Colorado Computer Science

Middle School

Computational Thinking

1 Systematically analyze a problem using decomposition and abstraction to formulate a solution.

1 Complex problems can be broken into smaller parts to facilitate program implementation and review processes. CS.6-8.1.2

a Decompose problems and subproblems into parts to facilitate the design, implementation, and review of programs. CS.6-8.1.2.A

2 Represent and analyze data in order to generate new knowledge and capability.

2 Data can be collected, transformed and analyzed to develop computational models. CS.6-8.1.3

a Collect data using computational tools and transform the data to make it more useful and reliable. CS.6-8.1.3.A

b Illustrate translation of a structure such as a game board, road map, or mind map into a labeled graph and explain the contributions of the components. CS.6-8.1.3.B

Computing Systems and Networks

3 Use systems thinking to describe networks and common software and hardware components.

1 Computer networks are composed of multiple, connected components and can be arranged logically in a variety of ways. CS.6-8.2.1

a Model the role of protocols in transmitting data across the Internet. CS.6-8.2.1.A

b Design projects that combine hardware and software components to collect and exchange data. CS.6-8.2.1.B

c Systematically identify and fix problems with computing devices and their components. CS.6-8.2.1.C

d Compare and contrast network topologies. CS.6-8.2.1.

4 Develop systems solutions from a set of specifications to complete a design process.

2 The way that users interact with devices can provide useful information for improving the design. CS.6-8.2.2

- a Recommend improvements to the design of computing devices, based on an analysis of how users interact with the devices. CS.6-8.2.2.A
- b Identify the role of connected network components. CS.6-8.2.2.B
- c Discuss issues of bias and accessibility in the design of existing technologies. CS.6-8.2.2.C

5 Recognize and analyze security concepts.

3 Cybersecurity threats can arise from a variety of sources. CS.6-8.2.3

- a Describe various types of threat actors. CS.6-8.2.3.A
- b Develop strategies to raise awareness of hardware vulnerabilities. CS.6-8.2.3.B
- c Evaluate the risks and benefits of Internet of Things devices. CS.6-8.2.3.C
- d Distinguish between responsible and malicious hacking. CS.6-8.2.3.D

Computer Programming

6 Design and create programs, individually and collaboratively, for a variety of disciplines.

3 Programs can combine control structures, including nested loops and compound conditionals to solve complex problems. CS.6-8.3.1

- a Design and iteratively develop programs that combine control structures, including nested loops and compound conditionals. CS.6-8.3.1.A
- b Use flowcharts and/or pseudocode to address complex problems as algorithms. CS.6-8.3.1.B
- c Systematically test and refine programs using a range of test cases. CS.6-8.3.1.C

7 Design and create programs, individually and collaboratively, for a variety of disciplines.

1 Collaborative development of computational artifacts can be made more efficient by employing strategies for project management, crowdsourcing, and feedback. CS.6-8.3.1

- a Represent data using multiple encoding schemes. CS.6-8.3.1.A
- b Document programs in order to make them easier to follow, test, and debug. CS.6-8.3.1.B
- c Seek and incorporate feedback from team members and users to refine a solution that meets user needs. CS.6-8.3.1.C
- d Distribute tasks and maintain a project timeline when collaboratively developing computational artifacts. CS.6-8.3.1.D
- e Collaborate with many contributors through strategies such as crowdsourcing or surveys when creating a computational artifact. CS.6-8.3.1.E

8 Create computational artifacts that consider security from tampering, malicious or otherwise.

2 Computational artifacts can be designed in ways that reduce the risk of data loss or tampering. CS.6-8.3.2

- a Explain the role and importance of backups. CS.6-8.3.2.A

Cybersecurity

9 Create a security risk profile that recognizes and analyzes security concepts.

1 Sharing information creates potential risks that the information could be used inappropriately, but these risks can be partially mitigated. CS.6-8.4.1

- a Explain how physical and digital security measures protect electronic information. CS.6-8.4.1.A
- b Apply multiple methods of encryption to model the secure transmission of information. CS.6-8.4.1.B
- c Describe tradeoffs between allowing information to be public and keeping information private and secure. CS.6-8.4.1.C
- d Discuss the risks and benefits of sharing PII. CS.6-8.4.1.D
- e Explain techniques to detect, correct, and prevent disclosure of PII. CS.6-8.4.1.E
- f Analyze specific federal, state, and local laws as they relate to cybersecurity and privacy. CS.6-8.4.1.F

Artificial Intelligence (AI)

10 Use AI tools to analyze and understand the world and to create and inspire ideas.

1 AI tools can be combined and adapted to solve a vast variety of problems and have the capacity to drive major changes in society. CS.6-8.5.1

- a Examine an aspect of daily life that is predicted to change due to the introduction of AI technologies. CS.6-8.5.1.A
- b Compare the changes AI is bringing to society with those of previous industrial revolutions. CS.6-8.5.1.B
- c Predict a new type of job that might arise, or how an existing type of job might change or go away, as a result of the adoption of AI technologies. CS.6-8.5.1.C
- d Create a novel application using some of the AI extensions or plugins available in the programming framework of your choice. CS.6-8.5.1.D
- e Research a societal problem and describe how AI technologies can be used to address that problem. CS.6-8.5.1.E
- f Create a dataset for training a decision tree classifier or predictor and explore the impact that different feature encodings have on the decision tree. CS.6-8.5.1.F

11 Evaluate the uses of AI.

2 The behavior of AI systems reflects both the goals of the designers and the data used to train the system. CS.6-8.5.2

- a Describe how a vision system might exhibit cultural bias if it lacked knowledge of objects not found in the culture of the people who created it (For example: road signs in different countries). CS.6-8.5.2.A
- b Train and evaluate a classification or prediction model using machine learning on a dataset. CS.6-8.5.2.B
- c Evaluate the ways various stakeholders' goals and values influence the design of AI systems. CS.6-8.5.2.C
- d Explain how the choice of training data shapes the behavior of the classifier, and how bias can be introduced if the training set is not properly balanced to represent the full range and distribution of items being classified. CS.6-8.5.2.D
- e Define criteria for consciousness and evaluate AI systems or fictional AI characters according to those criteria. CS.6-8.5.2.E

12 Explain how AI tools work and how they are built.

3 AI systems combine intelligent agents, reasoning models, and machine learning to 28 perform sophisticated functions such as solving physics problems or identifying human emotional states. CS.6-8.5.3

a Give examples of how intelligent agents combine information from multiple sensors. CS.6-8.5.3.A

b Give examples of different types of computer perception that can extract meaning from sensory signals. CS.6-8.5.3.B

c Illustrate how sequences of words can be recognized as phrases, even if some of the words are unclear, by looking at how the words fit together. CS.6-8.5.3.C

d Show how a game board (e.g., tic-tac-toe, Chutes and Ladders, Monopoly, chess) can be represented by a description in plain language. CS.6-8.5.3.D

e Evaluate how an AI system meets the design criteria of accountability and respect for privacy. CS.6-8.5.3.E

f Contrast the unique characteristics of human learning with the ways machine learning systems operate. CS.6-8.5.3.F

g Model how unsupervised learning finds patterns in unlabeled data. CS.6-8.5.3.G

h Explain the difference between training and using a reasoning model. CS.6-8.5.3.H

i Compare how a decision tree learning algorithm works vs. how a neural network learning algorithm works. CS.6-8.5.3.I

j Explain the differences between supervised learning and reinforcement learning. CS.6-8.5.3.J

k Illustrate the structure of a neural network and describe how its parts form a set of functions that compute an output. CS.6-8.5.3.K

l Illustrate how a computer can solve a maze, find a route on a map, or reason about concepts in a knowledge graph by drawing a search tree. CS.6-8.5.3.L

m Model the process of solving a graph search problem using breadth-first search to draw a search tree. CS.6-8.5.3.M

n Categorize problems as classification, prediction, combinatorial search, or sequential decision problems. CS.6-8.5.3.N

o Illustrate how word embeddings can be used to reason about the meaning of words. CS.6-8.5.3.O

p Describe some NLP (Natural Language Processing) tasks computers can perform and explain how they work. CS.6-8.5.3.P

q Explain the knowledge a computer would need to solve a naive physics reasoning problem. CS.6-8.5.3.Q

r Describe how computers use different types of cues to recognize human emotional states. CS.6-8.5.3.R

Digital Citizenship

13 Practice responsible, ethical, and safe use of computing technology and the Internet.

1 Users can employ specific strategies to mitigate the risks associated with online interactions. CS.6-8.6.1

- a Develop strategies to raise awareness of the effects of, and methods to identify and prevent, cyberbullying. CS.6-8.6.1.A
- b Recognize the many sources of data that make up a digital footprint. CS.6-8.6.1.B
- c Recognize the permanence of a digital footprint. CS.6-8.6.1.C
- d Explain how intellectual property and copyright relate to fair use. CS.6-8.6.1.D
- e Identify the role of social media in their lives. CS.6-8.6.1.E
- f Reflect on the positive and negative effects social media use has on their relationships. CS.6-8.6.1.F
- g Think about how to develop healthy habits when using digital media. CS.6-8.6.1.G
- h Explain why information about them and their behaviors is valuable to companies and consider potential strategies to limit access to information by third parties. CS.6-8.6.1.H