

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

Concept	Subconcept	Level 1A (Ages 5-7)	Level 1B (Ages 8-11)	Level 2 (Ages 11-14)	Level 3A (Ages 14-16)
		<i>By the end of Grade 2, students will be able to...</i>	<i>By the end of Grade 5, students will be able to...</i>	<i>By the end of Grade 8, students will be able to...</i>	<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)
	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)
	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)	
	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-26</b> Demonstrate ways a given algorithm applies to problems across disciplines. (P3.1)	
	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-27</b> Use tools and methods for collaboration on a project to increase connectivity of people in different cultures and career fields. (P2.4)
		<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-28</b> Explain the beneficial and harmful effects that intellectual property laws can have on innovation. (P7.3)
						<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)	

\*\*\*Standards highlighted in yellow are standards Sphero covers in a lesson, activity or program that is available to all Sphero Edu users.