

Fourth Grade: Computer Science

In Fourth Grade, students deepen their comprehension of the intricate connection between computing devices and networks. The exploration of cybersecurity becomes a focal point, guiding students in understanding the responsible use of computing technologies and the repercussions of inappropriate usage. The students investigate the mechanisms through which computers perceive the world, incorporating sensors and various inputs into their understanding. Computational practices progress as algorithms includes variables and user input. The utilization of data is broadened, with a focus on identifying appropriate data types for problem-solving and creating models of real-world situations.

Algorithms and Programming (AP)

- 4.AP.1 The student will apply computational thinking to identify patterns and design algorithms to compare and contrast multiple algorithms used for the same task.**
- a. Decompose an algorithm, process, or problem into a subset of smaller problems.
 - b. Identify multiple algorithms for the same task.
 - c. Describe patterns within multiple algorithms.
 - d. Determine which algorithm is most effective for a given task.
- 4.AP.2 The student will plan and implement algorithms that consist of sequencing, loops, variables, user input, and conditional control structures using a block-based programming language.**
- a. Identify user input and its role in improving a program.
 - b. Describe the concept of a variable.
 - c. Read and explain a design document to trace and predict an algorithm using plain language, pseudocode, or diagrams.
 - d. Create a design document to plan an algorithm using plain language, pseudocode, or diagrams.
 - e. Write programs that initialize, assign values to, name, and modify variables.
- 4.AP.3 The student will use the iterative design process to create, test, and debug programs containing sequencing, loops, variables, user inputs, and conditional control structures in a block-based programming tool.**
- a. Create and test programs that consist of sequencing, loops, variables, user inputs, and conditional control structures.
 - b. Create and use variables to store and process data.
 - c. Trace and predict the value of variables that change over the course of the program's runtime.
 - d. Analyze and describe program results to assess validity of outcomes.
 - e. Revise and improve programs to resolve errors or produce desired outcomes.

Computing Systems (CSY)

4.CSY.1 The student will model how a computing system works to accomplish a task.

- a. Describe how computing systems perceive the world through sensors and other inputs.
- b. Compare and contrast how humans and computers process information from inputs.
- c. Explain how computing devices may be used to classify and organize input.
- d. Diagram and describe a simple computing system indicating processors, inputs, and outputs.

4.CSY.2 The student will apply troubleshooting strategies when a computing system is not working as intended.

- a. Identify hardware, software, and connectivity problems using accurate terminology.
- b. Apply troubleshooting strategies to address hardware, software, and connectivity problems.

4.CSY.3 The student will describe the learning process of humans and computers.

- a. Compare and contrast how humans and computing technologies collect, store, and process data.
- b. Identify similarities and differences on how humans and computing technologies infer and extract meaning from data.
- c. Define machine learning and identify machine learning approaches: supervised, unsupervised, and reinforcement learning.

Cybersecurity (CYB)

4.CYB.1 The student will examine the impacts of appropriate and inappropriate use of computing technologies.

- a. Examine and explain scenarios for appropriate and inappropriate use of computing technologies.
- b. Develop possible solutions involving inappropriate use of computing technologies.

4.CYB.2 The student will identify and investigate best practices to safeguard information shared online and through online platforms.

- a. Classify personal, private, and public information.
- b. Research and evaluate tradeoffs of sharing information.
- c. Investigate and communicate best practices to limit unauthorized access to information on a computing device.
- d. Demonstrate proper use and protection of personal passwords.
- e. List methods used to safeguard online information.

4.CYB.3 The student will examine how information is shared online and explain the importance of cybersecurity.

- a. Investigate multiple ways people share information online.
- b. Determine and describe when information should be shared and to whom it should be shared.
- c. Describe how personal information can be collected and shared online.
- d. Explain the importance of cybersecurity.

Data and Analysis (DA)

4.DA.1 The student will identify the appropriate type of data needed to solve a problem or answer a question.

- a. Analyze a problem to determine the appropriate type of data needed.
- b. Evaluate the reliability of data sources.
- c. Use numeric values to represent non-numeric ideas to include binary, American Standard Code for Information Interchange (ASCII), and RGB values.
- d. Collect, store, clean, and organize data for analysis and to prepare visualizations.

4.DA.2 The student will create and evaluate data representations to make predictions and conclusions.

- a. Formulate questions that require the collection or acquisition of data.
- b. Collect data to create charts and graphs.
- c. Recognize and analyze patterns and relationships within data sets.
- d. Analyze visual representations to make predictions and draw conclusions.

4.DA.3 The student will create a computational model that represents attributes and behaviors associated with a concept.

- a. Examine models of physical objects and processes.
- b. Create a computational model that reflects the attributes and behaviors associated with a concept.
- c. Explain how a computer model illustrates a given concept.

Impacts of Computing (IC)

4.IC.1 The student will identify and examine the positive and negative impacts of the prevalence of computing technologies.

- a. Identify computing technologies that have changed Virginia's economy.
- b. Examine and explain how computing technologies influence and are influenced by culture.
- c. Identify social and ethical issues related to computing devices and networks.

4.IC.2 The student will describe the impact of screen time on relationships at home and at school.

- a. Describe the impact of excessive screen time on maintaining friendships and family dynamics.
- b. Explain how playing video games and the use of social media can impact relationships and personal health.

4.IC.3 The student will examine the impact of computing technologies in the workforce.

- a. Research and analyze the skills needed for careers in computing technology fields.
- b. Examine the impacts of diversity and inclusivity in computing technology fields.

4.IC.4 The student will describe the importance of copyrights and intellectual property rights.

- a. Demonstrate an understanding of copyright and the fair use of information.
- b. Explain how intellectual property can be protected.
- c. Give proper attribution to the original author of digital and online content.

Networks and the Internet (NI)

4.NI.1 The student will identify the interrelationship between computing devices and a computing network.

- a. Define client and server.
- b. Describe how packets are used to transmit information on a network.
- c. Describe factors that may affect the speed of data transmission.
- d. Differentiate between networking tasks that require Internet access and tasks that do not require Internet access.
- e. Model how computing devices in a network transmit and receive information.