

**Exploring
Computer
Science**

Curriculum Mapping to Learning Standards

CSTA Edition

Acknowledgements

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The CSTA standards included here are from <http://csta.acm.org/Curriculum/sub/K12Standards.html>. The same numbering scheme is used here as in the original documents.



Unit-by-Unit Overview of the ECS Curriculum Mapping to the CSTA K12 Computer Science Standards

UNIT	UNIT OBJECTIVES	COMPUTATIONAL PRACTICES	CSTA STANDARDS	
1	* Analyze the characteristics of hardware components to determine the applications for which they can be used.	* Analyze the effects of developments in Computing	CD.L2-01 CD.L2-02	Recognize that computers are devices that execute programs. Identify a variety of electronic devices that contain computational processors.
	* Use appropriate tools and methods to execute Internet searches which yield requested data.	* Design and implement creative solutions and artifacts.	CD.L2-04 CD.L2-07	Use developmentally appropriate, accurate terminology when communicating about technology. Describe what distinguishes humans from machines focusing on human intelligence versus machine intelligence and ways we can communicate.
	* Evaluate the results of web searches and the reliability of information found on the Internet.	* Apply abstractions and models.	CI.L2-02	Demonstrate knowledge of changes in information technologies over time and the effects those changes have on education, the workplace, and society.
	* Explain the differences between tasks that can and cannot be accomplished with a computer.	* Connect computation with other disciplines.	CI.L2-04 CI.L2-05	Evaluate the accuracy, relevance, appropriateness, comprehensiveness, and bias of electronic information sources concerning real-world problems. Describe ethical issues that relate to computers and networks (e.g., security, privacy, ownership, and information sharing).
	* Analyze the effects of computing on society within economic, social, and cultural contexts.	* Communicate thought processes and results.	CL.L2-02	Collaboratively design, develop, publish, and present products (e.g., videos, podcasts, websites) using technology resources that demonstrate and communicate curriculum concepts.
	* Communicate legal and ethical concerns raised by computing innovation.	* Work effectively in teams.	CL.L2-03 CL.L2-04	Collaborate with peers, experts, and others using collaborative practices such as pair programming, working in project teams, and participating in group active learning activities. Exhibit dispositions necessary for collaboration: providing useful feedback, integrating feedback, understanding and accepting multiple perspectives, socialization.
	* Explain the implications of communication as data exchange.		CL.L2-04 CPP.L2-03	Exhibit dispositions necessary for collaboration: providing useful feedback, integrating feedback, understanding and accepting multiple perspectives, socialization. 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.L2-07	Represent data in a variety of ways including text, sounds, pictures, and numbers
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.L2-15	Provide examples of interdisciplinary applications of computational thinking.
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).
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).
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.
CL.L3A-03	Describe how computing enhances traditional forms and enables new forms of experience, expression, communication, and collaboration.
CT.L3A-08	Use modeling and simulation to represent and understand natural phenomenon.

CT.L3A-11	Describe how computation shares features with art and music by translating human intention into artifact.
CD.L3B-05	Explain the notion of intelligent behavior through computer modeling and robotics.
CT.L3B-05	Use data analysis to enhance understanding of complex natural and human systems.

2	* Name and explain the steps they use in solving a problem.	* Analyze the effects of developments in computing.	CL.L2-02	Collaboratively design, develop, publish, and present products (e.g., videos, podcasts, websites) using technology resources that demonstrate and communicate curriculum concepts.
	* Solve a problem by applying appropriate problem-solving techniques.	* Apply abstractions and models.	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.
	* Express a solution using standard design tools.	* Connect computation with other disciplines.	CL.L2-04	Exhibit dispositions necessary for collaboration: providing useful feedback, integrating feedback, understanding and accepting multiple perspectives, socialization.
	* Determine if a given algorithm successfully solves a stated problem.	* Communicate thought processes and results.	CPP.L2-03	Design, develop, publish, and present products (e.g., webpages, mobile applications, animations) using technology resources that demonstrate and communicate curriculum concepts.
	* Create algorithms that meet specified objectives.	* Work effectively in teams.	CPP.L2-04	Demonstrate an understanding of algorithms and their practical application.
	* Explain the connections between binary numbers and computers.		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).
	* Summarize the behavior of an algorithm.		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).
	* Compare the tradeoffs between different algorithms for solving the same problem.		CT.L2-03	Define an algorithm as a sequence of instructions that can be processed by a computer.
	* Explain the characteristics of problems that cannot be solved by an algorithm.		CT.L2-04	Evaluate ways that different algorithms may be used to solve the same

problem.

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).
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.L3A-04	Apply analysis, design, and implementation techniques to solve problems (e.g., use one or more software life cycle models).
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.

3	* Create web pages to address specified objectives.	* Analyze the effects of developments in computing.	CI.L2-03	Analyze the positive and negative impacts of computing on human culture.
	* Create web pages with a practical, personal, and/or societal purpose.	* Design and implement creative solutions and artifacts.	CPP.L2-02	Use a variety of multimedia tools and peripherals to support personal productivity and learning throughout the curriculum.
	* Select appropriate techniques when creating web pages.	* Apply abstractions and models.	CPP.L2-03	Design, develop, publish, and present products (e.g., webpages, mobile applications, animations) using technology resources that demonstrate and communicate curriculum concepts.
	* Use abstraction to separate style from content in web page design and development.		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).
	* Describe the use of a website with appropriate documentation.		CT.L2-01	Use the basic steps in algorithmic problem-solving to design solutions (e.g., problem statement and exploration, examination of sample instances,

	* Analyze their computational work and the work of others.		CT.L2-08	design, implementing a solution, testing, evaluation). Use visual representations of problem states, structures, and data (e.g., graphs, charts, network diagrams, flowcharts).
	* Communicate thought processes and results.		CT.L2-12	Use abstraction to decompose a problem into sub problems
			CD.L3A-04	Compare various forms of input and output
			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).
			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 life cycle models).
			CPP.L3A-05	Use Application Program Interfaces (APIs) and libraries to facilitate programming solutions.
			CPP.L3A-06	Select appropriate file formats for various types and uses of data (moderate)
			CT.L3A-01	Use predefined functions and parameters, classes and methods to divide a complex problem into simpler parts.
			CT.L3A-02	Describe a software development process used to solve software problems (e.g., design, coding, testing, verification).

4	* Use appropriate algorithms to solve a problem.	* Design and implement creative solutions and artifacts.	CL.L2-04	Exhibit dispositions necessary for collaboration: providing useful feedback, integrating feedback, understanding and accepting multiple perspectives, socialization.
	* Design, code, test, and execute a program that corresponds to a set		CPP.L2-03	Design, develop, publish, and present products (e.g., webpages, mobile

	of specifications.			applications, animations) using technology resources that demonstrate and communicate curriculum concepts.
	* Select appropriate programming structures.	* Analyze their computational work and the work of others.	CPP.L2-05	Implement problem solutions using a programming language, including looping behavior, conditional statements, logic, expressions, variables, and functions.
	* Locate and correct errors in a program.	* Connect computation with other disciplines.	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).
	* Explain how a particular program functions.			
	* Justify the correctness of a program.	* Communicate thought processes and results.	CT.L2-02	Describe the process of parallelization as it relates to problem solving.
	* Create programs with practical, personal, and/or societal intent.		CT.L2-14	Examine connections between elements of mathematics and computer science including binary numbers, logic, sets and functions.
			CPP.L3A-05	Use Application Program Interfaces (APIs) and libraries to facilitate programming solutions.
			CPP.L3A-08	Explain the program execution process.
5	* Describe the features of appropriate data sets for specific problems.	* Analyze the effects of developments in computing.	CI.L2-01	Exhibit legal and ethical behaviors when using information and technology and discuss the consequences of misuse.
	* Apply a variety of analysis techniques to large data sets.	* Design and implement creative solutions and artifacts.	CL.L2-02	Collaboratively design, develop, publish, and present products (e.g., videos, podcasts, websites) using technology resources that demonstrate and communicate curriculum concepts.
	* Use computers to find patterns in data and test hypotheses about data.		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.
	* Compare different analysis techniques and discuss the tradeoffs among them.	* Analyze their computational work and the work of others.	CL.L2-04	Exhibit dispositions necessary for collaboration: providing useful feedback, integrating feedback, understanding and accepting multiple perspectives, socialization.
	* Justify conclusions drawn from data analysis.	* Connect computation with other	CPP.L2-03	Design, develop, publish, and present products (e.g., webpages, mobile applications, animations) using technology resources that demonstrate and communicate curriculum concepts.

	disciplines.	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).	
	* Communicate thought processes and results.	CT.L2-07	Represent data in a variety of ways including text, sounds, pictures, and numbers.	
	* Work effectively in teams.	CT.L2-10	Evaluate what kinds of problems can be solved using modeling and simulation.	
		CT.L2-15	Provide examples of interdisciplinary applications of computational thinking.	
		CD.L3A-04	Compare various forms of input and output	
		CL.L3A-01	Work in a team to design and develop a software artifact.	
		CPP.L3A-11	Describe techniques for locating and collecting small and large-scale data sets.	
		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.	
		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.	
6	* Identify the criteria that describe a robot and determine if something is a robot.	* Design and implement creative solutions and artifacts.	CL.L1-02	Work cooperatively and collaboratively with peers, teachers, and others using technology.
	* Match the actions of the robot to the corresponding parts of the program.	* Communicate thought processes and	CD.L2-07	Describe what distinguishes humans from machines focusing on human intelligence versus machine intelligence and ways we can communicate.
	* Build, code, and test a robot that		CD.L2-08	Describe ways in which computers use models of intelligent behavior (e.g., robot motion, speech and language understanding, and computer vision).

solves a stated problem.	results.	CL.L2-02	Collaboratively design, develop, publish, and present products (e.g., videos, podcasts, websites) using technology resources that demonstrate and communicate curriculum concepts.
* Explain ways in which different hardware designs affect the function of a machine.	* Work effectively in teams.	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.
* Describe the tradeoffs among multiple ways to program a robot to achieve a goal.		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).
		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).
		CD.L3A-10	Describe the major applications of artificial intelligence and robotics.
		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 of software products.
		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.
- CT.L3A-01 Use predefined functions and parameters, classes and methods to divide a complex problem into simpler parts.
- CD.L3B-05 Explain the notion of intelligent behavior through computer modeling and robotics.