

# Progression of Computer Science Teachers Association (CSTA) K-12 Computer Science Standards, Revised 2017

Concept	Subconcept	Level 1A (Ages 5-7) <i>By the end of Grade 2, students will be able to...</i>	Level 1B (Ages 8-11) <i>By the end of Grade 5, students will be able to...</i>	Level 2 (Ages 11-14) <i>By the end of Grade 8, students will be able to...</i>	Level 3A (Ages 14-16) <i>By the end of Grade 10, students will be able to...</i>
Computing Systems	Devices	<b>1A-CS-01</b> Select and operate appropriate software to perform a variety of tasks, and recognize that users have different needs and preferences for the technology they use. (P1.1)	<b>1B-CS-01</b> Describe how internal and external parts of computing devices function to form a system. (P7.2)	<b>2-CS-01</b> Recommend improvements to the design of computing devices, based on an analysis of how users interact with the devices. (P3.3)	<b>3A-CS-01</b> Explain how abstractions hide the underlying implementation details of computing systems embedded in everyday objects. (P4.1)
	Hardware & Software	<b>1A-CS-02</b> Use appropriate terminology in identifying and describing the function of common physical components of computing systems (hardware). (P7.2)	<b>1B-CS-02</b> Model how computer hardware and software work together as a system to accomplish tasks. (P4.4)	<b>2-CS-02</b> Design projects that combine hardware and software components to collect and exchange data. (P5.1)	<b>3A-CS-02</b> Compare levels of abstraction and interactions between application software, system software, and hardware layers. (P4.1)
	Troubleshooting	<b>1A-CS-03</b> Describe basic hardware and software problems using accurate terminology. (P6.2, P7.2)	<b>1B-CS-03</b> Determine potential solutions to solve simple hardware and software problems using common troubleshooting strategies. (P6.2)	<b>2-CS-03</b> Systematically identify and fix problems with computing devices and their components. (P6.2)	<b>3A-CS-03</b> Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors. (P6.2)
Networks & The Internet	Network Communication & Organization		<b>1B-NI-04</b> Model how information is broken down into smaller pieces, transmitted as packets through multiple devices over networks and the Internet, and reassembled at the destination. (P4.4)	<b>2-NI-04</b> Model the role of protocols in transmitting data across networks and the Internet. (P4.4)	<b>3A-NI-04</b> Evaluate the scalability and reliability of networks, by describing the relationship between routers, switches, servers, topology, and addressing. (P4.1)
	Cybersecurity	<b>1A-NI-04</b> Explain what passwords are and why we use them, and use strong passwords to protect devices and information from unauthorized access. (P7.3)	<b>1B-NI-05</b> Discuss real-world cybersecurity problems and how personal information can be protected. (P3.1)	<b>2-NI-05</b> Explain how physical and digital security measures protect electronic information. (P7.2)	<b>3A-NI-05</b> Give examples to illustrate how sensitive data can be affected by malware and other attacks. (P7.2)
				<b>2-NI-06</b> Apply multiple methods of encryption to model the secure transmission of information. (P4.4)	<b>3A-NI-06</b> Recommend security measures to address various scenarios based on factors such as efficiency, feasibility, and ethical impacts. (P3.3)
					<b>3A-NI-07</b> Compare various security measures, considering tradeoffs between the usability and security of a computing system. (P6.3)
				<b>3A-NI-08</b> Explain tradeoffs when selecting and implementing cybersecurity recommendations. (P7.2)	
Data & Analysis	Storage	<b>1A-DA-05</b> Store, copy, search, retrieve, modify, and delete information using a computing device and define the information stored as data. (P4.2)	<i>Continuation of standard 1A-DA-05</i>	<b>2-DA-07</b> Represent data using multiple encoding schemes. (P4.0)	<b>3A-DA-09</b> Translate between different bit representations of real-world phenomena, such as characters, numbers, and images. (P4.1)
					<b>3A-DA-10</b> Evaluate the tradeoffs in how data elements are organized and where data is stored. (P3.3)
	Collection, Visualization, & Transformation	<b>1A-DA-06</b> Collect and present the same data in various visual formats. (P7.1, P4.4)	<b>1B-DA-06</b> Organize and present collected data visually to highlight relationships and support a claim. (P7.1)	<b>2-DA-08</b> Collect data using computational tools and transform the data to make it more useful and reliable. (P6.3)	<b>3A-DA-11</b> Create interactive data visualizations using software tools to help others better understand real-world phenomena. (P4.4)
	Inference & Models	<b>1A-DA-07</b> Identify and describe patterns in data visualizations, such as charts or graphs, to make predictions. (P4.1)	<b>1B-DA-07</b> Use data to highlight or propose cause-and-effect relationships, predict outcomes, or communicate an idea. (P7.1)	<b>2-DA-09</b> Refine computational models based on the data they have generated. (P5.3, P4.4)	<b>3A-DA-12</b> Create computational models that represent the relationships among different elements of data collected from a phenomenon or process. (P4.4)
Algorithms & Programming	Algorithms	<b>1A-AP-08</b> Model daily processes by creating and following algorithms (sets of step-by-step instructions) to complete tasks. (P4.4)	<b>1B-AP-08</b> Compare and refine multiple algorithms for the same task and determine which is the most appropriate. (P6.3, P3.3)	<b>2-AP-10</b> Use flowcharts and/or pseudocode to address complex problems as algorithms. (P4.4, P4.1)	<b>3A-AP-13</b> Create prototypes that use algorithms to solve computational problems by leveraging prior student knowledge and personal interests. (P5.2)
	Variables	<b>1A-AP-09</b> Model the way programs store and manipulate data by using numbers or other symbols to represent information. (P4.4)	<b>1B-AP-09</b> Create programs that use variables to store and modify data. (P5.2)	<b>2-AP-11</b> Create clearly named variables that represent different data types and perform operations on their values. (P5.1, P5.2)	<b>3A-AP-14</b> Use lists to simplify solutions, generalizing computational problems instead of repeatedly using simple variables. (P4.1)
	Control	<b>1A-AP-10</b> Develop programs with sequences and simple loops, to express ideas or address a problem. (P5.2)	<b>1B-AP-10</b> Create programs that include sequences, events, loops, and conditionals. (P5.2)	<b>2-AP-12</b> Design and iteratively develop programs that combine control structures, including nested loops and compound conditionals. (P5.1, P5.2)	<b>3A-AP-15</b> Justify the selection of specific control structures when tradeoffs involve implementation, readability, and program performance, and explain the benefits and drawbacks of choices made. (P5.2)
				<b>3A-AP-16</b> Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue by using events to initiate instructions. (P5.2)	
<b>Practices</b>		P1. Fostering an Inclusive Computing Culture P2. Collaborating Around Computing	P3. Recognizing and Defining Computational Problems P4. Developing and Using Abstractions	P5. Creating Computational Artifacts P6. Testing and Refining Computational Artifacts	P7. Communicating About Computing

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Algorithms & Programming (continued)	Modularity	<b>1A-AP-11</b> Decompose (break down) the steps needed to solve a problem into a precise sequence of instructions. (P3.2)	<b>1B-AP-11</b> Decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process. (P3.2)	<b>2-AP-13</b> Decompose problems and subproblems into parts to facilitate the design, implementation, and review of programs. (P3.2)	<b>3A-AP-17</b> Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects. (P3.2)
			<b>1B-AP-12</b> Modify, remix, or incorporate portions of an existing program into one's own work, to develop something new or add more advanced features. (P5.3)	<b>2-AP-14</b> Create procedures with parameters to organize code and make it easier to reuse. (P4.1, P4.3)	<b>3A-AP-18</b> Create artifacts by using procedures within a program, combinations of data and procedures, or independent but interrelated programs. (P5.2)
	Program Development	<b>1A-AP-12</b> Develop plans that describe a program's sequence of events, goals, and expected outcomes. (P5.1, P7.2)	<b>1B-AP-13</b> Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences. (P1.1, P5.1)	<b>2-AP-15</b> Seek and incorporate feedback from team members and users to refine a solution that meets user needs. (P2.3, P1.1)	<b>3A-AP-19</b> Systematically design and develop programs for broad audiences by incorporating feedback from users. (P5.1)
		<b>1A-AP-13</b> Give attribution when using the ideas and creations of others while developing programs. (P7.3)	<b>1B-AP-14</b> Observe intellectual property rights and give appropriate attribution when creating or remixing programs. (P7.3)	<b>2-AP-16</b> Incorporate existing code, media, and libraries into original programs, and give attribution. (P4.2, P5.2, P7.3)	<b>3A-AP-20</b> Evaluate licenses that limit or restrict use of computational artifacts when using resources such as libraries. (P7.3)
		<b>1A-AP-14</b> Debug (identify and fix) errors in an algorithm or program that includes sequences and simple loops. (P6.2)	<b>1B-AP-15</b> Test and debug (identify and fix errors) a program or algorithm to ensure it runs as intended. (P6.1, P6.2)	<b>2-AP-17</b> Systematically test and refine programs using a range of test cases. (P6.1)	<b>3A-AP-21</b> Evaluate and refine computational artifacts to make them more usable and accessible. (P6.3)
			<b>1B-AP-16</b> Take on varying roles, with teacher guidance, when collaborating with peers during the design, implementation, and review stages of program development. (P2.2)	<b>2-AP-18</b> Distribute tasks and maintain a project timeline when collaboratively developing computational artifacts. (P2.2)	<b>3A-AP-22</b> Design and develop computational artifacts working in team roles using collaborative tools. (P2.4)
	<b>1A-AP-15</b> Using correct terminology, describe steps taken and choices made during the iterative process of program development. (P7.2)	<b>1B-AP-17</b> Describe choices made during program development using code comments, presentations, and demonstrations. (P7.2)	<b>2-AP-19</b> Document programs in order to make them easier to follow, test, and debug. (P7.2)	<b>3A-AP-23</b> Document design decisions using text, graphics, presentations, and/or demonstrations in the development of complex programs. (P7.2)	
Impacts of Computing	Culture	<b>1A-IC-16</b> Compare how people live and work before and after the implementation or adoption of new computing technology. (P7.0)	<b>1B-IC-18</b> Discuss computing technologies that have changed the world, and express how those technologies influence, and are influenced by, cultural practices. (P7.1)	<b>2-IC-20</b> Compare tradeoffs associated with computing technologies that affect people's everyday activities and career options. (P7.2)	<b>3A-IC-24</b> Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices. (P1.2)
			<b>1B-IC-19</b> Brainstorm ways to improve the accessibility and usability of technology products for the diverse needs and wants of users. (P1.2)	<b>2-IC-21</b> Discuss issues of bias and accessibility in the design of existing technologies. (P1.2)	<b>3A-IC-25</b> Test and refine computational artifacts to reduce bias and equity deficits. (P1.2)
					<b>3A-IC-26</b> Demonstrate ways a given algorithm applies to problems across disciplines. (P3.1)
	Social Interactions	<b>1A-IC-17</b> Work respectfully and responsibly with others online. (P2.1)	<b>1B-IC-20</b> Seek diverse perspectives for the purpose of improving computational artifacts. (P1.1)	<b>2-IC-22</b> Collaborate with many contributors through strategies such as crowdsourcing or surveys when creating a computational artifact. (P2.4, P5.2)	<b>3A-IC-27</b> Use tools and methods for collaboration on a project to increase connectivity of people in different cultures and career fields. (P2.4)
	Safety, Law, & Ethics		<b>1B-IC-21</b> Use public domain or creative commons media, and refrain from copying or using material created by others without permission. (P7.3)		<b>3A-IC-28</b> Explain the beneficial and harmful effects that intellectual property laws can have on innovation. (P7.3)
		<b>1A-IC-18</b> Keep login information private, and log off of devices appropriately. (P7.3)		<b>2-IC-23</b> Describe tradeoffs between allowing information to be public and keeping information private and secure. (P7.2)	<b>3A-IC-29</b> Explain the privacy concerns related to the collection and generation of data through automated processes that may not be evident to users. (P7.2)
				<b>3A-IC-30</b> Evaluate the social and economic implications of privacy in the context of safety, law, or ethics. (P7.3)	
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The K-12 Computer Science Framework, led by the Association for Computing Machinery, Code.org, Computer Science Teachers Association, Cyber Innovation Center, and National Math and Science Initiative in partnership with states and districts, informed the development of this work. View the framework at <http://k12cs.org>.

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