WEB DESIGN

Instructional Days: 3-4

Topic: Introduce the use of basic html:

- Students create a storyboard.
- Students learn to create an Html page with a title and body.
- Students learn to create paragraphs and headings.
- Students learn to include horizontal lines and line breaks in their html page.

ECS Focus

3.3 Design creation and representation
4.6 Graphs
5.1 Break a problem statement into specific requirements
5.2 Design a solution to a problem

Computational Practices

- Apply abstractions and models.

Standards

California Standards
• None

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ C6.1 Identify the basic design elements necessary to produce effective [print, video, audio, and] interactive media.
• Potentially Implied
  ○ C6.4 Develop a presentation or other multimedia project: [video, game, or interactive] Web sites, from storyboard to production.

Common Core Standards
• None

CSTA K-12 Computer Science Standards
• CT.L2-08: Use visual representations of problem states, structures, and data (e.g., graphs, charts, network diagrams, flowcharts). • CD.L3A-04: Compare various forms of input and output • CPP.L3A-04: Apply analysis, design, and implementation techniques to solve problems (e.g., use one or more software life cycle models). • CPP.L3A-01: Create and organize Web pages through the use of a variety of web programming design tools.

ISTE National Educational Technology Standards (NETS)
• 6a. Understand and use technology systems. • 6b. Select and use applications effectively and productively.

UNIT 3. WEB DESIGN

Instructional Days: 5

Topic: Introduce basic formatting in html:

- Students learn how to create emphasized text.

ECS Focus

1.2 Software components
1.3 Interaction of components
5.3 Choose appropriate tools and techniques

Computational Practices

- Design and implement creative solutions and artifacts.

Standards

California Standards
• None

California CTE Standards – Information and Communication Technologies
• Explicitly Covered   ○ C6.1 Identify the basic design elements necessary to produce effective [print, video, audio, and] interactive media.

Common Core Standards
• None

CSTA K-12 Computer Science Standards
• CPP.L3A-01: Create and organize Web pages through the use of a variety of web programming design tools.

ISTE National Educational Technology Standards (NETS)
• 6a. Understand and use technology systems. • 6b. Select and use applications effectively and productively.

UNIT 3. WEB DESIGN

Instructional Days: 6-7

Topic: Explore image editing for the web using Photoshop or an image editor of choice:

- Students learn to identify the standard image resolution for the web.
- Students learn how to resize and crop images.
- Students learn to identify between different image formats used in web sites.
- Students learn how to include images in a web page.

ECS Focus

1.2 Software components
1.3 Interaction of components
1.4 Selection of appropriate software components
5.3 Choose appropriate tools and techniques

Computational Practices

- Design and implement creative solutions and artifacts.

Standards

California Standards
• None

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ C6.3 Use media design and editing software: keyframe animation, drawing software, image editors, and three-dimensional design.
  ○ C6.6 Integrate media into a full project using appropriate tools.
• Potentially Implied
  ○ C6.4 Develop a presentation or other multimedia project: [video, game, or interactive] Web sites, [from storyboard to production].
  ○ C6.5 Analyze the use of media to determine the appropriate file format and [level of compression.]

Common Core Standards
• None

CSTA K-12 Computer Science Standards
• CPP.L2-02: Use a variety of multimedia tools and peripherals to support personal productivity and learning throughout the curriculum. • CPP.L3A-01: Create and organize Web pages through the use of a variety of web

programming design tools.
- CPP.L3A-06: Select appropriate file formats for various types and uses of data (moderate)

ISTE National Educational Technology Standards (NETS)
• 6a. Understand and use technology systems.

UNIT 3. WEB DESIGN

Instructional Days: 8-10

Topic: Introduce basic css:

- Students learn the purpose of css.
- Students learn about different methods for inserting styles.
- Students create a web page using inline styles.
- Students learn about the disadvantage of using inline styles.
- Students practice using internal style sheets.
- Students create their own web page with a picture, text formatting, different background and foreground colors.
- Students share their work with peers.

ECS Focus

1.2 Software components
1.3 Interaction of components
1.4 Selection of appropriate software components
5.2 Design a solution to a problem
5.3 Choose appropriate tools and techniques
5.4 Code a solution from a design
5.5 Test a solution to identify errors
5.7 Documentation and justification

Computational Practices

- Design and implement creative solutions and artifacts.
- Analyze their computational work and the work of others.

Standards

California Standards
• None

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ C6.6 Integrate media into a full project using appropriate tools.
  ○ C7.5 Create an online project, [Web-based business, and e-portfolio.]
  ○ C6.1 Identify the basic design elements necessary to produce effective [print, video, audio, and] interactive media.
• Potentially Implied
  ○ 2.4 Demonstrate elements of written and electronic communication such as accurate spelling, grammar, and format.

- 5.9 Deconstruct large problems into components to solve.
- 5.10 Use multiple layers of abstraction.
- 7.4 Practice time management and efficiency to fulfill responsibilities.
- 7.5 Apply high-quality techniques to product or presentation design and development.
- 9.6 Respect individual [and cultural] and recognize the importance of diversity in the workplace]
- C6.4 Develop a presentation or other multimedia project: [video, game, or interactive] Web sites, [from storyboard to production].

Common Core Standards

- Anchor Standards
  - CCSS.ELA-Literacy.CCRA.W.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
  - CCSS.ELA-Literacy.CCRA.W.8 Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.

CSTA K-12 Computer Science Standards

- CPP.L2-03: Design, develop, publish, and present products (e.g., webpages, mobile applications, animations) using technology resources that demonstrate and communicate curriculum concepts.
- CT.L3A-02: Describe a software development process used to solve software problems (e.g., design, coding, testing, verification).
- CPP.L3A-01: Create and organize Web pages through the use of a variety of web programming design tools.

ISTE National Educational Technology Standards (NETS)

- 1b. Create original works as a means of personal or group expression.
- 4b. Plan and manage activities to develop a solution or complete a project.
- 6a. Understand and use technology systems.

UNIT 3. WEB DESIGN

Instructional Days: 11-13

Topic: Explore the concept of separating style from structure by keeping separate html and css files:

- Students experience external styling.
- Students modify their webpage from the previous class to incorporate external style sheets.
- Students share their work through gallery walk.

ECS Focus

1.2 Software components
1.3 Interaction of components
1.4 Selection of appropriate software components
5.2 Design a solution to a problem
5.3 Choose appropriate tools and techniques
5.4 Code a solution from a design
5.5 Test a solution to identify errors
5.7 Documentation and justification

Computational Practices

- Design and implement creative solutions and artifacts.
- Analyze their computational work and the work of others.

Standards

California Standards
• California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3)

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ C6.6 Integrate media into a full project using appropriate tools.
  ○ C7.5 Create an online project, [Web-based business, and e-portfolio].
• Potentially Implied
  ○ 2.4 Demonstrate elements of written and electronic communication such as accurate spelling, grammar, and format.
  ○ 5.9 Deconstruct large problems into components to solve [separate style and content].
  ○ 7.4 Practice time management and efficiency to fulfill responsibilities.
  ○ 7.5 Apply high-quality techniques to product or presentation design and

development.
    - 9.6 Respect individual [and cultural] differences and recognize the importance of diversity [in the workplace].
    - C6.4 Develop a presentation or other multimedia project: [video, game, or interactive] Web sites, [from storyboard to production].

Common Core Standards

- Anchor Standards
    - CCSS.ELA-Literacy.CCRA.W.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

CSTA K-12 Computer Science Standards

- CPP.L2-03: Design, develop, publish, and present products (e.g., webpages, mobile applications, animations) using technology resources that demonstrate and communicate curriculum concepts.
- CT.L2-12: Use abstraction to decompose a problem into sub problems
- CT.L3A-02: Describe a software development process used to solve software problems (e.g., design, coding, testing, verification).
- CPP.L3A-01: Create and organize Web pages through the use of a variety of web programming design tools.

ISTE National Educational Technology Standards (NETS)

- 1b. Create original works as a means of personal or group expression.
- 4b. Plan and manage activities to develop a solution or complete a project.
- 6a. Understand and use technology systems.

UNIT 3. WEB DESIGN

Instructional Days: 14

Topic: Add hyperlinks to other websites:

- Students learn how to add hyperlinks to their web page.

ECS Focus

1.2 Software components
1.3 Interaction of components
1.4 Selection of appropriate software components
5.2 Design a solution to a problem
5.3 Choose appropriate tools and techniques
5.4 Code a solution from a design
5.5 Test a solution to identify errors
5.7 Documentation and justification

Computational Practices

- Design and implement creative solutions and artifacts.

Standards

California Standards
• None

California CTE Standards – Information and Communication Technologies
• None

Common Core Standards
• None

CSTA K-12 Computer Science Standards
• None

ISTE National Educational Technology Standards (NETS)
• None

UNIT 3. WEB DESIGN

Instructional Days: 15-16

Topic: Introduce a variety of page layout styles:

- Students learn to add tables to their web page.
- Students learn to add css styling to an html table.
- Students learn about ordered and unordered lists in an html page.
- Students learn how to add css styling to a list.
- Students use grid elements in css div placement.
- Students learn to create menus.
- Students create a web page that includes page layout styles.

ECS Focus

1.2 Software components
1.3 Interaction of components
5.3 Choose appropriate tools and techniques

Computational Practices

- Design and implement creative solutions and artifacts.

Standards

California Standards
• None

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ C7.5 Create an online project, [Web-based business, and e-portfolio].
• Potentially Implied
  ○ 2.4 Demonstrate elements of written and electronic communication such as accurate spelling, grammar, and format.
  ○ 7.4 Practice time management and efficiency to fulfill responsibilities.
  ○ 7.5 Apply high-quality techniques to product or presentation design and development.
  ○ C6.4 Develop a presentation or other multimedia project: [video, game, or interactive] Web sites, [from storyboard to production].

Common Core Standards
• Anchor Standards   ○ CCSS.ELA-Literacy.CCRA.W.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and

audience.
    - CCSS.ELA-Literacy.CCRA.W.8 Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.

CSTA K-12 Computer Science Standards
• None

ISTE National Educational Technology Standards (NETS)
• None

UNIT 3. WEB DESIGN

Instructional Days: 17-19

Topic: Practice the use of various design elements:

- Students create web pages which incorporate design elements previously studied.

ECS Focus

1.2 Software components
1.3 Interaction of components
5.3 Choose appropriate tools and techniques

Computational Practices

- Design and implement creative solutions and artifacts.

Standards

California Standards
• California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3)

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ C6.6 Integrate media into a full project using appropriate tools.
  ○ C7.5 Create an online project, [Web-based business, and e-portfolio.]
• Potentially Implied
  ○ 2.4 Demonstrate elements of written and electronic communication such as accurate spelling, grammar, and format.
  ○ 7.4 Practice time management and efficiency to fulfill responsibilities.
  ○ 7.5 Apply high-quality techniques to product or presentation design and development.
  ○ C6.4 Develop a presentation or other multimedia project: [video, game, or interactive] Web sites, [from storyboard to production].

Common Core Standards

• Anchor Standards
  ○ CCSS.ELA-Literacy.CCRA.W.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
  ○ CCSS.ELA-Literacy.CCRA.W.8 Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.

CSTA K-12 Computer Science Standards
• None

ISTE National Educational Technology Standards (NETS)
• None

UNIT 3. WEB DESIGN

Instructional Days: 20-21

Topic: Practice the use of various design elements: Introduce several different enhancements for website design, including web user interface elements combining JavaScript, html, css, and Photoshop, accordion menus, lightbox and sliding images:

- Students explore a variety of enhancements like rollover buttons, menus, accordion menus, lightbox, sliding images.
- Students create a multi-page website that includes 2 or more enhancements.

ECS Focus

1.2 Software components
1.3 Interaction of components
5.3 Choose appropriate tools and techniques
5.4 Code a solution from a design

Computational Practices

- Design and implement creative solutions and artifacts.

Standards

California Standards
• None

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ C4.6 Use proper programming language syntax.
  ○ C7.5 Create an online project, [Web-based business, and e-portfolio.]
• Potentially Implied
  ○ 7.4 Practice time management and efficiency to fulfill responsibilities.
  ○ 7.5 Apply high-quality techniques to product or presentation design and development.
  ○ C4.2 Describe the interaction and integration of programming languages and protocols [such as how client-side programming can work with server-side programming to use a query language to access a database.]
  ○ C6.6 Integrate media into a full project using appropriate tools.

Common Core Standards
• None

CSTA K-12 Computer Science Standards
• None

ISTE National Educational Technology Standards (NETS)
• None

UNIT 3. WEB DESIGN

Instructional Days: 22-25

Topic: Final projects and gallery walk:

- Students incorporate all unit objectives into a final project.

ECS Focus

3.1 Understanding the problem
3.2 Exploring problems: problem-solving heuristics and strategies
3.3 Design creating and representation
5.1 Break a problem statement into specific requirements
5.2 Design a solution to a problem
5.3 Choose appropriate tools and techniques
5.4 Code a solution from a design
5.5 Test a solution to identify errors
5.6 Refine solution
5.7 Documentation and justification

Computational Practices

- Design and implement creative solutions and artifacts.

Standards

California Standards
• Geometry California Standards Test: Logic and Geometric Proofs Cluster - Students construct and judge the validity of a logical argument and give counterexamples to disprove a statement (3.0)

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ C4.6 Use proper programming language syntax.
  ○ C6.6 Integrate media into a full project using appropriate tools.
  ○ C7.5 Create an online project, [Web-based business, and e-portfolio.]
• Potentially Implied
  ○ 2.4 Demonstrate elements of written and electronic communication such as accurate spelling, grammar, and format.
  ○ 2.5 Communicate information and ideas effectively [to multiple audiences] using a variety of media and formats.
  ○ 7.4 Practice time management and efficiency to fulfill responsibilities.
  ○ 7.5 Apply high-quality techniques to product or presentation design and development.
  ○ 9.6 Respect individual and [cultural] differences and recognize the importance of

diversity [in the workplace].
    - C6.3 Use media design and editing software: keyframe animation, drawing software, image editors, and three-dimensional design.
    - C6.4 Develop a presentation or other multimedia project: [video, game, or interactive] Web sites, from storyboard to production.

Common Core Standards

- Anchor Standards
    - CCSS.ELA-Literacy.CCRA.W.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
    - CCSS.ELA-Literacy.CCRA.W.8 Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.
- Mathematical Practice
    - CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them.

CSTA K-12 Computer Science Standards

- CT.L2-01: Use the basic steps in algorithmic problem-solving to design solutions (e.g., problem statement and exploration, examination of sample instances, design, implementing a solution, testing, evaluation).
- CPP.L2-03: Design, develop, publish, and present products (e.g., webpages, mobile applications, animations) using technology resources that demonstrate and communicate curriculum concepts.
- CPP.L2-08: Demonstrate dispositions amenable to open- ended problem solving and programming (e.g., comfort with complexity, persistence, brainstorming, adaptability, patience, propensity to tinker, creativity, accepting challenge).
- CT.L3A-01: Use predefined functions and parameters, classes and methods to divide a complex problem into simpler parts.
- CPP.L3A-01: Create and organize Web pages through the use of a variety of web programming design tools.
- CPP-L3A-03: Use various debugging and testing methods to ensure program correctness (e.g., test cases, unit testing, white box, black box, integration testing).
- CPP.L3A-04: Apply analysis, design, and implementation techniques to solve problems (e.g., use one or more software lifecycle models).

ISTE National Educational Technology Standards (NETS)

- 1b. Create original works as a means of personal or group expression.
- 4b. Plan and manage activities to develop a solution or complete a project.
- 6a. Understand and use technology systems.

UNIT 4. INTRODUCTION TO PROGRAMMING

Instructional Days: 1

Topic: Introduce the Scratch programming language, including the basic terms utilized in the language:

- Students learn the basic terms used in Scratch.
- Create the beginning of a simple program in Scratch.

ECS Focus

5.5 Code a solution from a design
5.6 Test a solution to identify errors

Computational Practices

- Design and implement creative solutions and artifacts.

Standards

California Standards
• None

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ C4.6 Use proper programming language syntax.
  ○ C5.5 Evaluate results against initial requirements.
• Potentially Implied
  ○ 2.4 Demonstrate elements of written [and electronic] communication such as accurate spelling, grammar, and format.
  ○ C4.3 [Identify and] use [different] authoring tools [and integrated development environments (IDEs).]

Common Core Standards

• Anchor Standards
  ○ CCSS.ELA-Literacy.CCRA.W.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.
  ○ CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.

CSTA K-12 Computer Science Standards
• CPP.L2-03: Design, develop, publish, and present products (e.g., webpages, mobile applications, animations) using technology resources that demonstrate and

communicate curriculum concepts.

- CPP.L2-05: Implement problem solutions using a programming language, including: looping behavior, conditional statements, logic, expressions, variables, and functions.
- CPP.L3A-05: Use Application Program Interfaces (APIs) and libraries to facilitate programming solutions.
- CPP.L3A-08: Explain the program execution process.

ISTE National Educational Technology Standards (NETS)

- 1c. Use models and simulations to explore complex systems and issues.
- 6a. Understand and use technology systems.

UNIT 4. INTRODUCTION TO PROGRAMMING

Instructional Days: 2-3

Topic: Practice using the basic features of Scratch in the context of creating a simple program:

- Students complete a simple Scratch program.

ECS Focus

5.5 Code a solution from a design
5.6 Test a solution to identify errors

Computational Practices

- Design and implement creative solutions and artifacts.

Standards

California Standards
• None

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ C4.6 Use proper programming language syntax.
  ○ C5.5 Evaluate results against initial requirements.
• Potentially Implied
  ○ 2.4 Demonstrate elements of written [and electronic] communication such as accurate spelling, grammar, and format.
  ○ C4.3 [Identify and] use [different] authoring tools [and integrated development environments (IDEs).]
  ○ C6.4 Develop a presentation or other multimedia project: video, game, or interactive Web sites, [from storyboard to production.]

Common Core Standards

• Anchor Standards
  ○ CCSS.ELA-Literacy.CCRA.W.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.
  ○ CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.

CSTA K-12 Computer Science Standards
• CPP.L2-03: Design, develop, publish, and present products (e.g., webpages, mobile

applications, animations) using technology resources that demonstrate and communicate curriculum concepts.

- CPP.L2-05: Implement problem solutions using a programming language, including: looping behavior, conditional statements, logic, expressions, variables, and functions.
- CPP.L3A-05: Use Application Program Interfaces (APIs) and libraries to facilitate programming solutions.
- CPP.L3A-08: Explain the program execution process.

ISTE National Educational Technology Standards (NETS)

- 1c. Use models and simulations to explore complex systems and issues.
- 4b. Plan and manage activities to develop a solution or complete a project.
- 6a. Understand and use technology systems.

UNIT 4. INTRODUCTION TO PROGRAMMING

Instructional Days: 4

Topic: Create a dialogue between two sprites:

- Students develop a dialogue between two or more Scratch sprites.
- Students learn the reasoning behind how their dialogues work.

ECS Focus

5.5 Code a solution from a design
5.6 Test a solution to identify errors

Computational Practices

- Design and implement creative solutions and artifacts.
- Communicate thought processes and results.

Standards

California Standards
• None

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ C4.6 Use proper programming language syntax.
  ○ C4.9 Create programs using control structures, procedures, [functions, parameters, variables, error recovery, and recursion.]
  ○ C5.5 Evaluate results against initial requirements.
• Potentially Implied
  ○ C4.3 [Identify and] use [different] authoring tools [and integrated development environments (IDEs).]
  ○ C5.4 Test software and projects.
  ○ C6.4 Develop a presentation or other multimedia project: video, game, or interactive Web sites, [from storyboard to production.]

Common Core Standards

• Anchor Standards
  ○ CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
  ○ CCSS.ELA-Literacy.CCRA.SL.4 Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.

CSTA K-12 Computer Science Standards
• CPP.L2-03: Design, develop, publish, and present products (e.g., webpages, mobile applications, animations) using technology resources that demonstrate and communicate curriculum concepts. • CPP.L2-05: Implement problem solutions using a programming language, including: looping behavior, conditional statements, logic, expressions, variables, and functions. • CPP.L3A-05: Use Application Program Interfaces (APIs) and libraries to facilitate programming solutions.

ISTE National Educational Technology Standards (NETS)
• 1c. Use models and simulations to explore complex systems and issues. • 4b. Plan and manage activities to develop a solution or complete a project. • 6a. Understand and use technology systems.

UNIT 4. INTRODUCTION TO PROGRAMMING

Instructional Days: 5-6

Topic: Introduce the methods of moving sprites in Scratch:

- Students learn the concept of iteration or looping.
- Students write a program using iteration.
- Students learn the concept of reinitialization.

ECS Focus

5.5 Code a solution from a design
5.6 Test a solution to identify errors

Computational Practices

- Design and implement creative solutions and artifacts.

Standards

California Standards
• California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3)

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ C4.6 Use proper programming language syntax.
  ○ C4.9 Create programs using control structures, procedures, [functions, parameters, variables, error recovery, and recursion.]
• Potentially Implied
  ○ C4.3 [Identify and] use [different] authoring tools [and integrated development environments (IDEs).]
  ○ C5.4 Test software and projects.
  ○ C6.4 Develop a presentation or other multimedia project: video, game, or interactive Web sites, [from storyboard to production.]

Common Core Standards
• Anchor Standards   ○ CCSS.ELA-Literacy.CCRA.W.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or

a day or two) for a range of tasks, purposes, and audiences.

CSTA K-12 Computer Science Standards
• CPP.L2-03: Design, develop, publish, and present products (e.g., webpages, mobile applications, animations) using technology resources that demonstrate and communicate curriculum concepts. • CPP.L2--05: Implement problem solutions using a programming language, including: looping behavior, conditional statements, logic, expressions, variables, and functions. • CPP.L3A-05: Use Application Program Interfaces (APIs) and libraries to facilitate programming solutions.

ISTE National Educational Technology Standards (NETS)
• 1c. Use models and simulations to explore complex systems and issues. • 4b. Plan and manage activities to develop a solution or complete a project. • 6a. Understand and use technology systems.

UNIT 4. INTRODUCTION TO PROGRAMMING

Instructional Days: 7-8

Topic: Practice the concept of event driven programming through the creation of an alphabet game:

- Students do event-driven programming.

ECS Focus

5.5 Code a solution from a design
5.6 Test a solution to identify errors

Computational Practices

- Design and implement creative solutions and artifacts.
- Communicate thought processes and results.

Standards

California Standards

- California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1)
- California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3)

California CTE Standards – Information and Communication Technologies

- Explicitly Covered
  - C4.5 Demonstrate awareness of various programming paradigms, including [procedural, object oriented,] event-driven, [and multithreaded] programing.
  - C4.6 Use proper programming language syntax.
  - C4.9 Create programs using control structures, procedures, [functions, parameters, variables, error recovery, and recursion.]
  - C5.5 Evaluate results against initial requirements.
- Potentially Implied
  - C4.3 [Identify and] use [different] authoring tools [and integrated development environments (IDEs).]
  - C5.4 Test software and projects.

Common Core Standards

- Anchor Standards
  - CCSS.ELA-Literacy.CCRA.W.10 Write routinely over extended time frames (time

for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.

- Mathematical Practice
  - CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them.

CSTA K-12 Computer Science Standards

- CPP.L2-03: Design, develop, publish, and present products (e.g., webpages, mobile applications, animations) using technology resources that demonstrate and communicate curriculum concepts.
- CPP.L2-05: Implement problem solutions using a programming language, including: looping behavior, conditional statements, logic, expressions, variables, and functions.
- CPP.L3A-05: Use Application Program Interfaces (APIs) and libraries to facilitate programming solutions.

ISTE National Educational Technology Standards (NETS)

- 1c. Use models and simulations to explore complex systems and issues.
- 4b. Plan and manage activities to develop a solution or complete a project.
- 6a. Understand and use technology systems.

UNIT 4. INTRODUCTION TO PROGRAMMING

Instructional Days: 9

Topic: Introduce the concept of broadcasting via role play:

- Students do an activity to understand the concept of broadcasting.
- Students continue implementing event driven programming.
- Students utilize broadcasting in an assignment to create a Summer Story using Scratch.

ECS Focus

5.5 Code a solution from a design
5.6 Test a solution to identify errors

Computational Practices

- Design and implement creative solutions and artifacts.

Standards

California Standards
• None

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ C4.5 Demonstrate awareness of various programming paradigms, including [procedural, object oriented,] event-driven, [and multithreaded] programing.
  ○ C4.6 Use proper programming language syntax.
  ○ C4.9 Create programs using control structures, procedures, [functions, parameters, variables, error recovery, and recursion.]
  ○ C5.5 Evaluate results against initial requirements.
• Potentially Implied
  ○ C4.3 [Identify and] use [different] authoring tools [and integrated development environments (IDEs).]
  ○ C5.4 Test software and projects.

Common Core Standards

• Anchor Standards
  ○ CCSS.ELA-Literacy.CCRA.W.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.
• Mathematical Practice
  ○ CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them.

CSTA K-12 Computer Science Standards
• CT.L2-02: Describe the process of parallelization as it relates to problem solving. • CPP.L2-03: Design, develop, publish, and present products (e.g., webpages, mobile applications, animations) using technology resources that demonstrate and communicate curriculum concepts. • CPP.L2-05: Implement problem solutions using a programming language, including: looping behavior, conditional statements, logic, expressions, variables, and functions. • CPP.L3A-05: Use Application Program Interfaces (APIs) and libraries to facilitate programming solutions.

ISTE National Educational Technology Standards (NETS)
• 1c. Use models and simulations to explore complex systems and issues. • 4b. Plan and manage activities to develop a solution or complete a project. • 6a. Understand and use technology systems.

UNIT 4. INTRODUCTION TO PROGRAMMING

Instructional Days: 10-13

Topic: Write Scratch stories and present them to the class. Conduct peer reviews:

- Students work on a project to create their own Summer Story.
- Students implement the problem solving process to create their Summer Story.
- Students do peer reviews from time to time to provide feedback/suggestions to each other.
- Students present their stories to the class.
- Students do peer grading and select the best two projects.

ECS Focus

5.5 Code a solution from a design
5.6 Test a solution to identify errors

Computational Practices

- Design and implement creative solutions and artifacts.
- Analyze their computational work and the work of others.
- Communicate thought processes and results.

Standards

California Standards
• None California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3)

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ 2.3 Interpret verbal and nonverbal communications and respond appropriately.
  ○ 2.5 Communicate information and ideas effectively [to multiple audiences using a variety of media and formats.]
  ○ 5.8 Create and use algorithms and solve problems.
  ○ C4.6 Use proper programming language syntax.
  ○ C4.9 Create programs using control structures, procedures, [functions, parameters, variables, error recovery, and recursion.]
  ○ C5.5 Evaluate results against initial requirements.
  ○ C6.4 Develop a presentation or other multimedia project: video, game, or

interactive Web sites, from storyboard to production.

- Potentially Implied
  - 5.9 Deconstruct large problems into components to solve.
  - 9.6 Respect individual [and cultural] differences and recognize the importance of diversity [in the workplace.] (peer grading)
  - A6.2 Use a logical and structured approach to isolate and identify the source of problems and to resolve problems.
  - C4.3 [Identify and] use [different] authoring tools [and integrated development environments (IDEs).]
  - C5.4 Test software and projects.

Common Core Standards

- Anchor Standards
  - CCSS.ELA-Literacy.CCRA.W.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.
  - CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
  - CCSS.ELA-Literacy.CCRA.SL.4 Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.
- Mathematical Practice
  - CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them.

CSTA K-12 Computer Science Standards

- CT.L2-02: Describe the process of parallelization as it relates to problem solving.
- CL.L2-04: Exhibit dispositions necessary for collaboration: providing useful feedback, integrating feedback, understanding and accepting multiple perspectives, socialization.
- CPP.L2-03: Design, develop, publish, and present products (e.g., webpages, mobile applications, animations) using technology resources that demonstrate and communicate curriculum concepts.
- CPP.L2-055: Implement problem solutions using a programming language, including: looping behavior, conditional statements, logic, expressions, variables, and functions.
- CPP.L3A-05: Use Application Program Interfaces (APIs) and libraries to facilitate programming solutions.

ISTE National Educational Technology Standards (NETS)

- 1c. Use models and simulations to explore complex systems and issues.
- 4b. Plan and manage activities to develop a solution or complete a project.
- 6a. Understand and use technology systems.

UNIT 4. INTRODUCTION TO PROGRAMMING

Instructional Days: 14

Topic: Introduce the concept of variable:

- Students learn the concept of variables.
- Students learn to do some math using variables.
- Students use their knowledge of healthy and unhealthy food options.
- Students create examples of variables.
- Students learn why they need to initialize variables.
- Students learn about iteration.
- Students create examples of iteration.

ECS Focus

5.5 Code a solution from a design
5.6 Test a solution to identify errors

Computational Practices

- Design and implement creative solutions and artifacts.
- Connect computation with other disciplines.

Standards

California Standards
• Algebra II California Standards Test - Series, Combinatorics, and Probability and Statistic Clusters: Students use properties from number systems to justify steps in combining and simplifying functions (25.0) • California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3)

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ 2.3 Interpret verbal and nonverbal communications and respond appropriately.
  ○ 10.1 Interpret and explain terminology and practices specific to the Information and Communication Technologies sector.
  ○ C4.6 Use proper programming language syntax.
  ○ C4.9 Create programs using control structures, procedures, functions,

parameters, variables, [error recovery, and recursion.]

- Potentially Implied
  - 2.4 Demonstrate elements of written [and electronic] communication such as accurate spelling, grammar, and format.
  - C3.1 Describe and apply the basic process of input, processing, and output.
  - C5.4 Test software and projects.

Common Core Standards

- Anchor Standards
  - CCSS.ELA-Literacy.CCRA.W.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.
- Mathematical Practice
  - CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them.
- Mathematical Content
  - CCSS.Math.Content.HSF-BF.A.1b Building Functions - Build a function that models a relationship between two quantities - Write a function that describes a relationship between two quantities: Combine standard function types using arithmetic operations.

CSTA K-12 Computer Science Standards

- CPP.L2-03: Design, develop, publish, and present products (e.g., webpages, mobile applications, animations) using technology resources that demonstrate and communicate curriculum concepts.
- CPP.L2-055: Implement problem solutions using a programming language, including: looping behavior, conditional statements, logic, expressions, variables, and functions.
- CPP.L3A-05: Use Application Program Interfaces (APIs) and libraries to facilitate programming solutions.

ISTE National Educational Technology Standards (NETS)

- 1c. Use models and simulations to explore complex systems and issues.
- 4b. Plan and manage activities to develop a solution or complete a project.
- 6a. Understand and use technology systems.

UNIT 4. INTRODUCTION TO PROGRAMMING

Instructional Days: 15

Topic: Introduce the concept of conditionals:

- Students learn the concept of conditionals.
- Students implement conditionals in a Scratch program.
- Students use their math knowledge of inequalities in a Scratch program.

ECS Focus

5.5 Code a solution from a design
5.6 Test a solution to identify errors

Computational Practices

- Design and implement creative solutions and artifacts.
- Connect computation with other disciplines.

Standards

California Standards
• Algebra II California Standards Test - Series, Combinatorics, and Probability and Statistic Clusters: Students use properties from number systems to justify steps in combining and simplifying functions (25.0) • California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3)

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ 10.1 Interpret and explain terminology and practices specific to the Information and Communication Technologies sector.
  ○ C4.6 Use proper programming language syntax.
  ○ C4.9 Create programs using control structures, procedures, functions, parameters, variables, [error recovery, and recursion.]
• Potentially Implied
  ○ 2.3 Interpret verbal and nonverbal communications and respond appropriately.
  ○ 2.4 Demonstrate elements of written [and electronic] communication such as accurate spelling, grammar, and format.
  ○ C5.4 Test software and projects.

Common Core Standards

- Anchor Standards
  - CCSS.ELA-Literacy.CCRA.W.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.
- Mathematical Practice
  - CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them.
- Mathematical Content:
  - CCSS.Math.Content.HSA-CED.A.3 Creating Equations - Create Equations that describe numbers or relationships: Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.

CSTA K-12 Computer Science Standards

- CPP.L2-03: Design, develop, publish, and present products (e.g., webpages, mobile applications, animations) using technology resources that demonstrate and communicate curriculum concepts.
- CPP.L2-05: Implement problem solutions using a programming language, including: looping behavior, conditional statements, logic, expressions, variables, and functions.
- CPP.L3A-05: Use Application Program Interfaces (APIs) and libraries to facilitate programming solutions.

ISTE National Educational Technology Standards (NETS)

- 1c. Use models and simulations to explore complex systems and issues.
- 4b. Plan and manage activities to develop a solution or complete a project.
- 6a. Understand and use technology systems.

UNIT 4. INTRODUCTION TO PROGRAMMING

Instructional Days: 16-17

Topic: Introduce And, Or and randomness:

- Students learn to use conditionals with And and Or to write a program.
- Students learn to use a random number generator.

ECS Focus

5.5 Code a solution from a design
5.6 Test a solution to identify errors

Computational Practices

- Design and implement creative solutions and artifacts.

Standards

California Standards
• Algebra II California Standards Test - Series, Combinatorics, and Probability and Statistic Clusters: Students use properties from number systems to justify steps in combining and simplifying functions (25.0) • California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3)

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ C4.6 Use proper programming language syntax.
  ○ C4.9 Create programs using control structures, procedures, functions, parameters, variables, [error recovery, and recursion.]
• Potentially Implied
  ○ 2.3 Interpret verbal and nonverbal communications and respond appropriately.
  ○ 2.4 Demonstrate elements of written [and electronic] communication such as accurate spelling, grammar, and format.
  ○ C5.4 Test software and projects.

Common Core Standards
• Anchor Standards   ○ CCSS.ELA-Literacy.CCRA.W.10 Write routinely over extended time frames (time

for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.

- Mathematical Practice
  - CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them.
- Mathematical Content
  - CCSS.Math.Content.HSA-CED.A.3 Creating Equations - Create Equations that describe numbers or relationships: Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.

CSTA K-12 Computer Science Standards

- CPP.L2-03: Design, develop, publish, and present products (e.g., webpages, mobile applications, animations) using technology resources that demonstrate and communicate curriculum concepts.
- CPP.L2-05: Implement problem solutions using a programming language, including: looping behavior, conditional statements, logic, expressions, variables, and functions.
- CPP.L3A-05: Use Application Program Interfaces (APIs) and libraries to facilitate programming solutions.
-

ISTE National Educational Technology Standards (NETS)

- 1c. Use models and simulations to explore complex systems and issues.
- 4b. Plan and manage activities to develop a solution or complete a project.
- 6a. Understand and use technology systems.

UNIT 4. INTRODUCTION TO PROGRAMMING

Instructional Days: 18

Topic: Apply knowledge of conditionals to develop a Rock Paper Scissors program in Scratch:

- Students apply knowledge of variables, conditionals and random number generation to write a Scratch program.

ECS Focus

5.5 Code a solution from a design
5.6 Test a solution to identify errors

Computational Practices

- Design and implement creative solutions and artifacts.

Standards

California Standards
• Algebra II California Standards Test - Series, Combinatorics, and Probability and Statistic Clusters: Students use properties from number systems to justify steps in combining and simplifying functions (25.0) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3)

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ C4.6 Use proper programming language syntax.
  ○ C4.9 Create programs using control structures, procedures, functions, parameters, variables, [error recovery, and recursion.]
• Potentially Implied
  ○ 2.3 Interpret verbal and nonverbal communications and respond appropriately.
  ○ C5.4 Test software and projects.

Common Core Standards

• Mathematical Practice
  ○ CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them.
• Mathematical Content
  ○ CCSS.Math.Content.HSA-CED.A.3 Creating Equations - Create Equations that describe numbers or relationships: Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.

CSTA K-12 Computer Science Standards
• CPP.L2-03: Design, develop, publish, and present products (e.g., webpages, mobile applications, animations) using technology resources that demonstrate and communicate curriculum concepts. • CPP.L2-05: Implement problem solutions using a programming language, including: looping behavior, conditional statements, logic, expressions, variables, and functions. • CPP.L3A-05: Use Application Program Interfaces (APIs) and libraries to facilitate programming solutions.

ISTE National Educational Technology Standards (NETS)
• 1c. Use models and simulations to explore complex systems and issues. • 4b. Plan and manage activities to develop a solution or complete a project. • 6a. Understand and use technology systems.

UNIT 4. INTRODUCTION TO PROGRAMMING

Instructional Days: 19

Topic: Build on previous programming concepts to create a timer.

ECS Focus

5.5 Code a solution from a design
5.6 Test a solution to identify errors

Computational Practices

- Design and implement creative solutions and artifacts.

Standards

California Standards
• Algebra II California Standards Test - Series, Combinatorics, and Probability and Statistic Clusters: Students use properties from number systems to justify steps in combining and simplifying functions (25.0) • California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3)

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ C4.6 Use proper programming language syntax.
  ○ C4.9 Create programs using control structures, procedures, functions, parameters, variables, [error recovery, and recursion.]
• Potentially Implied
  ○ C5.4 Test software and projects.
  ○ D3.1 Create a storyboard describing the essential elements, plot, flow, and functions of the game/simulation.

Common Core Standards

• Mathematical Practice
  ○ CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them.
• Mathematical Content
  ○ CCSS.Math.Content.HSF-BF.A.1b Building functions - Build a function that models a relationship between two quantities - Write a function that describes a

relationship between two quantities: Combine standard function types using arithmetic operations.

CSTA K-12 Computer Science Standards
• CPP.L2-03: Design, develop, publish, and present products (e.g., webpages, mobile applications, animations) using technology resources that demonstrate and communicate curriculum concepts. • CPP.L2-05: Implement problem solutions using a programming language, including: looping behavior, conditional statements, logic, expressions, variables, and functions. • CPP.L3A-05: Use Application Program Interfaces (APIs) and libraries to facilitate programming solutions.

ISTE National Educational Technology Standards (NETS)
• 1c. Use models and simulations to explore complex systems and issues. • 4b. Plan and manage activities to develop a solution or complete a project. • 6a. Understand and use technology systems.

UNIT 4. INTRODUCTION TO PROGRAMMING

Instructional Days: 20-23

Topic: Create a timing game in Scratch and present it to the class. Peer reviews are conducted:

- Students create a timing game.
- Students present their game to the class.
- Students do peer grading.

ECS Focus

5.5 Code a solution from a design
5.6 Test a solution to identify errors

Computational Practices

- Design and implement creative solutions and artifacts.
- Analyze their computational work and the work of others.

Standards

California Standards
• Algebra II California Standards Test - Series, Combinatorics, and Probability and Statistic Clusters: Students use properties from number systems to justify steps in combining and simplifying functions (25.0) • California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3)

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ 2.3 Interpret verbal and nonverbal communications and respond appropriately.
  ○ C4.6 Use proper programming language syntax.
  ○ C4.9 Create programs using control structures, procedures, functions, parameters, variables, [error recovery, and recursion.]
  ○ C5.5 Evaluate results against initial requirements.
  ○ C6.4 Develop a presentation or other multimedia project: video, game, or interactive Web sites, from storyboard to production.
  ○ D3.3 Using simple game development tools, create a game or simulation.
  ○ D3.4 Present the game or simulation.
• Potentially Implied

- C5.4 Test software and projects.
- 9.6 Respect individual [and cultural] differences and recognize the importance of diversity [in the workplace.]

Common Core Standards

- Mathematical Practice
  - CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them.
- Mathematical Content
  - CCSS.Math.Content.HSF-BF.A.1b Building Functions - Build a function that models a relationship between two quantities - Write a function that describes a relationship between two quantities: Combine standard function types using arithmetic operations.

CSTA K-12 Computer Science Standards

- CL.L2-04: Exhibit dispositions necessary for collaboration: providing useful feedback, integrating feedback, understanding and accepting multiple perspectives, socialization.
- CPP.L2-03: Design, develop, publish, and present products (e.g., webpages, mobile applications, animations) using technology resources that demonstrate and communicate curriculum concepts.
- CPP.L2-05: Implement problem solutions using a programming language, including: looping behavior, conditional statements, logic, expressions, variables, and functions.
- CPP.L3A-05: Use Application Program Interfaces (APIs) and libraries to facilitate programming solutions.

ISTE National Educational Technology Standards (NETS)

- 1c. Use models and simulations to explore complex systems and issues.
- 4b. Plan and manage activities to develop a solution or complete a project.
- 6a. Understand and use technology systems.

UNIT 4. INTRODUCTION TO PROGRAMMING

Instructional Days: 24

Topic: Investigate two types of games that may provide ideas for the final project.

ECS Focus

5.5 Code a solution from a design
5.6 Test a solution to identify errors

Computational Practices

- Design and implement creative solutions and artifacts.

Standards

California Standards
• Algebra II California Standards Test - Series, Combinatorics, and Probability and Statistic Clusters: Students use properties from number systems to justify steps in combining and simplifying functions (25.0) • California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3)

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ 2.3 Interpret verbal and nonverbal communications and respond appropriately.
  ○ C4.6 Use proper programming language syntax.
  ○ C4.9 Create programs using control structures, procedures, functions, parameters, variables, [error recovery, and recursion.]
  ○ C6.4 Develop a presentation or other multimedia project: video, game, or interactive Web sites, from storyboard to production.
  ○ D3.3 Using simple game development tools, create a game or simulation.
• Potentially Implied
  ○ 2.4 Demonstrate elements of written [and electronic] communication such as accurate spelling, grammar, and format.
  ○ C5.4 Test software and projects.

Common Core Standards
• Mathematical Content

- CCSS.Math.Content.HSF-BF.A.1b Building Functions - Build a function that models a relationship between two quantities - Write a function that describes a relationship between two quantities: Combine standard function types using arithmetic operations.

CSTA K-12 Computer Science Standards

- CPP.L2-03: Design, develop, publish, and present products (e.g., webpages, mobile applications, animations) using technology resources that demonstrate and communicate curriculum concepts.
- CPP.L2-05: Implement problem solutions using a programming language, including: looping behavior, conditional statements, logic, expressions, variables, and functions.
- CPP.L3A-05: Use Application Program Interfaces (APIs) and libraries to facilitate programming solutions.

ISTE National Educational Technology Standards (NETS)

- 1c. Use models and simulations to explore complex systems and issues.
- 4b. Plan and manage activities to develop a solution or complete a project.
- 6a. Understand and use technology systems.

UNIT 4. INTRODUCTION TO PROGRAMMING

Instructional Days: 25

Topic: Explain final project and the rubric for the final project:

- Students work on their final project to create a game using Scratch.

ECS Focus

5.5 Code a solution from a design
5.6 Test a solution to identify errors

Computational Practices

- Design and implement creative solutions and artifacts.

Standards

California Standards
• Algebra II California Standards Test - Series, Combinatorics, and Probability and Statistic Clusters: Students use properties from number systems to justify steps in combining and simplifying functions (25.0) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3)

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ 2.3 Interpret verbal and nonverbal communications and respond appropriately.
• Potentially Implied
  ○ C5.4 Test software and projects.
  ○ C6.4 Develop a presentation or other multimedia project: video, game, or interactive Web sites, from storyboard to production.
  ○ D3.3 Using simple game development tools, create a game or simulation.

Common Core Standards

• Mathematical Practice
  ○ CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them.
• Mathematical Content
  ○ CCSS.Math.Content.HSF-BF.A.1b Building Functions - Build a function that models a relationship between two quantities - Write a function that describes a relationship between two quantities: Combine standard function types using arithmetic operations.

CSTA K-12 Computer Science Standards
• CPP.L2-03: Design, develop, publish, and present products (e.g., webpages, mobile applications, animations) using technology resources that demonstrate and communicate curriculum concepts. • CPP.L2-05: Implement problem solutions using a programming language, including: looping behavior, conditional statements, logic, expressions, variables, and functions. • CPP.L2-08: Demonstrate dispositions amenable to open- ended problem solving and programming (e.g., comfort with complexity, persistence, brainstorming, adaptability, patience, propensity to tinker, creativity, accepting challenge). • CPP.L3A-05: Use Application Program Interfaces (APIs) and libraries to facilitate programming solutions.

ISTE National Educational Technology Standards (NETS)
• 1c. Use models and simulations to explore complex systems and issues. 4b. Plan and manage activities to develop a solution or complete a project. 6a. Understand and use technology systems.

UNIT 4. INTRODUCTION TO PROGRAMMING

Instructional Days: 26-28

Topic: Write Scratch programs for either My Community or Game project. Conduct peer reviews.

ECS Focus

5.5 Code a solution from a design
5.6 Test a solution to identify errors

Computational Practices

- Design and implement creative solutions and artifacts.

Standards

California Standards
• Algebra II California Standards Test - Series, Combinatorics, and Probability and Statistic Clusters: Students use properties from number systems to justify steps in combining and simplifying functions (25.0) • California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3)

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ 2.3 Interpret verbal and nonverbal communications and respond appropriately.
  ○ C4.6 Use proper programming language syntax.
  ○ C4.9 Create programs using control structures, procedures, functions, parameters, variables, [error recovery, and recursion.]
  ○ C5.5 Evaluate results against initial requirements.
  ○ C6.4 Develop a presentation or other multimedia project: video, game, or interactive Web sites, from storyboard to production.
  ○ D3.3 Using simple game development tools, create a game or simulation.
• Potentially Implied
  ○ 9.6 Respect individual [and cultural] differences and recognize the importance of diversity [in the workplace].
  ○ C5.4 Test software and projects.

Common Core Standards

- Anchor Standards
  - CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
- Mathematical Practice
  - CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them.
- Mathematical Content
  - CCSS.Math.Content.HSF-BF.A.1b Building Functions - Build a function that models a relationship between two quantities - Write a function that describes a relationship between two quantities: Combine standard function types using arithmetic operations.

CSTA K-12 Computer Science Standards

- CL.L2-04: Exhibit dispositions necessary for collaboration: providing useful feedback, integrating feedback, understanding and accepting multiple perspectives, socialization.
- CPP.L2-03: Design, develop, publish, and present products (e.g., webpages, mobile applications, animations) using technology resources that demonstrate and communicate curriculum concepts.
- CPP.L2-05: Implement problem solutions using a programming language, including: looping behavior, conditional statements, logic, expressions, variables, and functions.
- CPP.L2-08: Demonstrate dispositions amenable to open- ended problem solving and programming (e.g., comfort with complexity, persistence, brainstorming, adaptability, patience, propensity to tinker, creativity, accepting challenge).
- CPP.L3A-05: Use Application Program Interfaces (APIs) and libraries to facilitate programming solutions.

ISTE National Educational Technology Standards (NETS)

- 1c. Use models and simulations to explore complex systems and issues.
- 4b. Plan and manage activities to develop a solution or complete a project.
- 6a. Understand and use technology systems.

UNIT 4. INTRODUCTION TO PROGRAMMING

Instructional Days: 29

Topic: Complete final projects.

ECS Focus

5.5 Code a solution from a design
5.6 Test a solution to identify errors

Computational Practices

- None

Standards

California Standards
• None

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ 2.3 Interpret verbal and nonverbal communications and respond appropriately.
  ○ C6.4 Develop a presentation or other multimedia project: video, game, or interactive Web sites, from storyboard to production.

Common Core Standards

• Anchor Standards
  ○ CCSS.ELA-Literacy.CCRA.W.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.
  ○ CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.

CSTA K-12 Computer Science Standards
• CPP.L2-03: Design, develop, publish, and present products (e.g., webpages, mobile applications, animations) using technology resources that demonstrate and communicate curriculum concepts. • CPP.L2-05: Implement problem solutions using a programming language, including: looping behavior, conditional statements, logic, expressions, variables, and functions. • CPP.L2-08: Demonstrate dispositions amenable to open- ended problem solving and programming (e.g., comfort with complexity, persistence, brainstorming, adaptability, patience, propensity to tinker, creativity, accepting challenge). • CPP.L3A-05: Use Application Program Interfaces (APIs) and libraries to facilitate

programming solutions.

ISTE National Educational Technology Standards (NETS)
• 1c. Use models and simulations to explore complex systems and issues. • 4b. Plan and manage activities to develop a solution or complete a project. • 6a. Understand and use technology systems.

UNIT 4. INTRODUCTION TO PROGRAMMING

Instructional Days: 30

Topic: Presentations of final projects:

- Students do peer grading and select the two best projects.

ECS Focus

- None

Computational Practices

- Communicate thought processes and results.
- Analyze their computational work and the work of others.

Standards

California Standards
• None

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ 2.3 Interpret verbal and nonverbal communications and respond appropriately.
  ○ 2.5 Communicate information and ideas effectively to multiple audiences using a variety of media and formats.
  ○ C4.6 Use proper programming language syntax.
  ○ C5.5 Evaluate results against initial requirements.
  ○ C6.4 Develop a presentation or other multimedia project: video, game, or interactive Web sites, from storyboard to production.
  ○ C6.6 Integrate media into a full project using appropriate tools.
  ○ D3.3 Using simple game development tools, create a game or simulation.
  ○ D3.4 Present the game or simulation.
• Potentially Implied
  ○ 2.4 Demonstrate elements of written [and electronic] communication such as accurate spelling, grammar, and format.
  ○ 9.6 Respect individual [and cultural] differences and recognize the importance of diversity [in the workplace].
  ○ C5.4 Test software and projects.

Common Core Standards
• Anchor Standards   ○ CCSS.ELA-Literacy.CCRA.SL.4 Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and

audience.

CSTA K-12 Computer Science Standards
• CL.L2-04: Exhibit dispositions necessary for collaboration: providing useful feedback, integrating feedback, understanding and accepting multiple perspectives, socialization.

ISTE National Educational Technology Standards (NETS)
• 2b. Communicate information and ideas effectively to multiple audiences using a variety of digital environments and media.

UNIT 5. COMPUTING AND DATA ANALYSIS

Instructional Days: 1

Topic: Review how data can be used for making a case/discovery and provide an overview of the final project.

ECS Focus

6.2 Methods for collection and generation.
6.3 Patterns, trends, and discoveries

Computational Practices

- Communicate thought processes and results.

Standards

California Standards
• Geometry California Standards Test - Logic and Geometric Proofs Cluster: Students construct and judge the validity of a logical argument and give counterexamples to disprove a statement. (3.0) • California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1) • California High School Exit Exam -- Math - Mathematical Reasoning: Make and test conjectures by using both inductive and deductive reasoning (2.4) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Communicate the logical connection among hypotheses, science concepts, tests conducted, data collected, and conclusions drawn from scientific evidence (7SIE7.c.) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Evaluate the accuracy and reproducibility of data (8SIE9.b) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions (BIIE1.c.) • Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Select and use appropriate tools and technology to perform tests, collect data, analyze relationships, and display data (ESIE1.a) • Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Formulate explanations by using logic and evidence (ESIE1.d)

California CTE Standards – Information and Communication Technologies
• Potentially Implied   ○ 2.3 Interpret verbal and nonverbal communications and respond appropriately.

Common Core Standards
• None

CSTA K-12 Computer Science Standards
• CT.L2-07: Represent data in a variety of ways including text, sounds, pictures, and numbers. • CT.L2-10: Evaluate what kinds of problems can be solved using modeling and simulation.

ISTE National Educational Technology Standards (NETS)
• 3a. Plan strategies to guide inquiry

UNIT 5. COMPUTING AND DATA ANALYSIS

Instructional Days: 2

Topic: Discuss photo ethics and student safety related to android phone use:

- Students learn about photo ethics.

ECS Focus

7.2 Legal and ethical concerns.
7.3 Privacy and cyber security.

Computational Practices

- Analyze the effects of developments in computing.

Standards

California Standards
• None

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ 2.3 Interpret verbal and nonverbal communications and respond appropriately.
  ○ 7.8 Explore issues of global significance and document the impact on the Information and Communication Technologies sector.
  ○ 8.8 Identify legal and ethical issues that have proliferated with increased technology adoption, including [hacking, scamming, and] breach of privacy.
• Potentially Implied
  ○ 2.4 Demonstrate elements of written [and electronic] communication such as accurate spelling, grammar, and format.
  ○ 2.6 Advocate and practice safe, legal, and responsible use of digital media information and communications technologies.
  ○ 5.1 Identify and ask significant questions that clarify various points of view to solve problems.
  ○ 8.3 Demonstrate ethical and legal practices consistent with Information and Communication Technologies sector workplace standards.
  ○ 10.2 Comply with the rules, regulations, and expectations of all aspects of the Information and Communication Technologies sector.

Common Core Standards
• Anchor Standards   ○ CCSS.ELA-Literacy.CCRA.W.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.

- CCSS.ELA-Literacy.CCRA.SL.2 [Integrate and] evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.
- CCSS.ELA-Literacy.CCRA.SL.3 Evaluate a [speaker's] point of view, reasoning, and use of evidence and rhetoric.

CSTA K-12 Computer Science Standards

- CI.L2-01: Exhibit legal and ethical behaviors when using information and technology and discuss the consequences of misuse. 2-CI-6: Discuss how the unequal distribution of computing resources in a global economy raises issues of equity, access, and power.

ISTE National Educational Technology Standards (NETS)

- 5a. Advocate and practice safe, legal, and responsible use of information and technology.

UNIT 5. COMPUTING AND DATA ANALYSIS

Instructional Days: 3-5

Topic: Distribute phones. Create groups. Discuss group roles and responsibilities. Navigate the android application. Navigate the online system:

- Students learn about rules for sharing phones.
- Students login and navigate through the basic features of the phone applications.
- Students login and navigate through the basic features of the online system.
- Students develop a method for data collection for their final project.

ECS Focus

6.2 Methods for collection and generation.

Computational Practices

- Design and implement creative solutions and artifacts. Communicate thought processes and results.
- Work effectively in teams.

Standards

California Standards
• Geometry California Standards Test - Logic and Geometric Proofs Cluster: Students construct and judge the validity of a logical argument and give counterexamples to disprove a statement. (3.0) • California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1) • California High School Exit Exam -- Math - Mathematical Reasoning: Make and test conjectures by using both inductive and deductive reasoning (2.4) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Communicate the logical connection among hypotheses, science concepts, tests conducted, data collected, and conclusions drawn from scientific evidence (7SIE7.c.) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Evaluate the accuracy and reproducibility of data (8SIE9.b) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions (BIIE1.c.)

- Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Select and use appropriate tools and technology to perform tests, collect data, analyze relationships, and display data (ESIE1.a)
- Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Formulate explanations by using logic and evidence (ESIE1.d)
- Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Investigate a science-based societal issue by researching the literature, analyzing data, and communicating the findings (ESIE1.m)

California CTE Standards – Information and Communication Technologies

- Explicitly Covered
  - 9.7 Participate in interactive teamwork to solve [real] Information and Communication Technologies sector issues and problems.
- Potentially Implied
  - 7.2 Explain the importance of accountability and responsibility in fulfilling personal, community, and workplace roles.
  - 9.3 Understand the characteristics and benefits of teamwork, [leadership, and citizenship] in the school, [community, and workplace setting].

Common Core Standards

- Anchor Standards
  - CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.

CSTA K-12 Computer Science Standards

- CT.L2-07: Represent data in a variety of ways including text, sounds, pictures, and numbers. 3-CPP-2: Use mobile devices/emulators to design, develop, and implement mobile computing applications.

ISTE National Educational Technology Standards (NETS)

- 5a. Advocate and practice safe, legal, and responsible use of information and technology.

UNIT 5. COMPUTING AND DATA ANALYSIS

Instructional Days: 6

Topic: Data check-in—Discuss issues that arise (aggregating data, etc.):

- Students describe the data they have collected.
- Students discuss issues that may arise during data collection.
- Students learn why they will be pooling the data from all of the groups at the end of the unit.

ECS Focus

6.1 Representation and Storage
6.2 Methods for collection and generation.

Computational Practices

- Communicate thought processes and results.

Standards

California Standards
• Geometry California Standards Test - Logic and Geometric Proofs Cluster: Students construct and judge the validity of a logical argument and give counterexamples to disprove a statement. (3.0) • California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1) • California High School Exit Exam -- Math - Mathematical Reasoning: Make and test conjectures by using both inductive and deductive reasoning (2.4) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Communicate the logical connection among hypotheses, science concepts, tests conducted, data collected, and conclusions drawn from scientific evidence (7SIE7.c.) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Evaluate the accuracy and reproducibility of data (8SIE9.b) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions (BIIE1.c.) • Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Select and use appropriate tools and technology to perform tests, collect data, analyze

relationships, and display data (ESIE1.a)
- Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Formulate explanations by using logic and evidence (ESIE1.d)
- Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Investigate a science-based societal issue by researching the literature, analyzing data, and communicating the findings (ESIE1.m)

California CTE Standards – Information and Communication Technologies

- Explicitly Covered
  - 9.7 Participate in interactive teamwork to solve [real] Information and Communication Technologies sector issues and problems.
- Potentially Implied
  - 2.4 Demonstrate elements of written [and electronic] communication such as accurate spelling, grammar, and format.
  - 4.4 Discern the quality and value of information collected using digital technologies, and recognize bias and intent of the associated sources.

Common Core Standards

- Anchor Standards
  - CCSS.ELA-Literacy.CCRA.W.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.
  - CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.

CSTA K-12 Computer Science Standards

- CT.L2-07: Represent data in a variety of ways including text, sounds, pictures, and numbers.
- CPP.L2-08: Demonstrate dispositions amenable to open- ended problem solving and programming (e.g., comfort with complexity, persistence, brainstorming, adaptability, patience, propensity to tinker, creativity, accepting challenge).

ISTE National Educational Technology Standards (NETS)

- 4c. Collect and analyze data to identify solutions and/or make informed decisions.
- 6a. Understand and use technology systems.

UNIT 5. COMPUTING AND DATA ANALYSIS

Instructional Days: 7-10

Topic: Introduce R/Deducer. Create maps using the latitude and longitude of a location and then create maps from a file of data:

- Students learn to use online graphing tools such as R/Deducer.
- Students learn to translate a place on a map to latitude and longitude.
- Students explore LA Bike data and Deducer.
- Students learn about a variable or column in a data set.
- Students learn how to make frequency tables.
- Students learn to sort data.
- Students learn to create subsets of data.
- Students learn to make Bubble charts.
- Students learn to analyze data sets using frequency tables and charts.

ECS Focus

4.2 Basic Sets
6.1 Representation and Storage
6.2 Methods for collection and generation.
6.3 Patterns, trends, and discoveries
6.5 Computational Models

Computational Practices

- Connect computation with other disciplines.

Standards

California Standards
• Geometry California Standards Test - Logic and Geometric Proofs Cluster: Students construct and judge the validity of a logical argument and give counterexamples to disprove a statement. (3.0) • California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1) • California High School Exit Exam -- Math - Mathematical Reasoning: Make and test conjectures by using both inductive and deductive reasoning (2.4) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Communicate the logical connection among hypotheses, science

concepts, tests conducted, data collected, and conclusions drawn from scientific evidence (7SIE7.c.)
- California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Evaluate the accuracy and reproducibility of data (8SIE9.b)
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- Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Formulate explanations by using logic and evidence (ESIE1.d)

California CTE Standards – Information and Communication Technologies

- Explicitly Covered
  - C8.8 Analyze and display data [to assist with decision making] using methods like cross tabulations, graphs, and charts.
- Potentially Implied
  - 2.4 Demonstrate elements of written [and electronic] communication such as accurate spelling, grammar, and format.
  - C8.5 Use queries to extract and manipulate data (select queries, action queries).

Common Core Standards

- Anchor Standards
  - CCSS.ELA-Literacy.CCRA.W.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.
- Mathematical Practice
  - CCSS.Math.Practice.MP4 Model with mathematics.
  - CCSS.Math.Practice.MP5 Use appropriate tools strategically.
- Mathematical Content:
  - CCSS.Math.Content.HSS-ID.A.1 Interpreting Categorical and Quantitative Data - Summarize, represent, and interpret data on a single count or measurement variable: Represent data with plots on the real number line (dot plots, histograms, and box plots).
  - CCSS.Math.Content.HSS-CP.A.1 Conditional Probability and the Rules of Probability - Understand independence and conditional probability and use them to interpret data: Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or" and "not").

CSTA K-12 Computer Science Standards
• CT.L2-07: Represent data in a variety of ways including text, sounds, pictures, and numbers. • CT.L3A-04: Compare techniques for analyzing massive data collections. • CT.L3A-06: Analyze the representation and trade-offs among various forms of digital information. • CT.L3A-07: Describe how various types of data are stored in a computer system. • CPP.L3A-11: Describe techniques for locating and collecting small and large-scale data sets. • CT.L3B-08: Use models and simulations to help formulate, refine, and test scientific hypotheses. • CT.L3B-09: Analyze data and identify patterns through modeling and simulation. 3-CPP-7: Describe a variety of programming languages available to solve problems and develop systems.

ISTE National Educational Technology Standards (NETS)
• 3d. Process data and report results. • 6a. Understand and use technology systems.

UNIT 5. COMPUTING AND DATA ANALYSIS

Instructional Days: 11

Topic: Create maps with student data and related data set:

- Students learn to do spatial analysis for use in the final projects.

ECS Focus

4.2 Basic Sets
6.1 Representation and Storage
6.2 Methods for collection and generation.
6.3 Patterns, trends, and discoveries
6.5 Computational Models

Computational Practices

- Connect computation with other disciplines.
- Analyze their computational work and the work of others.
- Work effectively in teams.

Standards

California Standards
• Geometry California Standards Test - Logic and Geometric Proofs Cluster: Students construct and judge the validity of a logical argument and give counterexamples to disprove a statement. (3.0) • California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1) • California High School Exit Exam -- Math - Mathematical Reasoning: Make and test conjectures by using both inductive and deductive reasoning (2.4) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Communicate the logical connection among hypotheses, science concepts, tests conducted, data collected, and conclusions drawn from scientific evidence (7SIE7.c.) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Evaluate the accuracy and reproducibility of data (8SIE9.b) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions (BIIE1.c.)

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- Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Formulate explanations by using logic and evidence (ESIE1.d)
- Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Investigate a science-based societal issue by researching the literature, analyzing data, and communicating the findings (ESIE1.m)

California CTE Standards – Information and Communication Technologies

- Explicitly Covered
  - 9.7 Participate in interactive teamwork to solve [real] Information and Communication Technologies sector issues and problems.
  - C8.8 Analyze and display data [to assist with decision making] using methods like cross tabulations, graphs, and charts.

Common Core Standards

- Anchor Standards
  - CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
- Mathematical Practice
  - CCSS.Math.Practice.MP4 Model with mathematics.
  - CCSS.Math.Practice.MP5 Use appropriate tools strategically.

Mathematical Content

- CCSS.Math.Content.HSS-IC.B.4 Making inferences and Justifying Conclusions - Make inferences and justify conclusions from sample surveys, experiments, and observational studies: Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.

CSTA K-12 Computer Science Standards

- CT.L2-07: Represent data in a variety of ways including text, sounds, pictures, and numbers.
- CPP.L2-08: Demonstrate dispositions amenable to open- ended problem solving and programming (e.g., comfort with complexity, persistence, brainstorming, adaptability, patience, propensity to tinker, creativity, accepting challenge).
- CT.L3A-06: Analyze the representation and trade-offs among various forms of digital information.
- CT.L3A-07: Describe how various types of data are stored in a computer system.
- CT.L3B-08: Use models and simulations to help formulate, refine, and test scientific hypotheses.
- CT.L3B-09: Analyze data and identify patterns through modeling and simulation.

ISTE National Educational Technology Standards (NETS)
• 4c. Collect and analyze data to identify solutions and/or make informed decisions. • 6a. Understand and use technology systems.

UNIT 5. COMPUTING AND DATA ANALYSIS

Instructional Days: 12-14

Topic: Discuss bar plots, categorical and continuous data, and mosaic plots as a vehicle for comparing categorical data, and looking at trends in data:

- Students learn to read and interpret bar plots.
- Students learn to create bar plots.
- Students learn the difference between categorical and continuous data.
- Students learn to compare two categorical sources with mosaic plots.
- Student look for trends by analyzing various plots.

ECS Focus

4.2 Basic Sets
6.1 Representation and Storage
6.2 Methods for collection and generation.
6.3 Patterns, trends, and discoveries
6.5 Computational Models

Computational Practices

- Communicate thought processes and results.

Standards

California Standards
• Geometry California Standards Test - Logic and Geometric Proofs Cluster: Students construct and judge the validity of a logical argument and give counterexamples to disprove a statement. (3.0) • California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1) • California High School Exit Exam -- Math - Mathematical Reasoning: Make and test conjectures by using both inductive and deductive reasoning (2.4) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Communicate the logical connection among hypotheses, science concepts, tests conducted, data collected, and conclusions drawn from scientific evidence (7SIE7.c.) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Evaluate the accuracy and reproducibility of data (8SIE9.b)

- California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions (BIIE1.c.)
- Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Select and use appropriate tools and technology to perform tests, collect data, analyze relationships, and display data (ESIE1.a)
- Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Formulate explanations by using logic and evidence (ESIE1.d)

California CTE Standards – Information and Communication Technologies

- Explicitly Covered
  - 2.3 Interpret verbal and nonverbal communications and respond appropriately.
  - 5.2 Solve predictable and unpredictable [work-related] problems using various types of reasoning (inductive, deductive) as appropriate.
  - 5.4 Interpret information and draw conclusions, based on the best analysis, to make informed decisions.
  - C8.8 Analyze and display data to assist with decision making using methods like cross tabulations, graphs, and charts.
- Potentially Implied
  - 2.4 Demonstrate elements of written [and electronic] communication such as accurate spelling, grammar, and format.

Common Core Standards

- Anchor Standards
  - CCSS.ELA-Literacy.CCRA.W.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.
  - CCSS.ELA-Literacy.CCRA.L.6 Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when encountering an unknown term important to comprehension or expression.
- Mathematical Practice
  - CCSS.Math.Practice.MP4 Model with mathematics.
  - CCSS.Math.Practice.MP5 Use appropriate tools strategically.
- Mathematical Content
  - CCSS.Math.Content.HSS-ID.A.1 Interpreting Categorical and Quantitative Data - Summarize, represent, and interpret data on a single count or measurement variable: Represent data with plots on the real number line (dot plots, histograms, and box plots).
  - CCSS.Math.Content.HSS-ID.A.3 Interpreting Categorical and Quantitative Data - Summarize, represent, and interpret data on a single count or measurement

variable: Interpret differences in shape, center, and spread in the context of data sets, accounting for possible effects of extreme data points (outliers).

CSTA K-12 Computer Science Standards
• CT.L2-07: Represent data in a variety of ways including text, sounds, pictures, and numbers. • CT.L3A-04: Compare techniques for analyzing massive data collections. • CT.L3A-06: Analyze the representation and trade-offs among various forms of digital information. • CT.L3A-07: Describe how various types of data are stored in a computer system. • CPP.L3A-11: Describe techniques for locating and collecting small and large-scale data sets. • CT.L3B-08: Use models and simulations to help formulate, refine, and test scientific hypotheses. • CT.L3B-09: Analyze data and identify patterns through modeling and simulation.

ISTE National Educational Technology Standards (NETS)
• 1d. Identify trends and forecast possibilities. • 3d. Process data and report results. • 6a. Understand and use technology systems.

UNIT 5. COMPUTING AND DATA ANALYSIS

Instructional Days: 15

Topic: Create bar plots and mosaic plots with student data and related data set:

- Students work in groups to analyze the data they collected using bar and mosaic plots.

ECS Focus

4.2 Basic Sets
6.1 Representation and Storage
6.2 Methods for collection and generation.
6.3 Patterns, trends, and discoveries
6.5 Computational Models

Computational Practices

- Communicate thought processes and results.
- Work effectively in teams.
- Analyze their computational work and the work of others.

Standards

California Standards
• Geometry California Standards Test - Logic and Geometric Proofs Cluster: Students construct and judge the validity of a logical argument and give counterexamples to disprove a statement. (3.0) • California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1) • California High School Exit Exam -- Math - Mathematical Reasoning: Make and test conjectures by using both inductive and deductive reasoning (2.4) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Communicate the logical connection among hypotheses, science concepts, tests conducted, data collected, and conclusions drawn from scientific evidence (7SIE7.c.) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Evaluate the accuracy and reproducibility of data (8SIE9.b) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions (BIIE1.c.)

- Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Select and use appropriate tools and technology to perform tests, collect data, analyze relationships, and display data (ESIE1.a)
- Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Formulate explanations by using logic and evidence (ESIE1.d)
- Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Investigate a science-based societal issue by researching the literature, analyzing data, and communicating the findings (ESIE1.m)

California CTE Standards – Information and Communication Technologies

- Explicitly Covered
  - C8.8 Analyze and display data to assist with decision making using methods like cross tabulations, graphs, and charts.
- Potentially Implied
  - 9.7 Participate in [interactive] teamwork to solve [real] Information and Communication Technologies sector issues and problems.

Common Core Standards

- Anchor Standards
  - CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
- Mathematical Practice
  - CCSS.Math.Practice.MP4 Model with mathematics.
  - CCSS.Math.Practice.MP5 Use appropriate tools strategically.
- Mathematical Content
  - CCSS.Math.Content.HSS-ID.A.3 Interpreting Categorical and Quantitative Data - Summarize, represent, and interpret data on a single count or measurement variable: Interpret differences in shape, center, and spread in the context of data sets, accounting for possible effects of extreme data points (outliers).

CSTA K-12 Computer Science Standards

- CT.L2-07: Represent data in a variety of ways including text, sounds, pictures, and numbers.
- CPP.L2-03: Design, develop, publish, and present products (e.g., webpages, mobile applications, animations) using technology resources that demonstrate and communicate curriculum concepts.
- CPP.L2-08: Demonstrate dispositions amenable to open- ended problem solving and programming (e.g., comfort with complexity, persistence, brainstorming, adaptability, patience, propensity to tinker, creativity, accepting challenge).
- CT.L3A-06: Analyze the representation and trade-offs among various forms of digital information.

- CT.L3A-07: Describe how various types of data are stored in a computer system.
- CT.L3B-08: Use models and simulations to help formulate, refine, and test scientific hypotheses.
- CT.L3B-09: Analyze data and identify patterns through modeling and simulation.

ISTE National Educational Technology Standards (NETS)

- 1d. Identify trends and forecast possibilities.
- 4c. Collect and analyze data to identify solutions and/or make informed decisions.
- 6a. Understand and use technology systems.

UNIT 5. COMPUTING AND DATA ANALYSIS

Instructional Days: 16-18

Topic: Review mean, median, minimum, maximum. Discuss various ways to subset data. Represent data with box plots and histograms:

- Students learn to read and interpret a histogram.
- Students learn to create a histogram.
- Students learn to read and interpret a box plot.
- Students learn to create a box plot.
- Students learn when to use histograms and when to use bar charts.
- Students learn about mean, median, minimum, maximum.
- Students learn to create and query subsets of a data set.

ECS Focus

4.2 Basic Sets
6.1 Representation and Storage
6.2 Methods for collection and generation.
6.3 Patterns, trends, and discoveries
6.5 Computational Models

Computational Practices

- Analyze their computational work and the work of others.
- Communicate thought processes and results.

Standards

California Standards
• Geometry California Standards Test - Logic and Geometric Proofs Cluster: Students construct and judge the validity of a logical argument and give counterexamples to disprove a statement. (3.0) • California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1) • California High School Exit Exam -- Math - Mathematical Reasoning: Make and test conjectures by using both inductive and deductive reasoning (2.4) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Communicate the logical connection among hypotheses, science concepts, tests conducted, data collected, and conclusions drawn from scientific

evidence (7SIE7.c.)
- California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Evaluate the accuracy and reproducibility of data (8SIE9.b)
- California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions (BIIE1.c.)
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- Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Formulate explanations by using logic and evidence (ESIE1.d)

California CTE Standards – Information and Communication Technologies

- Explicitly Covered
  - 2.3 Interpret verbal and nonverbal communications and respond appropriately.
  - C8.5 Use queries to extract and [manipulate data] (select queries, action queries).
  - C8.8 Analyze and display data [to assist with decision making] using methods like cross tabulations, graphs, and charts.
- Potentially Implied
  - 2.4 Demonstrate elements of written [and electronic] communication such as accurate spelling, grammar, and format.
  - 5.4 Interpret information and draw conclusions, based on the best analysis, to make informed decisions.

Common Core Standards

- Anchor Standards
  - CCSS.ELA-Literacy.CCRA.W.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.
  - CCSS.ELA-Literacy.CCRA.L.6 Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when encountering an unknown term important to comprehension or expression.
- Mathematical Practice
  - CCSS.Math.Practice.MP4 Model with mathematics.
  - CCSS.Math.Practice.MP5 Use appropriate tools strategically.
- Mathematical Content:
  - CCSS.Math.Content.HSS-ID.A.13 Interpreting Categorical and Quantitative Data - Summarize, represent, and interpret data on a single count or measurement

variable: Represent data with plots on the real number line (dot plots, histograms, and box plots).
    - CCSS.Math.Content.HSS-ID.A.3 Interpreting Categorical and Quantitative Data - Summarize, represent, and interpret data on a single count or measurement variable: Interpret differences in shape, center, and spread in the context of data sets, accounting for possible effects of extreme data points (outliers).
    - CCSS.Math.Content.HSS-CP.A.1 Conditional Probability and Rules of Probability - Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or", "and", "not").

CSTA K-12 Computer Science Standards

- CT.L2-07: Represent data in a variety of ways including text, sounds, pictures, and numbers.
- CT.L3A-04: Compare techniques for analyzing massive data collections.
- CT.L3A-06: Analyze the representation and trade-offs among various forms of digital information.
- CT.L3A-07: Describe how various types of data are stored in a computer system.
- CPP.L3A-11: Describe techniques for locating and collecting small and large-scale data sets.
- CT.L3B-08: Use models and simulations to help formulate, refine, and test scientific hypotheses.
- CT.L3B-09: Analyze data and identify patterns through modeling and simulation.

ISTE National Educational Technology Standards (NETS)

- 1d. Identify trends and forecast possibilities.
- 3d. Process data and report results.
- 6a. Understand and use technology systems.

UNIT 5. COMPUTING AND DATA ANALYSIS

Instructional Days: 19

Topic: Identify mean, median, minimum, maximum, create subsets, and create box plots and histograms with student data and related data set:

- Students work in their groups to analyze their data using statistical analysis and a variety of plots.

ECS Focus

4.2 Basic Sets
6.1 Representation and Storage
6.2 Methods for collection and generation.
6.3 Patterns, trends, and discoveries
6.5 Computational Models

Computational Practices

- Work effectively in teams.
- Communicate thought processes and results.
- Analyze their computational work and the work of others.

Standards

California Standards
• Geometry California Standards Test - Logic and Geometric Proofs Cluster: Students construct and judge the validity of a logical argument and give counterexamples to disprove a statement. (3.0) • California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1) • California High School Exit Exam -- Math - Mathematical Reasoning: Make and test conjectures by using both inductive and deductive reasoning (2.4) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Communicate the logical connection among hypotheses, science concepts, tests conducted, data collected, and conclusions drawn from scientific evidence (7SIE7.c.) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Evaluate the accuracy and reproducibility of data (8SIE9.b) • California Standards Tests in Science Investigation and Experimentation Cluster - Life

Science (Grade 10): Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions (BIIE1.c.)
- Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Select and use appropriate tools and technology to perform tests, collect data, analyze relationships, and display data (ESIE1.a)
- Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Formulate explanations by using logic and evidence (ESIE1.d)
- Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Investigate a science-based societal issue by researching the literature, analyzing data, and communicating the findings (ESIE1.m)

California CTE Standards – Information and Communication Technologies

- Explicitly Covered
  - 9.7 Participate in [interactive] teamwork to solve [real] Information and Communication Technologies sector issues and problems.

Common Core Standards

- Anchor Standards
  - CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
- Mathematical Practice
  - CCSS.Math.Practice.MP4 Model with mathematics.
  - CCSS.Math.Practice.MP5 Use appropriate tools strategically.
- Mathematical Content
  - CCSS.Math.Content.HSS-IC.B.4 Making Inferences and Justifying Conclusions - Make inferences and justify conclusions from sample surveys, experiments, and observational studies: Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.

CSTA K-12 Computer Science Standards

- CT.L2-07: Represent data in a variety of ways including text, sounds, pictures, and numbers.
- CPP.L2-03: Design, develop, publish, and present products (e.g., webpages, mobile applications, animations) using technology resources that demonstrate and communicate curriculum concepts.
- CPP.L2-088: Demonstrate dispositions amenable to open- ended problem solving and programming (e.g., comfort with complexity, persistence, brainstorming, adaptability, patience, propensity to tinker, creativity, accepting challenge).
- CT.L3A-06: Analyze the representation and trade-offs among various forms of digital information.

- CT.L3B-08: Use models and simulations to help formulate, refine, and test scientific hypotheses.
- CT.L3B-09: Analyze data and identify patterns through modeling and simulation.

ISTE National Educational Technology Standards (NETS)

- 1d. Identify trends and forecast possibilities.
- c. Collect and analyze data to identify solutions and/or make informed decisions.
  6a. Understand and use technology systems.

UNIT 5. COMPUTING AND DATA ANALYSIS

Instructional Days: 20-22

Topic: Use a variety of filters and queries to create subsets of text data. Create bar plots to graphically display the information:

- Students work with textual data.
- Students learn to filter text data (remove punctuation, remove case, remove stop words, etc.)
- Students create a bar chart for analyzing text.
- Students create and query subsets of a text data set.

ECS Focus

4.2 Basic Sets
6.1 Representation and Storage
6.2 Methods for collection and generation.
6.3 Patterns, trends, and discoveries
6.5 Computational Models

Computational Practices

- Analyze their computational work and the work of others.

Standards

California Standards
• Geometry California Standards Test - Logic and Geometric Proofs Cluster: Students construct and judge the validity of a logical argument and give counterexamples to disprove a statement. (3.0) • California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1) • California High School Exit Exam -- Math - Mathematical Reasoning: Make and test conjectures by using both inductive and deductive reasoning (2.4) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Communicate the logical connection among hypotheses, science concepts, tests conducted, data collected, and conclusions drawn from scientific evidence (7SIE7.c.) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Evaluate the accuracy and reproducibility of data (8SIE9.b)

- California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions (BIIE1.c.)
- Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Select and use appropriate tools and technology to perform tests, collect data, analyze relationships, and display data (ESIE1.a)
- Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Formulate explanations by using logic and evidence (ESIE1.d)

California CTE Standards – Information and Communication Technologies

- Explicitly Covered
  - 2.3 Interpret verbal and nonverbal communications and respond appropriately.
  - 10.1 Interpret and explain terminology and practices specific to the Information and Communication Technologies sector.
  - C8.5 Use queries to extract and [manipulate data] (select queries, action queries).
  - C8.8 Analyze and display data [to assist with decision making] using methods like cross tabulations, graphs, and charts.
- Potentially Implied
  - 2.4 Demonstrate elements of written [and electronic] communication such as accurate spelling, grammar, and format.

Common Core Standards

- Anchor Standards
  - CCSS.ELA-Literacy.CCRA.W.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.
  - CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
  - CCSS.ELA-Literacy.CCRA.L.6 Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when encountering an unknown term important to comprehension or expression.
- Mathematical Practice
  - CCSS.Math.Practice.MP4 Model with mathematics.
  - CCSS.Math.Practice.MP5 Use appropriate tools strategically.
- Mathematical Content
  - CCSS.Math.Content.HSS-ID.A.1 Interpreting Categorical and Quantitative Data - Summarize, represent, and interpret data on a single count or measurement variable: Represent data with plots on the real number line (dot plots,

histograms, and box plots).
    - CCSS.Math.Content.HSS-CP.A.1 Conditional Probability and the Rules of Probability - Understand independence and conditional probability and use them to interpret data: Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or" and "not").

CSTA K-12 Computer Science Standards

- CT.L2-07: Represent data in a variety of ways including text, sounds, pictures, and numbers.
- CT.L3A-06: Analyze the representation and trade-offs among various forms of digital information.
- CT.L3A-07: Describe how various types of data are stored in a computer system.
- CPP.L3A-11: Describe techniques for location and collecting small and large-scale data sets
- CT.L3B-08: Use models and simulations to help formulate, refine, and test scientific hypotheses.
- CT.L3B-09: Analyze data and identify patterns through modeling and simulation.

ISTE National Educational Technology Standards (NETS)

- 3d. Process data and report results
- 6a. Understand and use technology systems.

UNIT 5. COMPUTING AND DATA ANALYSIS

Instructional Days: 23

Topic: Analyze text in student data and related data set:

- Students work in groups to analyze their data using textual analysis techniques.

ECS Focus

4.2 Basic Sets
6.1 Representation and Storage
6.2 Methods for collection and generation.
6.3 Patterns, trends, and discoveries
6.5 Computational Models

Computational Practices

- Analyze their computational work and the work of others.

Standards

California Standards
• Geometry California Standards Test - Logic and Geometric Proofs Cluster: Students construct and judge the validity of a logical argument and give counterexamples to disprove a statement. (3.0) • California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1) • California High School Exit Exam -- Math - Mathematical Reasoning: Make and test conjectures by using both inductive and deductive reasoning (2.4) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Communicate the logical connection among hypotheses, science concepts, tests conducted, data collected, and conclusions drawn from scientific evidence (7SIE7.c.) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Evaluate the accuracy and reproducibility of data (8SIE9.b) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions (BIIE1.c.) • Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Select and use appropriate tools and technology to perform tests, collect data, analyze

relationships, and display data (ESIE1.a)
- Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Formulate explanations by using logic and evidence (ESIE1.d)
- Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Investigate a science-based societal issue by researching the literature, analyzing data, and communicating the findings (ESIE1.m)

California CTE Standards – Information and Communication Technologies

- Explicitly Covered
  - 9.7 Participate in [interactive] teamwork to solve [real] Information and Communication Technologies sector issues and problems.
  - C8.5 Use queries to extract and [manipulate data] (select queries, action queries).
  - C8.8 Analyze and display data [to assist with decision making] using methods like cross tabulations, graphs, and charts.
- Potentially Implied
  - 9.2 Identify the characteristics of successful teams, including leadership, cooperation, collaboration, and effective decision-making skills as applied in groups, teams, and career technical student organization activities.
  - 9.3 Understand the characteristics and benefits of teamwork, [leadership, and citizenship] in the school, [community, and workplace setting].

Common Core Standards

- Anchor Standards
  - CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
- Mathematical Practice
  - CCSS.Math.Practice.MP4 Model with mathematics.
  - CCSS.Math.Practice.MP5 Use appropriate tools strategically.
- Mathematical Content
  - CCSS.Math.Content.HSS-IC.B.4 Making inferences and Justifying Conclusions - Make inferences and justify conclusions from sample surveys, experiments, and observational studies: Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.

CSTA K-12 Computer Science Standards

- CT.L2-07: Represent data in a variety of ways including text, sounds, pictures, and numbers.
- CPP.L2-03: Design, develop, publish, and present products (e.g., webpages, mobile applications, animations) using technology resources that demonstrate and

communicate curriculum concepts.

- CPP.L2-08: Demonstrate dispositions amenable to open- ended problem solving and programming (e.g., comfort with complexity, persistence, brainstorming, adaptability, patience, propensity to tinker, creativity, accepting challenge).
- CT.L3A-06: Analyze the representation and trade-offs among various forms of digital information.
- CT.L3A-07: Describe how various types of data are stored in a computer system.
- CPP.L3A-11: Describe techniques for location and collecting small and large-scale data sets
- CT.L3B-08: Use models and simulations to help formulate, refine, and test scientific hypotheses.
- CT.L3B-08: Analyze data and identify patterns through modeling and simulation.

ISTE National Educational Technology Standards (NETS)

- 1d. Identify trends and forecast possibilities.
- 4c. Collect and analyze data to identify solutions and/or make informed decisions.
  6a. Understand and use technology systems.

UNIT 5. COMPUTING AND DATA ANALYSIS

Instructional Days: 24-26

Topic: Finalize data analysis for final project:

- Student groups work to incorporate unit objectives into their projects.

ECS Focus

4.2 Basic Sets
6.1 Representation and Storage
6.2 Methods for collection and generation.
6.3 Patterns, trends, and discoveries
6.5 Computational Models

Computational Practices

- Design and implement creative solutions and artifacts.
- Work effectively in teams.

Standards

California Standards
• Geometry California Standards Test - Logic and Geometric Proofs Cluster: Students construct and judge the validity of a logical argument and give counterexamples to disprove a statement. (3.0) • California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1) • California High School Exit Exam -- Math - Mathematical Reasoning: Make and test conjectures by using both inductive and deductive reasoning (2.4) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Communicate the logical connection among hypotheses, science concepts, tests conducted, data collected, and conclusions drawn from scientific evidence (7SIE7.c.) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Evaluate the accuracy and reproducibility of data (8SIE9.b) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions (BIIE1.c.) • Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Select

and use appropriate tools and technology to perform tests, collect data, analyze relationships, and display data (ESIE1.a)
- Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Formulate explanations by using logic and evidence (ESIE1.d)
- Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Investigate a science-based societal issue by researching the literature, analyzing data, and communicating the findings (ESIE1.m)

California CTE Standards – Information and Communication Technologies

- Explicitly Covered
  - 2.3 Interpret verbal and nonverbal communications and respond appropriately.
  - 9.7 Participate in [interactive] teamwork to solve [real] Information and Communication Technologies sector issues and problems.
  - C8.5 Use queries to extract and [manipulate data] (select queries, action queries).
  - C8.8 Analyze and display data [to assist with decision making] using methods like cross tabulations, graphs, and charts.
- Potentially Implied
  - 2.4 Demonstrate elements of written [and electronic] communication such as accurate spelling, grammar, and format.
  - 9.2 Identify the characteristics of successful teams, including leadership, cooperation, collaboration, and effective decision-making skills as applied in groups, teams, and career technical student organization activities.
  - 9.3 Understand the characteristics and benefits of teamwork, [leadership, and citizenship] in the school, [community, and workplace setting].

Common Core Standards

- Anchor Standards
  - CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
  - CCSS.ELA-Literacy.CCRA.SL.5 Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations
- Mathematical Practice
  - CCSS.Math.Practice.MP4 Model with mathematics.
  - CCSS.Math.Practice.MP5 Use appropriate tools strategically.
- Mathematical Content
  - CCSS.Math.Content.HSS-IC.B.4 Making inferences and Justifying Conclusions - Make inferences and justify conclusions from sample surveys, experiments, and observational studies: Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation

models for random sampling.
    - CCSS.Math.Content.HSS-ID.A.1 Interpreting Categorical and Quantitative Data - Summarize, represent, and interpret data on a single count or measurement variable: Represent data with plots on the real number line (dot plots, histograms, and box plots).

CSTA K-12 Computer Science Standards

- CT.L2-07: Represent data in a variety of ways including text, sounds, pictures, and numbers.
- CPP.L2-03: Design, develop, publish, and present products (e.g., webpages, mobile applications, animations) using technology resources that demonstrate and communicate curriculum concepts.
- CPP.L2-08: Demonstrate dispositions amenable to open- ended problem solving and programming (e.g., comfort with complexity, persistence, brainstorming, adaptability, patience, propensity to tinker, creativity, accepting challenge).
- CT.L3A-06: Analyze the representation and trade-offs among various forms of digital information.
- CT.L3A-07: Describe how various types of data are stored in a computer system.
- CT.L3B-08: Use models and simulations to help formulate, refine, and test scientific hypotheses.
- CT.L3B-09: Analyze data and identify patterns through modeling and simulation.
- CD.L3A-04: Compare various forms of input and output

ISTE National Educational Technology Standards (NETS)

- 1d. Identify trends and forecast possibilities.
- 2b. Interact, collaborate, and publish with peers, experts, or others employing a variety of digital environments and media.
- 2d. Contribute to project teams to produce original works or solve problems.
- 4c. Collect and analyze data to identify solutions and/or make informed decisions.
- 6a. Understand and use technology systems.

UNIT 5. COMPUTING AND DATA ANALYSIS

Instructional Days: 27-29

Topic: Develop website or Scratch program to present data analysis campaign:

- Student groups work to incorporate all unit objects into the final project.

ECS Focus

4.2 Basic Sets
6.1 Representation and Storage
6.2 Methods for collection and generation.
6.3 Patterns, trends, and discoveries
6.4 Evaluation
6.5 Computational Models

Computational Practices

- Design and implement creative solutions and artifacts.
- Work effectively in teams.

Standards

California Standards
• Geometry California Standards Test - Logic and Geometric Proofs Cluster: Students construct and judge the validity of a logical argument and give counterexamples to disprove a statement. (3.0) • California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1) • California High School Exit Exam -- Math - Mathematical Reasoning: Make and test conjectures by using both inductive and deductive reasoning (2.4) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Communicate the logical connection among hypotheses, science concepts, tests conducted, data collected, and conclusions drawn from scientific evidence (7SIE7.c.) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Evaluate the accuracy and reproducibility of data (8SIE9.b) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions (BIIE1.c.)

- Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Select and use appropriate tools and technology to perform tests, collect data, analyze relationships, and display data (ESIE1.a)
- Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Formulate explanations by using logic and evidence (ESIE1.d)
- Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Investigate a science-based societal issue by researching the literature, analyzing data, and communicating the findings (ESIE1.m)

California CTE Standards – Information and Communication Technologies

- Explicitly Covered
  - 2.3 Interpret verbal and nonverbal communications and respond appropriately.
  - 9.7 Participate in [interactive] teamwork to solve [real] Information and Communication Technologies sector issues and problems.
  - C6.4 Develop a presentation or other multimedia project: video, game, or interactive Web sites, from storyboard to production.
  - C8.5 Use queries to extract and [manipulate data] (select queries, action queries).
  - C8.8 Analyze and display data [to assist with decision making] using methods like cross tabulations, graphs, and charts.
- Potentially Implied
  - 2.4 Demonstrate elements of written [and electronic] communication such as accurate spelling, grammar, and format.
  - 9.2 Identify the characteristics of successful teams, including leadership, cooperation, collaboration, and effective decision-making skills as applied in groups, teams, and career technical student organization activities.
  - 9.3 Understand the characteristics and benefits of teamwork, [leadership, and citizenship] in the school, [community, and workplace setting].

Common Core Standards

- Anchor Standards
  - CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
  - CCSS.ELA-Literacy.CCRA.SL.5 Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations
- Mathematical Practice
  - CCSS.Math.Practice.MP4 Model with mathematics.
  - CCSS.Math.Practice.MP5 Use appropriate tools strategically.
- Mathematical Content
  - CCSS.Math.Content.HSS-IC.B.4 Making inferences and Justifying Conclusions -

Make inferences and justify conclusions from sample surveys, experiments, and observational studies: Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.

- CCSS.Math.Content.HSS-ID.A.1 Interpreting Categorical and Quantitative Data - Summarize, represent, and interpret data on a single count or measurement variable: Represent data with plots on the real number line (dot plots, histograms, and box plots).

CSTA K-12 Computer Science Standards

- CT.L2-07: Represent data in a variety of ways including text, sounds, pictures, and numbers.
- CL.L2-02: Collaboratively design, develop, publish, and present products (e.g., videos, podcasts, websites) using technology resources that demonstrate and communicate curriculum concepts.
- CL.L2-03: Collaborate with peers, experts, and others using collaborative practices such as pair programming, working in project teams, and participating in group active learning activities.
- CL.L2-04: Exhibit dispositions necessary for collaboration: providing useful feedback, integrating feedback, understanding and accepting multiple perspectives, socialization.
- CPP.L2-03: Design, develop, publish, and present products (e.g., webpages, mobile applications, animations) using technology resources that demonstrate and communicate curriculum concepts.
- CPP.L2-08: Demonstrate dispositions amenable to open- ended problem solving and programming (e.g., comfort with complexity, persistence, brainstorming, adaptability, patience, propensity to tinker, creativity, accepting challenge).
- CT.L3A-06: Analyze the representation and trade-offs among various forms of digital information.
- CT.L3A-07: Describe how various types of data are stored in a computer system.
- CL.L3A-01: Work in a team to design and develop a software artifact.
- CT.L3B-08: Use models and simulations to help formulate, refine, and test scientific hypotheses.
- CT.L3B-09: Analyze data and identify patterns through modeling and simulation.

ISTE National Educational Technology Standards (NETS)

- 1d. Identify trends and forecast possibilities.
- 2b. Interact, collaborate, and publish with peers, experts, or others employing a variety of digital environments and media.
- 2d. Contribute to project teams to produce original works or solve problems.
- 4c. Collect and analyze data to identify solutions and/or make informed decisions.

6a. Understand and use technology systems.

UNIT 5. COMPUTING AND DATA ANALYSIS

Instructional Days: 30

Topic: Final project presentations:

- Teams present their findings to the class.
- Other teams ask questions and participate in the discussion.

ECS Focus

4.2 Basic Sets
6.1 Representation and Storage
6.2 Methods for collection and generation.
6.3 Patterns, trends, and discoveries
6.4 Evaluation
6.5 Computational Models

Computational Practices

- Communicate thought processes and results.
- Analyze their computational work and the work of others.

Standards

California Standards
• Geometry California Standards Test - Logic and Geometric Proofs Cluster: Students construct and judge the validity of a logical argument and give counterexamples to disprove a statement. (3.0) • California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1) • California High School Exit Exam -- Math - Mathematical Reasoning: Make and test conjectures by using both inductive and deductive reasoning (2.4) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Communicate the logical connection among hypotheses, science concepts, tests conducted, data collected, and conclusions drawn from scientific evidence (7SIE7.c.) California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Evaluate the accuracy and reproducibility of data (8SIE9.b) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Identify possible reasons for inconsistent results, such as sources of

error or uncontrolled conditions (BIIE1.c.)
- Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Select and use appropriate tools and technology to perform tests, collect data, analyze relationships, and display data (ESIE1.a)
- Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Formulate explanations by using logic and evidence (ESIE1.d)
- Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Investigate a science-based societal issue by researching the literature, analyzing data, and communicating the findings (ESIE1.m)

California CTE Standards – Information and Communication Technologies

- Explicitly Covered
  - 2.3 Interpret verbal and nonverbal communications and respond appropriately.
  - 9.7 Participate in [interactive] teamwork to solve [real] Information and Communication Technologies sector issues and problems.
- Potentially Implied
  - 9.2 Identify the characteristics of successful teams, including leadership, cooperation, collaboration, and effective decision-making skills as applied in groups, teams, and career technical student organization activities.
  - 9.3 Understand the characteristics and benefits of teamwork, [leadership, and citizenship] in the school, [community, and workplace setting].

Common Core Standards

- Anchor Standards
  - CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
  - CCSS.ELA-Literacy.CCRA.SL.4 Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.
  - CCSS.ELA-Literacy.CCRA.SL.5 Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations
- Mathematical Practice
  - CCSS.Math.Practice.MP4 Model with mathematics.
  - CCSS.Math.Practice.MP5 Use appropriate tools strategically.
- Mathematical Content
  - CCSS.Math.Content.HSS-IC.B.4 Making inferences and Justifying Conclusions - Make inferences and justify conclusions from sample surveys, experiments, and observational studies: Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation

models for random sampling.
    - CCSS.Math.Content.HSS-ID.A.1 Interpreting Categorical and Quantitative Data - Summarize, represent, and interpret data on a single count or measurement variable: Represent data with plots on the real number line (dot plots, histograms, and box plots).

CSTA K-12 Computer Science Standards

- CL.L2-04: Exhibit dispositions necessary for collaboration: providing useful feedback, integrating feedback, understanding and accepting multiple perspectives, socialization.
- CPP.L2-03: Design, develop, publish, and present products (e.g., webpages, mobile applications, animations) using technology resources that demonstrate and communicate curriculum concepts.

ISTE National Educational Technology Standards (NETS)

- 2b. Communicate information and ideas effectively to multiple audiences using a variety of digital environments and media.

UNIT 6. ROBOTICS

Instructional Days: 1

Topic: What is a robot? Identify the criteria that make an item a robot:

- Students do activities to list and explain the criteria that describe a robot.
- Students determine if something is a robot, using the criteria.

ECS Focus

2.1 What is intelligence?
2.2 Computers vs. humans

Computational Practices

- Communicate thought processes and results.

Standards

California Standards
• Geometry California Standards Test - Logic and Geometric Proofs Cluster: Students construct and judge the validity of a logical argument and give counterexamples to disprove a statement. (3.0) • California High School Exit Exam -- Math - Mathematical Reasoning: Make and test conjectures by using both inductive and deductive reasoning (2.4) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3)

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ 2.3 Interpret verbal and nonverbal communications and respond appropriately.
  ○ 10.1 Interpret and explain terminology and practices specific to the Information and Communication Technologies sector.
  ○ C3.1 Describe and apply the basic process of input, processing, and output.
  ○ C9.1 Demonstrate awareness of the applications of device development work, including personalized computing, robotics, and smart appliances.

Common Core Standards
• Anchor Standards   ○ CCSS.ELA-Literacy.CCRA.L.6 Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when encountering an unknown term important to comprehension or expression.

CSTA K-12 Computer Science Standards
• CD.L2-07: Describe what distinguishes humans from machines focusing on human intelligence versus machine intelligence and ways we can communicate. • CD.L2-08: Describe ways in which computers use models of intelligent behavior (e.g., robot motion, speech and language understanding, and computer vision). • CD.L3A-10: Describe the major applications of artificial intelligence and robotics. • CD.L3B-05: Explain the notion of intelligent behavior through computer modeling and robotics.

ISTE National Educational Technology Standards (NETS)
• 4b. Plan and manage activities to develop a solution or complete a project.

UNIT 6. ROBOTICS

Instructional Days: 2-3

Topic: Evaluate robot body designs and create algorithms to control robot behavior:

- Students evaluate how the design of a robot's body affects its behavior.
- Students simulate a human robot using only 5 commands.

ECS Focus

3.1 Exploring problems: problem-solving heuristics and strategies
3.9 Algorithm efficiency

Computational Practices

- Communicate thought processes and results.

Standards

California Standards
• Geometry California Standards Test - Logic and Geometric Proofs Cluster: Students construct and judge the validity of a logical argument and give counterexamples to disprove a statement. (3.0) • California High School Exit Exam -- Math - Mathematical Reasoning: Make and test conjectures by using both inductive and deductive reasoning (2.4) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3) • Investigation and Experimentation Cluster - Earth Science, Biology, Chemistry: Formulate explanations by using logic and evidence (ESIE1.d)

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ 2.3 Interpret verbal and nonverbal communications and respond appropriately.
  ○ 2.5 Communicate information and ideas effectively [to multiple audiences using a variety of media and formats].
• Potentially Implied
  ○ 2.4 Demonstrate elements of written [and electronic] communication such as accurate spelling, grammar, and format.
  ○ 5.7 Work out problems iteratively and recursively.
  ○ 5.8 Create and use algorithms and solve problems.
  ○ 9.7 Participate in interactive teamwork to solve [real] Information and Communication Technologies sector issues and problems.
  ○ 9.3 Understand the characteristics and benefits of teamwork, [leadership, and citizenship] in the school, [community, and workplace setting].

Common Core Standards

- Anchor Standards
  - CCSS.ELA-Literacy.CCRA.W.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.
  - CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.

CSTA K-12 Computer Science Standards

- CT.L2-03: Define an algorithm as a sequence of instructions that can be processed by a computer.
- CT.L2-06: Describe and analyze a sequence of instructions being followed (e.g., describe a character's behavior in a video game as driven by rules and algorithms).

ISTE National Educational Technology Standards (NETS)

- 4b. Plan and manage activities to develop a solution or complete a project.

UNIT 6. ROBOTICS

Instructional Days: 4

Topic: Set up LEGO® Mindstorms® NXT® kit.

ECS Focus

None

Computational Practices

None

Standards

California Standards
• None

California CTE Standards – Information and Communication Technologies

• Potentially Implied
  ○ 9.3 Understand the characteristics and benefits of teamwork, [leadership, and citizenship] in the school, [community, and workplace setting].
  ○ 9.7 Participate in interactive teamwork to solve [real] Information and Communication Technologies sector issues and problems.

Common Core Standards
• Anchor Standards   ○ CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.

CSTA K-12 Computer Science Standards
• CL.L1-02: Work cooperatively and collaboratively with peers, teachers, and others using technology. • CL.L2-02: Collaboratively design, develop, publish, and present products (e.g., videos, podcasts, websites) using technology resources that demonstrate and communicate curriculum concepts. • CL.L2-03: Collaborate with peers, experts, and others using collaborative practices such as pair programming, working in project teams, and participating in group active learning activities. • CL.L2-04. Exhibit dispositions necessary for collaboration: providing useful feedback, integrating feedback, understanding and accepting multiple perspectives, socialization. • CL.L3A-01: Work in a team to design and develop a software artifact. • CL.L3A-04: Identify how collaboration influences the design and development

ISTE National Educational Technology Standards (NETS)
• 6a. Understand and use technology systems.

UNIT 6. ROBOTICS

Instructional Days: 5

Topic: Build robot base.

ECS Focus

None

Computational Practices

None

Standards

California Standards
• None

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ 9.7 Participate in interactive teamwork to solve real Information and Communication Technologies sector issues and problems.
  ○ C9.2 Install equipment, assemble hardware, [and perform tests using appropriate tools and technology].
• Potentially Implied
  ○ 9.3 Understand the characteristics and benefits of teamwork, [leadership, and citizenship] in the school, [community, and workplace setting].

Common Core Standards
• Anchor Standards   ○ CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.

CSTA K-12 Computer Science Standards
• CL.L1-02: Work cooperatively and collaboratively with peers, teachers, and others using technology. • CL.L2-02: Collaboratively design, develop, publish, and present products (e.g., videos, podcasts, websites) using technology resources that demonstrate and communicate curriculum concepts. • CL.L2-03: Collaborate with peers, experts, and others using collaborative practices such as pair programming, working in project teams, and participating in group active learning activities.

- CL.L2-04. Exhibit dispositions necessary for collaboration: providing useful feedback, integrating feedback, understanding and accepting multiple perspectives, socialization.
- CL.L3A-01: Work in a team to design and develop a software artifact.

ISTE National Educational Technology Standards (NETS)

- 6a. Understand and use technology systems.
- 2d. Contribute to project teams to produce original works or solve problems

UNIT 6. ROBOTICS

Instructional Days: 6-7

Topic: Introduce the features of NXT Brick—the "brain" of the robot:

- Students distinguish between parts of the NXT brick.
- Students learn to hook up input and output devices correctly.
- Student use built-in NXT Brick programs.

ECS Focus

None

Computational Practices

None

Standards

California Standards
• None

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ 2.3 Interpret verbal and nonverbal communications and respond appropriately.
  ○ C9.2 Install equipment, assemble hardware, and perform tests using appropriate tools and technology.
  ○ C9.3 Use hardware to gain input, process information, and take action.
• Potentially Implied
  ○ 2.7 Use technical [writing and] communication skills to work effectively with diverse groups of people.

Common Core Standards
• None

CSTA K-12 Computer Science Standards
• None

ISTE National Educational Technology Standards (NETS)
• 6a. Understand and use technology systems.

UNIT 6. ROBOTICS

Instructional Days: 8-9

Topic: Introduce the features of the Mindstorms NXT software:

- Students recognize the parts of the Mindstorms software.
- Students learn about the different palettes and how to use them.
- Students learn about the difference between software errors and hardware errors.
- Students learn about the difference between logical errors and syntax errors.

ECS Focus

None

Computational Practices

None

Standards

California Standards
• None

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ 2.3 Interpret verbal and nonverbal communications and respond appropriately.
  ○ 4.1 Use electronic reference materials to gather information and produce products and services.
  ○ A6.6 Distinguish types of symptoms and which component's issue could exhibit those symptoms: [the user,] hardware, [network,] or software.
  ○ C9.3 Use hardware to gain input, process information, and take action.
  ○ C9.4 Apply the concepts of embedded programming, including digital logic, machine-level representation of data, and memory-system organization.
  ○ C9.5 Program a micro-controller for a device or robot.
• Potentially Implied
  ○ 5.4 Interpret information and draw conclusions, based on the best analysis, to make informed decisions.
  ○ 5.5 Use a logical and structured approach to isolate and identify the source of problems and to resolve problems.
  ○ 5.8 Create and use algorithms and solve problems.
  ○ C5.4 Test software and projects.

Common Core Standards
• Mathematical Practice   ○ CCSS.Math.Practice.MP5 Use appropriate tools strategically.

CSTA K-12 Computer Science Standards
• CPP.L3A-05: Use Application Program Interfaces (APIs) and libraries to facilitate programming solutions.

ISTE National Educational Technology Standards (NETS)
• 6a. Understand and use technology systems.

UNIT 6. ROBOTICS

Instructional Days: 10-13

Topic: Program the robot using the Mindstorm Robot Educator Software tutorials:

- Students program the robot using some or all of the complete palette of blocks.

ECS Focus

3.2 Design a solution to a problem.
3.3 Choose appropriate tools and techniques.
3.4 Code a solution from a design.
3.5 Test a solution to identify errors.

Computational Practices

None

Standards

California Standards
• California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3)

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ 4.1 Use electronic reference materials to gather information and produce products and services.
  ○ 5.4 Interpret information and draw conclusions, based on the best analysis, to make informed decisions.
  ○ 5.5 Use a logical and structured approach to isolate and identify the source of problems and to resolve problems.
  ○ A6.2 Use a logical and structured approach to isolate and identify the source of problems and to resolve problems.
  ○ C9.4 Apply the concepts of embedded programming, including digital logic, machine-level representation of data, and memory-system organization.
  ○ C9.5 Program a micro-controller for a device or robot.
• Potentially Implied
  ○ 2.3 Interpret verbal and nonverbal communications and respond appropriately.
  ○ 5.8 Create and use algorithms and solve problems.

- A6.6 Distinguish types of symptoms and which component's issue could exhibit those symptoms: [the user,] hardware, [network,] or software.
- C5.4 Test software and projects.
- C9.2 Install equipment, assemble hardware, and perform tests using appropriate tools and technology.
- C9.3 Use hardware to gain input, process information, and take action.

Common Core Standards

- Anchor Standards
  - CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
- Mathematical Practice
  - CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them.

CSTA K-12 Computer Science Standards

- CT.L3A-01: Use predefined functions and parameters, classes and methods to divide a complex problem into simpler parts.
- CPP.L3A-05: Use Application Program Interfaces (APIs) and libraries to facilitate programming solutions.
- CL.L1-02: Work cooperatively and collaboratively with peers, teachers, and others using technology.
- CL.L2-02: Collaboratively design, develop, publish, and present products (e.g., videos, podcasts, websites) using technology resources that demonstrate and communicate curriculum concepts.
- CL.L2-03: Collaborate with peers, experts, and others using collaborative practices such as pair programming, working in project teams, and participating in group active learning activities.
- Cl.L2-04. Exhibit dispositions necessary for collaboration: providing useful feedback, integrating feedback, understanding and accepting multiple perspectives, socialization.
- CL.L3A-01: Work in a team to design and develop a software artifact.
- ~~3A-CL-4: Identify how collaboration influences the design and development~~

ISTE National Educational Technology Standards (NETS)

- 6a. Understand and use technology systems.
- 2d. Contribute to project teams to produce original works or solve problems

UNIT 6. ROBOTICS

Instructional Days: 14

Topic: Introduce RoboCup real life robotic competition and write instructions for tic-tac-toe:

- Students learn how a sequence of game moves can be expressed in simple statements.
- Students examine how robots may be programmed to play soccer.
- Students learn to develop if-then statements and use Boolean operators to direct a human "robot" to play tic-tac-toe.

ECS Focus

3.1 Exploring problems: problem-solving heuristics and strategies
3.9 Algorithm efficiency

Computational Practices

- Design and implement creative solutions and artifacts.

Standards

California Standards
• California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3)

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ 2.3 Interpret verbal and nonverbal communications and respond appropriately.
  ○ 5.8 Create and use algorithms and solve problems.
  ○ 5.12 Apply the concepts of Boolean logic to decision making [and searching].
  ○ 9.7 Participate in interactive teamwork to solve real Information and Communication Technologies sector issues and problems.
• Potentially Implied
  ○ 5.4 Interpret information and draw conclusions, based on the best analysis, to make informed decisions.
  ○ 5.5 Use a logical and structured approach to isolate and identify the source of problems and to resolve problems.
  ○ C5.5 Evaluate results against initial requirements.

Common Core Standards

- Anchor Standards
  - CCSS.ELA-Literacy.CCRA.R.2 Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
  - CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
- Mathematical Practice
  - CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them.
- Mathematical Content
  - CCSS.Math.Content.HSA-CED.A.3 Creating Equations - Create Equations that describe numbers or relationships: Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.

CSTA K-12 Computer Science Standards

- CT.L2-03: Define an algorithm as a sequence of instructions that can be processed by a computer.
- CT.L2-06: Describe and analyze a sequence of instructions being followed (e.g., describe a character's behavior in a video game as driven by rules and algorithms).
- CPP.L2-05: Implement problem solutions using a programming language, including: looping behavior, conditional statements, logic, expressions, variables, and functions.
- CPP.L2-08: Demonstrate dispositions amenable to open- ended problem solving and programming (e.g., comfort with complexity, persistence, brainstorming, adaptability, patience, propensity to tinker, creativity, accepting challenge).
- CL.L1-02: Work cooperatively and collaboratively with peers, teachers, and others using technology.
- CL.L2-02: Collaboratively design, develop, publish, and present products (e.g., videos, podcasts, websites) using technology resources that demonstrate and communicate curriculum concepts.
- CL.L2-03: Collaborate with peers, experts, and others using collaborative practices such as pair programming, working in project teams, and participating in group active learning activities.
- CL.L2-04. Exhibit dispositions necessary for collaboration: providing useful feedback, integrating feedback, understanding and accepting multiple perspectives, socialization.
- CL.L3A-01: Work in a team to design and develop a software artifact.

ISTE National Educational Technology Standards (NETS)

- 2d. Contribute to project teams to produce original works or solve problems.
- 4b. Plan and manage activities to develop a solution and/or make informed decisions.
- 6a. Understand and use technology systems.

UNIT 6. ROBOTICS

Instructional Days: 15

Topic: RoboTic-Tac-Toe Tournament and introduction to RoboCupJunior Dance Challenge:

- Students learn to debug conditional statements by testing them and compete as teams in a Robot Tic-Tac-Toe Challenge.
- Students describe dancing robots that have competed in the RoboCupJunior Dance Challenge.

ECS Focus

3.2 Design a solution to a problem.
3.3 Choose appropriate tools and techniques.
3.4 Code a solution from a design.
3.5 Test a solution to identify errors.

Computational Practices

- Design and implement creative solutions and artifacts.
- Work effectively in teams.

Standards

California Standards
• California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions (BIIE1.c.)

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ 2.3 Interpret verbal and nonverbal communications and respond appropriately.
  ○ 5.5 Use a logical and structured approach to isolate and identify the source of problems and to resolve problems.
  ○ 5.8 Create and use algorithms and solve problems.
  ○ 9.7 Participate in interactive teamwork to solve real Information and Communication Technologies sector issues and problems.
  ○ C5.5 Evaluate results against initial requirements.

- Potentially Implied
  - 9.3 Understand the characteristics and benefits of teamwork, [leadership, and citizenship] in the school, [community, and workplace setting].

Common Core Standards

- Mathematical Practice
  - CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them.
- Mathematical Content
  - CCSS.Math.Content.HSA-CED.A.3 Creating Equations - Create Equations that describe numbers or relationships: Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.

CSTA K-12 Computer Science Standards

- CPP.L2-08: Demonstrate dispositions amenable to open- ended problem solving and programming (e.g., comfort with complexity, persistence, brainstorming, adaptability, patience, propensity to tinker, creativity, accepting challenge).
- CPP.L3A-03: Use various debugging and testing methods to ensure program correctness (e.g., test cases, unit testing, white box, black box, integration testing)
- CPP.L3A-04: Apply analysis, design, and implementation techniques to solve problems (e.g., use one or more software life cycle models).
- CPP.L3A-05:Use Application Program Interfaces (APIs) and libraries to facilitate programming solutions.
- CL.L1-02: Work cooperatively and collaboratively with peers, teachers, and others using technology.
- CL.L2-02: Collaboratively design, develop, publish, and present products (e.g., videos, podcasts, websites) using technology resources that demonstrate and communicate curriculum concepts.
- CL.L2-03: Collaborate with peers, experts, and others using collaborative practices such as pair programming, working in project teams, and participating in group active learning activities.
- CL.L2-04. Exhibit dispositions necessary for collaboration: providing useful feedback, integrating feedback, understanding and accepting multiple perspectives, socialization.
- CL.L3A-01: Work in a team to design and develop a software artifact.

ISTE National Educational Technology Standards (NETS)

- 2d. Contribute to project teams to produce original works or solve problems.
- 4b. Plan and manage activities to develop a solution and/or make informed decisions.
- 6a. Understand and use technology systems.

UNIT 6. ROBOTICS

Instructional Days: 16-18

Topic: Student teams build, program, and present a dancing robot.

ECS Focus

3.2 Design a solution to a problem.
3.3 Choose appropriate tools and techniques.
3.4 Code a solution from a design.
3.5 Test a solution to identify errors.

Computational Practices

- Design and implement creative solutions and artifacts.
- Work effectively in teams.

Standards

California Standards
• Geometry California Standards Test - Logic and Geometric Proofs Cluster: Students construct and judge the validity of a logical argument and give counterexamples to disprove a statement. (3.0) • California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions (BIIE1.c.)

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ 2.3 Interpret verbal and nonverbal communications and respond appropriately.
  ○ 2.5 Communicate information and ideas effectively [to multiple audiences] using a variety of media and formats.
  ○ 5.5 Use a logical and structured approach to isolate and identify the source of problems and to resolve problems.
  ○ 5.8 Create and use algorithms and solve problems.
  ○ 5.12 Apply the concepts of Boolean logic to decision making [and searching.]
  ○ 9.7 Participate in interactive teamwork to solve real Information and

Communication Technologies sector issues and problems.
    - A6.2 Use a logical and structured approach to isolate and identify the source of problems and to resolve problems.
    - C1.4 Work as a member of, and within the scope and boundaries of, a development project team.
    - C4.9 Create programs using control structures, [procedures, functions, parameters, variables, error recovery, and recursion.]
    - C5.4 Test software and projects.
    - C5.5 Evaluate results against initial requirements.
    - C9.4 Apply the concepts of embedded programming, including digital logic, machine-level representation of data, and memory-system organization.
    - C9.5 Program a micro-controller for a device or robot.
- Potentially Implied
    - 2.4 Demonstrate elements of written [and electronic] communication such as accurate spelling, grammar, and format.
    - 5.4 Interpret information and draw conclusions, based on the best analysis, to make informed decisions.
    - 9.3 Understand the characteristics and benefits of teamwork, [leadership, and citizenship] in the school, [community, and workplace setting].
    - A6.6 Distinguish types of symptoms and which component's issue could exhibit those symptoms: [the user,] hardware, [network,] or software.
    - C9.2 Install equipment, assemble hardware, and perform tests using appropriate tools and technology.
    - C9.3 Use hardware to gain input, process information, and take action.

Common Core Standards

- Anchor Standards
    - CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
- Mathematical Practice
    - CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them.

CSTA K-12 Computer Science Standards

- CPP.L2-03: Design, develop, publish, and present products (e.g., webpages, mobile applications, animations) using technology resources that demonstrate and communicate curriculum concepts.
- CPP.L2-05: Implement problem solutions using a programming language, including: looping behavior, conditional statements, logic, expressions, variables, and functions.
- CPP.L2-088: Demonstrate dispositions amenable to open- ended problem solving and programming (e.g., comfort with complexity, persistence, brainstorming, adaptability,

patience, propensity to tinker, creativity, accepting challenge).
- CPP.L3A-03: Use various debugging and testing methods to ensure program correctness (e.g., test cases, unit testing, white box, black box, integration testing).
- CPP.L3A-04: Apply analysis, design, and implementation techniques to solve problems (e.g., use one or more software life cycle models).
- CPP.L3A-05: Use Application Program Interfaces (APIs) and libraries to facilitate programming solutions.
- CL.L3A-01: Work in a team to design and develop a software artifact.
- CL.L1-02: Work cooperatively and collaboratively with peers, teachers, and others using technology.
- CL.L2-02: Collaboratively design, develop, publish, and present products (e.g., videos, podcasts, websites) using technology resources that demonstrate and communicate curriculum concepts.
- CL.L2-03: Collaborate with peers, experts, and others using collaborative practices such as pair programming, working in project teams, and participating in group active learning activities.
- CL.L2-04. Exhibit dispositions necessary for collaboration: providing useful feedback, integrating feedback, understanding and accepting multiple perspectives, socialization.
- CL.L3A-01: Work in a team to design and develop a software artifact.

ISTE National Educational Technology Standards (NETS)

- 2d. Contribute to project teams to produce original works or solve problems.
- 4b. Plan and manage activities to develop a solution and/or make informed decisions.
- 6a. Understand and use technology systems.

UNIT 6. ROBOTICS

Instructional Days: 19-23

Topic: Student teams build program and present a rescue robot.

ECS Focus

3.2 Design a solution to a problem.
3.3 Choose appropriate tools and techniques.
3.4 Code a solution from a design.
3.5 Test a solution to identify errors.

Computational Practices

- Design and implement creative solutions and artifacts.
- Work effectively in teams.

Standards

California Standards

- Geometry California Standards Test - Logic and Geometric Proofs Cluster: Students construct and judge the validity of a logical argument and give counterexamples to disprove a statement. (3.0)
- California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1)
- California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3)
- California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions (BIIE1.c.)

California CTE Standards – Information and Communication Technologies

- Explicitly Covered
  - 2.3 Interpret verbal and nonverbal communications and respond appropriately.
  - 2.5 Communicate information and ideas effectively [to multiple audiences] using a variety of media and formats.
  - 5.5 Use a logical and structured approach to isolate and identify the source of problems and to resolve problems.
  - 5.8 Create and use algorithms and solve problems.
  - 5.12 Apply the concepts of Boolean logic to decision making and searching.
  - 9.7 Participate in interactive teamwork to solve real Information and Communication Technologies sector issues and problems.

- A6.2 Use a logical and structured approach to isolate and identify the source of problems and to resolve problems.
- C1.4 Work as a member of, and within the scope and boundaries of, a development project team.
- C4.9 Create programs using control structures, [procedures, functions, parameters, variables, error recovery, and recursion.]
- C5.4 Test software and projects.
- C5.5 Evaluate results against initial requirements.
- C9.1 Demonstrate awareness of the applications of device development work, including personalized computing, robotics, and smart appliances.
- C9.2 Install equipment, assemble hardware, and perform tests using appropriate tools and technology.

- Potentially Implied
  - 2.4 Demonstrate elements of written [and electronic] communication such as accurate spelling, grammar, and format.
  - A6.6 Distinguish types of symptoms and which component's issue could exhibit those symptoms: [the user,] hardware, [network,] or software.
  - 9.3 Understand the characteristics and benefits of teamwork, [leadership, and citizenship] in the school, [community, and workplace setting].

Common Core Standards

- Anchor Standards
  - CCSS.ELA-Literacy.CCRA.W.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.
  - CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
- Mathematical Practice
  - CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them.

CSTA K-12 Computer Science Standards

- CL.L1-02: Work cooperatively and collaboratively with peers, teachers, and others using technology.
- CL.L2-02: Collaboratively design, develop, publish, and present products (e.g., videos, podcasts, websites) using technology resources that demonstrate and communicate curriculum concepts.
- CL.L2-03: Collaborate with peers, experts, and others using collaborative practices such as pair programming, working in project teams, and participating in group active learning activities.
- CL.L2-044. Exhibit dispositions necessary for collaboration: providing useful feedback, integrating feedback, understanding and accepting multiple perspectives, socialization.

- CL.L3A-01: Work in a team to design and develop a software artifact.

ISTE National Educational Technology Standards (NETS)
• 2d. Contribute to project teams to produce original works or solve problems. • 4b. Plan and manage activities to develop a solution and/or make informed decisions. • 6a. Understand and use technology systems.

UNIT 6. ROBOTICS

Instructional Days: 24-33

Topic: Final projects and presentations:

- Student groups design, build, and program a robot that solves a stated problem.

ECS Focus

3.2 Design a solution to a problem.
3.3 Choose appropriate tools and techniques.
3.4 Code a solution from a design.
3.5 Test a solution to identify errors.

Computational Practices

- Design and implement creative solutions and artifacts.
- Work effectively in teams.

Standards

California Standards
• Geometry California Standards Test - Logic and Geometric Proofs Cluster: Students construct and judge the validity of a logical argument and give counterexamples to disprove a statement. (3.0) • California High School Exit Exam -- Math - Mathematical Reasoning: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns (1.1) • California High School Exit Exam -- Math - Mathematical Reasoning: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations (3.3) • California Standards Tests in Science Investigation and Experimentation Cluster - Life Science (Grade 10): Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions (BIIE1.c.)

California CTE Standards – Information and Communication Technologies

• Explicitly Covered
  ○ 2.3 Interpret verbal and nonverbal communications and respond appropriately.
  ○ 2.5 Communicate information and ideas effectively [to multiple audiences] using a variety of media and formats.
  ○ 2.7 Use technical writing and communication skills to work effectively with [diverse] groups of people.
  ○ 5.5 Use a logical and structured approach to isolate and identify the source of problems and to resolve problems.

- 5.8 Create and use algorithms and solve problems.
- 9.7 Participate in interactive teamwork to solve real Information and Communication Technologies sector issues and problems.
- C1.4 Work as a member of, and within the scope and boundaries of, a development project team.
- C4.9 Create programs using control structures, [procedures, functions, parameters, variables, error recovery, and recursion].
- C5.4 Test software and projects.
- C5.5 Evaluate results against initial requirements.
- C9.1 Demonstrate awareness of the applications of device development work, including personalized computing, robotics, and smart appliances.
- C9.2 Install equipment, assemble hardware, and perform tests using appropriate tools and technology.
- C9.3 Use hardware to gain input, process information, and take action.
- C9.4 Apply the concepts of embedded programming, including digital logic, machine-level representation of data, and memory-system organization.
- C9.5 Program a micro-controller for a device or robot.

- Potentially Implied
  - 2.4 Demonstrate elements of written [and electronic] communication such as accurate spelling, grammar, and format.
  - 5.12 Apply the concepts of Boolean logic to decision making and searching.
  - 7.2 Explain the importance of accountability and responsibility in fulfilling personal, community, and workplace roles.
  - 7.4 Practice time management and efficiency to fulfill responsibilities.
  - A6.6 Distinguish types of symptoms and which component's issue could exhibit those symptoms: [the user,] hardware, [network,] or software.
  - C1.3 Identify and describe how specifications and requirements are developed for new [and existing] software applications.
  - 9.2 Identify the characteristics of successful teams, including leadership, cooperation, collaboration, and effective decision-making skills as applied in groups, teams, and career technical student organization activities.
  - 9.3 Understand the characteristics and benefits of teamwork, [leadership, and citizenship] in the school, [community, and workplace setting].
  - C1.1 Identify the phases of the systems development life cycle, including analysis, design, programming, testing, implementation, maintenance, and improvement.

Common Core Standards

- Anchor Standards
  - CCSS.ELA-Literacy.CCRA.W.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.
  - CCSS.ELA-Literacy.CCRA.W.4 Produce clear and coherent writing in which the

development, organization, and style are appropriate to task, purpose, and audience.
    - CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
- Mathematical Practice
    - CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them.

CSTA K-12 Computer Science Standards

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- CL.L2-02: Collaboratively design, develop, publish, and present products (e.g., videos, podcasts, websites) using technology resources that demonstrate and communicate curriculum concepts.
- CL.L2-03: Collaborate with peers, experts, and others using collaborative practices such as pair programming, working in project teams, and participating in group active learning activities.
- CL.L2-04. Exhibit dispositions necessary for collaboration: providing useful feedback, integrating feedback, understanding and accepting multiple perspectives, socialization.
- CL.L3A-01: Work in a team to design and develop a software artifact.
- CL.L3A-04: Identify how collaboration influences the design and development

ISTE National Educational Technology Standards (NETS)

- 2d. Contribute to project teams to produce original works or solve problems.
- 4b. Plan and manage activities to develop a solution and/or make informed decisions.
- 6a. Understand and use technology systems.

References

State Standards	
California	http://www.cde.ca.gov/be/st/ss/

National Standards	
Common Core Standards	http://www.corestandards.org/the-standards

National IT- Related Standards	
NETS	http://www.iste.org/standards/nets-for-students
CSTA K-12 Computer Science Standards	http://csta.acm.org/Curriculum/sub/K12Standards.html http://csta.acm.org/Curriculum/sub/CurrFiles/CSTA_Standards_Mapped_to_CommonCoreStandards.pdf