Alabama Course of Study
DIGITAL LITERACY AND
COMPUTER SCIENCE

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Alabama Course of Study: Digital Literacy and Computer Science Education
Preface

The *Alabama Course of Study: Digital Literacy and Computer Science* provides the framework for the study of technology from Kindergarten through Grade 12 in Alabama’s public schools. Content standards in this document define minimum requirements, in accordance with provisions of the Code of Alabama (1975, §16-35-4). The standards are fundamental and specific but not exhaustive. This document provides an overview and learning goals for each grade band, then outlines minimum standards for each grade. When developing local curriculum, school systems are encouraged to include additional content standards to reflect local philosophies, and may add implementation guidelines, resources, and activities.

The 2017 Digital Literacy and Computer Science Course of Study Committee made extensive use of the 2016 ISTE Standards for Students, published by the International Society for Technology in Education; CSTA K-12 Computer Science Standards; and the K-12 Computer Science Framework, which was a collaborative effort licensed under the Creative Commons Attribution. In addition, Committee and Task Force members reviewed other states’ technology curricula and read numerous articles in professional journals and magazines during the development of this Course of Study. Committee members also attended state and national conferences, listened to and read suggestions from interested individuals and groups throughout Alabama, and thoroughly discussed the issues and standards. The Committee and Task Force reached consensus that the standards contained herein provide a comprehensive Digital Literacy and Computer Science curriculum for Alabama’s students.
Alabama Course of Study: 
**Digital Literacy and Computer Science**

**General Introduction**

Technology allows educators and students to transform teaching and learning and to develop crucial skills for communicating, learning, creating, and interacting with each other in our global society. Although technology is not a panacea for all instructional problems, it equips students with tools that have not existed in the past. Technology offers digitally and computationally literate students the opportunity to transition from being simply consumers of information and media to being producers as well. The goal for Alabama students is to be at the forefront of exploring these technological opportunities.

Attaining digital and computational literacy strengthens life skills such as solving problems creatively, thinking critically, and working cooperatively in teams. Because technology is at the center of almost every aspect of daily life, the digitally literate person is more likely to face the challenges of a dynamic global society with confidence.

Digitally literate students demonstrate the ability to use technology responsibly and appropriately to create, collaborate, think critically, and apply algorithmic processes. They can access and evaluate information to gain lifelong knowledge and skills in all subject areas. Alabama includes computational literacy in its definition of digital literacy. Our goal is digital and computational literacy for all Alabama students.

The *Alabama Course of Study: Digital Literacy and Computer Science* defines the minimum required content that students should know and be able to do in order to learn effectively and become capable, responsible, and self-reliant citizens in this information-based global society. Content standards in this document are minimum and required, as specified in the Code of Alabama (1975), §16-35-4. They are fundamental but not exhaustive. In developing local curriculum, school systems are encouraged to include additional content standards reflecting local philosophies and to add implementation guidelines, resources, and activities, which by design, are not contained in this document.

This plan draws upon the requirements of nationally recognized programs. The International Society for Technology in Education (ISTE) Standards for Students emphasize the skills and qualities we want to foster in students, enabling them to engage and thrive in a connected, digital world. The standards are designed for use by educators across the curriculum at every grade level, so that these skills are cultivated throughout a student’s academic career (2016 ISTE Standards for Students). The K–12 Computer Science Framework illuminates the big ideas of computer science through the lenses of concepts (what students should know) and practices (what students should do), representing the behaviors that computationally literate students use to engage with the core concepts of computer science.

The DLCS standards will enable students to employ cognitive and technical skills to find, evaluate, create, and communicate information via existing and emerging technologies. The standards introduce the study of computers and algorithmic processes, including computer science principles, hardware and software designs, applications, networks, and societal impact, in order for students to use their increasingly valuable knowledge and skills in college and careers.

Students are already using digital tools outside of school to create, communicate, and collaborate. These tools provide powerful, engaging learning experiences which pervade their daily lives and impact the future, and we must give our students everything they need to increase their competence. Technological understanding prepares students to be productive citizens. For Alabama’s students to be competitive in a global marketplace, we must ensure that they have the skills they need to thrive in the digital age.
In the early grades, the continuum focuses more on digital literacy, the skills that students must learn with the introduction of computer science standards. In the later grades, the instructional focus transitions more towards computer science while continuing to address more advanced digital literacy skills. While both focus areas are present along the entire continuum, this graph represents the transition in the level of instructional focus as students progress along the continuum.
Conceptual Framework

A citizen of the world, an Alabama student, is depicted as the epicenter from which six strands radiate around the globe. This graphic, depicted on page 3, exemplifies the premise of Alabama’s Digital Literacy and Computer Science Course of Study, which is to improve the lives of students by providing them the knowledge and skills to be innovators and positive contributors to the world. The student’s heart is a prominent feature of the framework, as communication, collaboration, creativity, and critical thinking all require empathy. Empathy begins with understanding the human condition and opening the mind to new perspectives and ideas. Without these, progress cannot be made. Technology has the potential to amplify students’ capacity to collaborate, create, and communicate in an increasingly global economy. In order to improve the world, one must understand how technology has helped to shape the landscape and reshape our institutions at an ever-increasing speed.

A global citizen needs to be proficient not only in the use of digital tools but also in the understanding of how and why they work in order to employ and produce new technologies. These abilities include utilizing technological tools, algorithmic thinking, and digital strategies to acquire knowledge, communicate and collaborate locally and globally, identify and solve complex problems, and share solutions and ideas with the world.

The conceptual framework graphic succinctly summarizes the structure and goals of digital literacy and computer science education in Alabama. The six strands emerging from the student to encircle the globe coincide with the organizational structure of the content standards and specify the roles filled by students of today and tomorrow: Computational Thinker, Citizen of the Digital Culture, Global Collaborator, Computing Analyst, and Innovative Designer. The careful observer notices a sixth ribbon, currently unlabeled, to indicate that new and emerging technologies will require openness to future changes. The strands radiate from the Alabama student to represent his/her digital connection to the world. Digital citizens should not merely connect, but responsibly work together to improve the world. In the background, underpinning the strands, are two elements that are key to their growth. The first is the circuit board, which represents tangible hardware. The next is binary code, which represents the building blocks of software and computer science. Students not only interact with both of these on a daily basis but also take part in their construction in order to become the innovative citizens the world needs today and tomorrow.

The goal of the Digital Literacy and Computer Science standards is to enable students to use cognitive and technical skills responsibly in finding, evaluating, creating, and communicating information. Standards will also introduce students to the study of computers and algorithmic processes, including computer science principles, hardware and software design, applications, networks, and societal impacts, so that students will be fully equipped with the important, increasingly valuable knowledge and skills needed in college and careers.
Crosscutting Standards for Digital Literacy and Computer Science

These standards identify crucial content that will be addressed in every grade. Under these six broad areas, a description, which will become progressively more demanding as students learn and mature, will be outlined in this document later.

Safety, Privacy, and Security
1. Identify, demonstrate, and apply safe use techniques when employing digital devices.

Legal and Ethical Standards
2. Recognize and demonstrate age-appropriate responsible use of digital devices and resources as outlined in school/district rules.

Impact of Computing
3. Identify the purpose of digital content and assess its validity.

Systems
4. Identify and employ appropriate troubleshooting techniques to solve computing or connectivity issues.

Collaborative Research
5. Locate and curate information from digital sources to answer research questions.

Digital Tools
6. Produce, review, and revise authentic, multimedia artifacts using appropriate digital tools.
Grades K - 2 Overview

Students in the primary grades (Grades K-2) begin their formal study of digital literacy and computer science skills. As they are introduced to the digital world, students explore concepts by integrating basic digital literacy skills with simple ideas about computational thinking. With a focus on learning, students begin to conceptualize that digital tools are a means to an end and exercise their autonomy when choosing the best tools or processes to meet a need or to solve a problem. They discover ways to think and to use digital tools to help complete tasks more easily and efficiently.

Students in kindergarten through second grade will meet the following learning goals:

- As **Computational Thinkers**, students will understand computing is an integral part of our world.
- As **Citizens of a Digital Culture**, students will understand how to be good digital citizens.
- As **Global Collaborators**, students will collaborate and contribute ideas with learners from diverse backgrounds.
- As **Computing Analysts**, students will use computers to create.
- As **Innovative Designers**, students will understand challenges and create new ways to address existing problems.

By the end of second grade, students understand the importance of perseverance as they create plans, collect data, and analyze data to make informed decisions.
Students in kindergarten explore ways they relate to their world and to digital environments. They start to learn that safety online is necessary and that certain information should be confidential. As a class, students begin to collaborate beyond the walls of their classroom by learning from others, exploring new ideas, collecting data, and analyzing data to make decisions. These students learn to use digital tools to express ideas, complete tasks, and solve problems, and begin to comprehend how technology can help them understand and relate to others.

*Students can:*

**Computational Thinker**

**Algorithms**
1. Identify the elements of an event.

**Programming and Development**
2. Demonstrate use of input devices.
   - Examples: Mouse, touch screen, keyboard.

**Citizen of a Digital Culture**

**Safety, Privacy, and Security**
3. Identify age-appropriate methods for keeping personal information private.
   - Example: Keeping passwords confidential.
4. Identify safe practices for working in a digital environment.
   - Examples: Do not share personal information, use sites approved by a trusted adult, participate in collaborative scenario discussions, etc.

**Legal and Ethical Behavior**
5. Use a design process to create an artifact or solve a problem.

**Impact of Computing**
6. Recognize ways in which computing devices have changed people’s lives.

**Global Collaborator**

**Digital Tools**
7. Use a variety of programs.
   - Examples: Word processing, presentations, spreadsheets, web applications.
8. Locate letters and numbers on the keyboard.

**Collaborative Research**
9. Recall and share information from a variety of digital resources.
10. Create a research-based product collaboratively using online digital tools, given specific guidance.
Computing Analyst

Data
11. Collect data and organize it in a chart or graph collaboratively.
12. Understand that digital devices can save information.

Systems
13. Use digital devices with a variety of operating systems in a collaborative setting.

Innovative Designer

Design Thinking
15. Define design process as a problem-solving method.
Grade 1

Students in first grade understand, communicate, and use the basic functions of computing devices. They begin to create algorithms collaboratively and start learning keyboarding skills. First graders explore and identify the appropriateness of specific online behaviors. As a class, students communicate and collaborate with people outside of their learning environment to understand how others use technology in their daily lives. Students use digital tools to demonstrate their knowledge to others and use feedback to solve problems.

Students can:

### Computational Thinker

Abstraction
1. Classify and sort information into useful order with/without a computer.
   Examples: Sort by shape, color, or other attribute; sort A-Z.

Algorithms
2. Order events into a logical sequence (algorithm).
   Examples: Unplugged coding, sequence of instruction.

Programming and Development
3. Construct elements of a simple computer program in collaboration with others.
   Examples: Block programming, basic robotics, unplugged programming.

### Citizen of a Digital Culture

Safety, Privacy, and Security
4. Demonstrate age-appropriate methods for keeping personal information private.
   Example: Keeping passwords confidential.
5. Demonstrate safe practices for working in a digital environment.
   Examples: Do not share personal information, use sites approved by a trusted adult.

Legal and ethical behavior
6. Differentiate between prior knowledge and that gained from others.
7. Identify appropriate behaviors for communicating in a digital environment.
   Examples: Cyber bullying, role-playing, stories, collaborative discussion.
8. Identify rules and guidelines governing the use of digital tools.
   Examples: AUP, Terms of Use.

Digital Identity

Impact of Computing
10. Identify ways in which computing devices have impacted people’s lives.
    Example: Communication.
Global Collaborator

Communication
11. Use a variety of digital tools collaboratively to connect with other learners.
   Examples: Online conferences, blogs, collaborative documents.

Digital Tools
12. Create digital artifacts using a variety of programs when given support tools.
   Examples: Word processing, presentations, spreadsheets.
13. Identify an appropriate tool to complete a task when given guidance and support.
14. Type five words-per-minute (wpm) times grade level with 95% accuracy using appropriate
    keyboarding techniques. First grade = 5 wpm.

Collaborative Research
15. Identify keywords in a search and discuss how they may be used to gather information.
16. Collect information from a variety of digital resources.
17. Create a research-based product collaboratively using online digital tools.

Computing Analyst

Data
18. Define why data is collected and organized.
19. Understand that digital devices can save information as data that can be stored, searched, retrieved, and deleted.

Systems
20. Use digital devices with a variety of operating systems.
   Examples: Visible input/output components such as USB, touch screen, keyboard, audio jack, HDMI port, VGA port, speakers.

Innovative Designer

Design Thinking
22. Identify and revise problem-solving strategies to solve a simple problem.
23. Illustrate the design process as a cyclical problem-solving method.
Grade 2

Students in second grade take proper care of computing devices and use them responsibly, gaining benefits from various digital tools as they find ways to use them in their daily tasks. Students research meaningful topics using appropriate sources and acknowledge their sources properly. Students exchange information through various media and present their ideas to diverse audiences. Second graders demonstrate their knowledge of computational thinking by creating multi-step algorithms to solve problems.

Students can:

**Computational Thinker**

Abstraction
1. Create and sort information into useful order using digital tools.
   Examples: Sort data spreadsheets A-Z, simple filters, and tables.

Algorithms
2. Create an algorithm for other learners to follow.
   Examples: Unplugged coding, illustrate sequence of a process such as making a sandwich.

Programming and Development
3. Construct elements of a simple computer program using basic commands.
   Examples: Online drag-and-drop programming, basic robotics.

**Citizen of a Digital Culture**

Safety, Privacy, and Security
4. Practice safe methods for keeping personal information private.
   Example: Keeping passwords confidential.
5. Apply safe practices for working in a digital environment.
   Examples: Do not share personal information; use sites approved by a trusted adult.

Legal and Ethical Behavior
6. Cite media/owners of digital content at an age-appropriate level.
7. Demonstrate appropriate behaviors for communicating in a digital environment.
   Example: Cyberbullying.
8. Apply rules and guidelines governing the use of digital tools.
   Examples: AUP, Terms of Use.

Digital Identity
9. Recognize the positive and negative impacts of digital communication.
   Examples: Anything posted or communicated electronically may be easily reproduced and will remain a part of your digital identity/footprint.

Impact of Computing
10. Analyze ways in which computing devices have influenced people’s lives.
**Global Collaborator**

Communication
11. Use a variety of digital tools to connect with other learners.  
   Examples: Online conferences, blogs, collaborative documents.

Digital Tools
12. Design digital artifacts using a variety of programs.  
   Examples: Word processing, presentations, spreadsheets.
13. Identify multiple tools to complete a task.
14. Type five words-per-minute (wpm) times grade level with 95% accuracy using appropriate  
    keyboading techniques. Second grade = 10 wpm.

Collaborative Research
15. Conduct basic keyword searches to gather information.
16. Synthesize information from a variety of digital resources.
17. Create a research-based product using online digital tools.

**Computing Analyst**

Data
18. Collect, create, and organize data in a digital chart or graph.
19. Explain that users control how digital devices can save information in an organized manner.  
   Example: File structures.

Systems
20. Compare the different operating systems on digital devices.
21. Explain the purposes of visible input/output components of digital devices.

**Innovative Designer**

Design Thinking
22. Reflect upon the design process and use digital tools to illustrate potential solutions, given guidance  
    and support.
23. Implement the design process to solve a given problem.
Grades 3 – 5 Overview

In Grades 3-5, students explore diverse computing devices and digital tools while developing their problem-solving and computational thinking skills. These skills are necessary across the curriculum, in English language arts, social studies, math, the arts, and science. Third through fifth grade students are able to engage in learning in ways that are methodical and imaginative. Students’ capabilities as problem solvers, innovators, and creators build on their K–2 experiences.

Students in third, fourth, and fifth grades will meet the following learning goals:

- As Computational Thinkers, students will use problem-solving processes to understand how to write and debug an algorithm and to evaluate and create new informational representation, which successfully reframes an issue.
- As Citizens of a Digital Culture, students will demonstrate an understanding of concepts involving safety and security, responsible use of technology, and the influence of technology on its users.
- As Global Collaborators, students will utilize intermediate research skills to collaboratively create artifacts and use digital tools to communicate or exchange information.
- As Computing Analysts, students will understand and use various computing devices strategically to solve a problem and accomplish a task in the most effective way.
- As Innovative Designers, students will pioneer new solutions, products, and processes through design thinking and be familiar with the advantages and limitations of technology.

When these learning goals are mastered in a student-centered environment, students will become proficient global citizens who are able to deal with a rapidly changing world. Alabama’s students will be able to solve intermediate/complex problems and find desirable solutions for both local and global issues. The design thinking process will allow students to use logic, intuition, imagination, and systematic reasoning to explore what could be and create innovative solutions that benefit themselves and others.
In third grade, students build on the foundations of K-2 by looking at basic troubleshooting and whole-class problem solving. Students will identify appropriate uses of technology and a broad range of computing systems. Third grade standards focus on collaboration and communication.

*Students can:*

### Computational Thinker

**Abstraction**
1. Use numbers or letters to represent information in another form.  
   Examples: Secret codes, Roman numerals, or abbreviations.
2. Analyze a given list of sub-problems while addressing a larger problem.

**Algorithms**
3. Recognize that different solutions exist for the same problem or sub-problem.
4. Examine logical reasoning to predict outcomes of an algorithm.
5. Create an algorithm to solve a problem in collaboration with others. Example: Move a character/robot/person through a maze.

**Programming and Development**
6. Test and debug a given program in a visual environment using arithmetic operators, conditionals, and repetition in programs in collaboration with others. Example: Block-based visual programming language.
7. Identify that programs need known starting values. Examples: Set initial score to zero in a game.

### Citizen of a Digital Culture

**Safety, Privacy, and Security**
8. Describe how to use proper ergonomics when using devices.  
   Examples: Body position, lighting, positioning of equipment, taking breaks.
9. Recognize the proper use and operation of security technologies.  
   Examples: Passwords, virus protection software, spam filters, pop-up blockers, cookies.
10. Identify threats and ways to employ safe practices to avoid the potential risks and dangers associated with using online environments.  
    Examples: Various forms of online communications, downloading and opening software programs, following hyperlinks, Internet purchases, advertisements, inappropriate content online, or SPAM, spyware, phishing, viruses.
11. Identify different types of cyberbullying and procedures for reporting.  
    Examples: Harassment, flaming, excluding people, outing, impersonation.

**Legal and Ethical Behavior**
12. Recognize the guidelines for copyright/fair use of downloading, sharing, or modifying digital artifacts and possible consequences of inappropriate use of digital artifacts protected by copyright.  
    Examples: Creative commons or copyright.

**Digital Identity**
13. Recognize the different forms of web advertising and why websites, digital resources, and artifacts may include advertisements and collect personal information.  
    Examples: Search ads, pay-per-click ads, banner ads, targeted ads, in-game ads, email ads.
Impact of Computing
14. Identify resources in the community that can give people access to technology. Examples: Libraries, community centers, restaurants, education programs, schools, or hardware/software donation programs.
15. Identify how access to technology helps empower individuals and groups. Examples: Gives access to information, the ability to communicate with others around the world, or buy and sell things.
16. Discuss how access to technology helps empower individuals and groups. Examples: Gives users with varying abilities access to information, the ability to communicate with others around the world, ability to buy or sell things.

Global Collaborator

Communication
17. Communicate key ideas and details collaboratively in a way that informs, persuades, and/or entertains, using digital tools.

Digital Tools
18. Type five words-per-minute (wpm) times grade level with 95% accuracy using appropriate keyboarding techniques. Third grade = 15 wpm.
19. Identify local, networked, and/or online/cloud environments.
   Examples: Uploads, downloads.
20. Manipulate and publish multimedia artifacts using appropriate digital tools locally and online.

Collaborative Research
21. Conduct basic keyword searches to produce valid, appropriate results and evaluate results for accuracy, relevance, and appropriateness.
   Examples: Search techniques, check for credibility and validity.
22. Curate information collaboratively from given digital sources to answer research questions.
   Examples: Correctly cite sources, quote, paraphrase, summarize, avoid plagiarism.

Computing Analyst

Data
23. Describe examples of collections of data (databases) from everyday life.
   Examples: Library catalogs, school records, telephone directories, or contact lists.

Systems
24. Identify a broad range of digital devices, the services they provide, and appropriate uses for them. Examples: Computers, smartphones, tablets, robots, e-textiles, driving directions apps that access remote map services, digital personal assistants that access remote information services.
25. Describe the differences between hardware and software.
26. Practice intermediate troubleshooting techniques that could be used to solve computing issues.
   Examples: Power, connections, application window, toolbar.

Innovative Designer

Human/Computer Partnerships
27. Compare and contrast human and computer performance on similar tasks to understand which is better suited to the task.
   Examples: Sorting alphabetically, finding a path across a cluttered room.
28. Explain advantages and limitations of technology.
   Examples: A spell-checker can check thousands of words faster than a human could look them up; however, a spell-checker might not know whether *underserved* is correct or if the author’s intent was to type *undeserved*.

Design Thinking
29. Reflect upon the design process and use digital tools to illustrate potential solutions.
30. Implement the design process to solve a simple problem.
Fourth graders will delve into more intricate processes of digital literacy and computer science through small group collaboration under the supervision and instruction of the teacher as a facilitator. Students will work with partners to identify and describe the different aspects of computational thinking and global collaboration using various devices.

**Students can:**

### Computational Thinker

**Abstraction**
1. Construct a basic system of numbers, letters, or symbols to represent information.  
   Example: Inventing a cipher (secret code).
2. Synthesize complex information from multiple sources in different ways to make it more useful/relevant.  
   Examples: Combine data from multiple sources sorting multi-level.
3. Formulate a list of sub-problems to consider while addressing a larger problem.

**Algorithms**
4. Identify that different solutions exist for the same problem (or sub-problem).
5. Detect and debug logical errors in various basic algorithms.  
   Examples: Written, mapped, live action, digital.

**Programming and Development**
6. Create a working program in a visual environment using arithmetic operators, conditionals, and repetition in programs in collaboration with others.  
   Examples: Block-based visual programming language.
7. Demonstrate that programs require known starting values and need to re-initialize upon program completion.  
   Examples: Set initial score to zero in a game.

### Citizen of a Digital Culture

**Safety, Privacy, and Security**
8. Demonstrate the proper use and operation of security technologies.  
   Examples: Passwords, virus protection software, spam filters, pop-up blockers, cookies.
9. Describe threats and ways to employ safe practices to avoid the potential risks and dangers associated with using online environments.  
   Examples: Various forms of online communications, downloading and opening software programs, following hyperlinks, Internet purchases, advertisements, inappropriate content online, or SPAM, spyware, phishing, viruses.
10. Describe different types of cyberbullying and explain procedures for reporting it.  
    Examples: Harassment, flaming, excluding people, outing, impersonation.

**Legal and Ethical Behavior**
11. Apply the guidelines for the fair use of downloading, sharing, or modifying of digital artifacts and identify the possible consequences for inappropriate use of digital artifacts protected by copyright.
12. Identify laws and tools that help ensure that users of varying abilities can access electronic and information technology.
Digital Identity
13. Identify the different forms of web advertising and why websites, digital resources, and artifacts may include advertisements and collect personal information.
   Examples: Search ads, pay-per-click ads, banner ads, targeted ads, in-game ads, or email ads.

Impact of Computing
14. Locate resources in the community that can give people access to technology.
   Examples: Libraries, community centers, education programs, schools, hardware/software donation programs.
15. Discuss the digital divide as unequal access to technology based on differences such as income, education, age, or geographic location.

Global Collaborator

Communication
16. Use basic features of digital tools to communicate key ideas and details in a way that informs and/or persuades.

Digital Tools
17. Type five words-per-minute (wpm) times grade level with 95% accuracy using appropriate keyboarding techniques. Third grade = 15 wpm
18. Create and edit authentic artifacts that include text and images using appropriate digital tools.

Collaborative Research
19. Conduct complex keyword searches to produce valid, appropriate results and evaluate results for accuracy, relevance, and appropriateness.
   Examples: Search techniques, check for credibility and validity.
20. Curate information collaboratively from digital sources to answer research questions.
   Examples: Correctly cite sources, quoting, paraphrasing, and/or summarizing, avoid plagiarism.

Computing Analyst

Data
21. Gather and organize data to answer a question using a variety of computing methods.
   Examples: Sorting, totaling, or averaging, such as a spreadsheet.

Systems
22. Demonstrate an appropriate level of proficiency in using a range of digital devices.
   Examples: Collect and record data, print, send command, connect to Internet, search, probes, sensors, printers, robots, or computers.

Modeling and Simulation
23. Individually and collaboratively create a simple model of a system and explain what the model shows and does not show.
   Examples: Water cycle, solar system.
24. Identify the concepts, features, and behaviors illustrated by a simulation and those that were not included.
   Examples: Object motion, weather, ecosystem, predator/prey.
25. Individually and collaboratively, use data from a simulation to answer a question.
Human/Computer Partnerships
26. Explain how hardware and applications can enable everyone, including people with disabilities, to do things they could not do otherwise.

Design Thinking
27. Develop, test, and refine prototypes as part of a cyclical design process to solve a simple problem.
Grade 5

During their fifth grade year, students will progress toward independence while continuing to collaborate on local and global issues. These standards are written to encourage student-centered learning through teacher facilitation and creative, hands-on activities. Students learn to be creators, not only consumers, who can effectively utilize digital tools and understand the influence of technology.

Students can:

Computational Thinker

Abstraction
1. Construct a complex system of numbers or letters to represent information.
   Example: Complex secret codes in problem-solving activities/games.
2. Publish organized information in different ways to make it more useful/relevant.
   Examples: Infographic, student created website.
3. Develop and recommend solutions to a given problem and explain the process to an audience.

Algorithms
5. Create an algorithm to solve a problem while detecting and debugging logical errors within the algorithm.
   Example: Move a character/robot/person through a maze.

Programming and Development
6. Create a working program in a visual environment using arithmetic operators, conditionals, and repetition in programs.
   Examples: Block-based visual programming language.
7. Demonstrate that programs require known starting values and need to re-initialize upon program completion.
   Examples: Set initial score to zero in a game.

Citizen of a Digital Culture

Safety, Privacy, and Security
8. Explain the proper use and operation of security technologies.
   Examples: Passwords, virus protection software, spam filters, pop up blockers, cookies.
9. Advocate for safe practices and promote ways to avoid the potential risks or dangers associated with using online environments.
   Examples: Various forms of online communications, downloading and opening software programs, following hyperlinks, Internet purchases, advertisements, inappropriate content online, SPAM, spyware, phishing, viruses.
10. Identify patterns of cyberbullying and explain and procedures for reporting.
    Examples: Harassment, flaming, excluding people, outing, impersonation.
11. Identify appropriate and inappropriate uses of communication technology and the permanence of actions in the digital world.

Legal and Ethical Behavior
12. Practice and share their understanding of the guidelines for copyright/fair use of downloading, sharing, or modifying of digital artifacts and possible consequences of inappropriate use of digital artifacts protected by copyright.
    Examples: Creative commons or copyright.
13. Explain the laws and tools that exist to help ensure that people of varying abilities can access electronic and information technology.
   Examples: Section 508, Telecommunication Act of 1996.

Digital Identity
14. Explain the different forms of web advertising and why websites, digital resources, and artifacts may include advertisements and collect personal information.
   Examples: Search ads, pay-per-click ads, banner ads, targeted ads, in-game ads, email ads.

Impact of Computing
15. Share resources in the community that can give people access to technology.
   Examples: Libraries, community centers, education programs, schools, hardware/software donation programs.
16. Identify the impact of social media on individuals, families, and society.

Global Collaborator

Communication
17. Use advanced features of digital tools and media-rich resources to communicate key ideas and details in a way that informs, persuades, and/or entertains.

Digital Tools
18. Type five words-per-minute (wpm) times grade level with 95% accuracy using appropriate keyboarding techniques. Fifth grade = 25 wpm.
19. Produce, review, and revise authentic artifacts that include text, audio, video, and images using appropriate digital tools.

Collaborative Research
20. Conduct advanced keyword searches to produce valid, appropriate results and evaluate results for accuracy, relevance, and appropriateness.
   Examples: Search techniques, check for credibility and validity.
21. Curate and publish information from digital sources to answer research questions.
   Examples: Correctly cite sources, quote, paraphrase, summarize, avoid plagiarism.

Social Interactions
22. Collaborate locally and globally through online digital tools under teacher supervision.

Computing Analyst

Data
23. Manipulate data to answer a question using a variety of computing methods and tools to collect, organize, graph, analyze, and publish data.
   Examples: Sorting, totaling, averaging, spreadsheets.

Systems
24. Identify and explain that some computing functions are on by default
   Examples: Locations function on smartphones.
25. Define that a network is made up of a variety of components and identify the key parts
   Examples: Links, nodes, networking devices.
26. Describe the need for authentication of users and devices as it relates to access permissions, privacy, and security.

Modeling and Simulations
27. Individually and collaboratively create a simple model of a system and explain what the model shows and does not show.
   Examples: Water cycle, solar system.
28. Identify the concepts, features, and behaviors illustrated by a simulation and note those that were not included.
   Examples: Object motion, weather, ecosystem, predator/prey.
29. Individually and collaboratively, use data from a simulation to answer a question.

**Innovative Designer**

Human/Computer Partnerships
30. Explore and predict how advances in computing technologies affect job opportunities and/or processes now and in the future.
31. Define social engineering.
   Examples: Phishing, hacking, viruses

Design Thinking
32. Develop, test, and refine prototypes as part of a cyclical design process to solve a complex problem.
Grades 6 – 8 Overview

Students in Grades 6-8 are developing more independence physically, socially, and emotionally as they seek their places in an increasingly digital and global society. Many of these students will begin developing their global online presence for the first time. In these grades, students are becoming proficient digital citizens, while continuing to build on a strong foundation in computer science principles. The goals of the content strands at this level demonstrate this balance.

Sixth, seventh, and eighth grade students will meet the following learning goals:

- **As Computational Thinkers**, students will break problems into component parts, identify key pieces of information, and use that information to solve problems.
- **As Citizens of a Digital Culture**, students will understand the impact of computing in a global society while safely, securely, ethically, and legally interacting with digital environments and protecting their digital identities.
- **As Global Collaborators**, students will use appropriate digital tools to communicate data that informs, persuades, and entertains to collaborate with society locally and globally.
- **As Computing Analysts**, students will utilize computing systems efficiently in the management and interpretation of data and information.
- **As Innovative Designers**, students will leverage human and computer partnerships within a design process, creating useful and thoughtful solutions to problems.

The content standards for Grades 6-8 encourage analysis, synthesis, and evaluation in digital literacy and computer science as crosscutting themes within all areas of the academic curriculum. Furthermore, students in Grades 6-8 will work collaboratively to explore, employ, and develop digital tools.
Grade 6

During their sixth-grade year, students will continue to develop the foundation of computer science principles. They will expand their problem-solving skills and progress toward independence physically, socially, and emotionally, while continuing to collaborate on local and global issues. These standards are written to encourage student-centered learning through innovative and engaging activities. Students must be creators, not just consumers, who can effectively utilize digital tools and understand the influence of technology.

Students can:

**Computational Thinker**

Abstraction
1. Illustrate a hierarchical classification scheme by decomposing everyday processes. Examples: Graphic, flowchart, structure diagram.
2. Define a simple function.

Algorithms
3. Define pseudocode.
4. Differentiate between flowcharts and pseudocode when used in planning or algorithms.

Programming and Development
5. Define key components of complex problems.
6. Describe how automation works to increase efficiency.
7. Define and identify variables including programming variables.

**Citizen of a Digital Culture**

Safety, Privacy, and Security
8. Differentiate between a secure and a non-secure website and how the two affect personal data.

Legal and Ethical Behavior
9. Describe the cause and effect of illegal use of intellectual property as it relates to print and digital media, considering copyright, fair use, licensing, sharing, and attribution.
10. Differentiate between appropriate and inappropriate digital content and use.

Digital Identity
11. Define data permanence.

Impact of Computing
13. Define, identify, and describe emerging technologies in computing.
14. Identify the unique perspectives and needs of a global culture.
15. Recognize the impact of bias on computing culture through distorting, exaggerating, or misrepresenting data.
Global Collaborator

Creative Communications
16. Communicate and/or publish collaboratively to inform learners from a variety of backgrounds and cultures about issues and problems.

Digital Tools
17. Type five words-per-minute (wpm) times grade level with 95% accuracy using appropriate keyboarding techniques. Sixth grade = 30 wpm

Social Interactions
18. Define net neutrality

Computing Analyst

Data
19. Track data change from a variety of sources.
20. Identify data transferring/protocols, visualization, and the purpose of data and methods of storage.
21. Identify and label data storage structures.
   Examples: Stack, array, queue, table, database.
22. Recognize varying data structures/systems and methods of classification, including decimal, hexadecimal, octal, and binary.
   Examples: Bit representation, pixilation.
23. Summarize the purpose of the ASCII.

Systems
24. Identify a variety of digital devices used to collect, analyze, and present information for content-related problems.
25. Compare and contrast the different networks including physical, wireless, local, wide area, mobile, internet, and intranet.
26. Differentiate between secure and non-secure systems.

Modeling and Simulation
27. Identify what it means to use models as logical representations of a physical mathematical, or logical system or process.
28. Recognize simulations as methods for implementing models.

Innovative Designer

Human/Computer Partnerships
29. Define assistive device.
30. Define artificial intelligence and identify artificial intelligence in the community.
   Examples: Image recognition, voice assistants.

Design Thinking
31. Exhibit perseverance, a tolerance for ambiguity, and the capacity to work with open-ended problems.
Grade 7

During their seventh-grade year, students will become independent thinkers while developing their global online presence. These standards are written for student-centered learning with teacher mentoring. Students must be creators, not just consumers, who will effectively utilize digital tools, understand technology’s impact on a global society, and integrate principles of computer science.

Students can:

**Computational Thinker**

Abstraction
1. Describe the cause and effects of illegal use of intellectual property as it relates to print and digital media, considering copyright, fair use, licensing, sharing, and attribution.
2. Define validity and various types of bias as it relates to web content. Examples: Satire, political or personal
3. Differentiate between appropriate and inappropriate digital content and use.

Algorithms
4. Create pseudocode.
5. Illustrate daily activity using a flowchart.

Programming and Development
6. Identify appropriate technologies to solve complex problems.
7. Formulate a narrative for each step in the process and its intended result, given an algorithm using either pseudocode or code.
8. Organize algorithms into a set to order efficiently for automation.
9. Distinguish similarities and differences in programming variables and algebraic variables.

**Citizen of a Digital Culture**

Safety, Privacy, and Security
10. Identify common methods of file, data, and web encryption. Examples: Lock, password, permissions, encryption.

Legal and Ethical Behavior
11. Explain social engineering, including countermeasures and the impact on a digital society. Examples: Phishing, hacking, viruses.
12. Demonstrate positive, safe, legal, and ethical habits when creating and sharing digital content and identify the consequences of failure to act responsibly.

Digital Identity
13. Discuss the impact of data permanence on digital identity including best practices to protect personal digital footprint.
Impact of Computing
14. Compare and contrast web information available locally and globally.
15. Discuss current events related to emerging technologies in computing and the effects such events have on individuals and the global society.
16. Discuss unique perspectives and needs of a global culture when developing computational products, including options for accessibility for all users.
17. Research patterns of bias in computing culture through distorting, exaggerating, or misrepresenting data.

Global Collaborator

Creative Communications
18. Construct content designed for specific audiences through an appropriate medium.

Digital Tools
19. Type five words-per-minute (wpm) times grade level with 95% accuracy using appropriate keyboarding techniques. Seventh grade = 35 wpm.

Social Interactions
20. Discuss the benefits and limitations of net neutrality.

Computing Analyst

Data
21. Verify validity of data using a variety of sources.
22. Compare common methods of transferring/protocols and visualization.
23. Compare the value of data storage structures.
   Examples: Stack, array, queue, table, database.
24. Evaluate the varying data structures/systems for data conversion and extraction, including decimal, hexadecimal, octal, and binary.
   Examples: Using ASCII, bit representation, pixelation, decoding or encrypting characters.

Systems
25. Demonstrate the use of a variety of digital devices individually and collaboratively to collect, analyze, and present information for content-related problems.
26. Identify network type given a specific setup or need.
27. Identify common methods of systems cybersecurity.
   Examples: Various password requirements, two factor authentication, sensory, biometric, geolocation.

Modeling and Simulation
28. Categorize models based on the most appropriate representation of various systems.
29. Assess simulation appropriateness for implementing a specific model.
Innovative Designer

Human/Computer Partnerships
30. Classify types of assistive devices.
31. Compare and contrast human intelligence and artificial intelligence.

Design Thinking
32. Identify non-linear patterns of ideation and iteration in the design process to create innovative products or solve problems.
Grade 8

During their eighth-grade year, students will expound upon computer science principles and global collaboration experiences. These standards are written to provide student-centered learning with minimal guidance from the teacher. Students will be designers, not just consumers, who will effectively utilize digital tools and articulate the impact of technology on a global society.

Students can:

**Computational Thinker**

Abstraction
1. Create a hierarchical classification scheme of a technological application using decomposition.
2. Design and test efficient simple functions to represent and solve a complex task.

Algorithms
3. Implement pseudocode.
4. Design a flowchart from a set of instructions, pseudocode, or algorithm.

Programming and Development
5. Apply technology solutions to solve complex problems.
6. Utilize program commenting to describe the intended behavior of pseudocode.
7. Combine algorithmic processes and automation to increase efficiency.
8. Design an algorithm that includes the use of variables.

**Citizen of a Digital Culture**

Safety, Privacy, and Security
9. Compare and contrast common methods of data encryption.
10. Secure a file or other data.

Legal and Ethical Behavior
11. Analyze different modes of social engineering and their effectiveness.
   Examples: Phishing, hacking, viruses.
12. Advocate for positive, safe, legal, and ethical habits when creating and sharing digital content.

Digital Identity
13. Cite evidence of the positive and negative effects of data permanence on personal and professional digital identity.

Impact of Computing
14. Evaluate the impact of digital globalization on public perception and ways internet censorship can affect free and equitable access to information.
15. Analyze current events related to computing and their effects on education, the workplace, individuals, communities, and global society.
16. Critique computational productions, including options for accessibility for all users, with respect to the needs of a global culture.
17. Design an artifact that demonstrates bias through distorting, exaggerating, or misrepresenting data.

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<tr>
<th>Global Collaborator</th>
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<tbody>
<tr>
<td>Creative Communications</td>
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<tr>
<td>18. Present content designed for specific audiences through an appropriate medium.</td>
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<tr>
<td>19. Communicate and/or publish individually or collaboratively to persuade peers, experts, community, etc. about issues and problems to gain a broader perspective.</td>
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<tr>
<th>Digital Tools</th>
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<tr>
<td>20. Type five words-per-minute (wpm) times grade level with 95% accuracy using appropriate keyboarding techniques. Eighth grade = 40 wpm.</td>
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<tr>
<th>Social Interactions</th>
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<tr>
<td>21. Critique the benefits and limitations of net neutrality as it impacts global society.</td>
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<th>Computing Analyst</th>
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<td>Data</td>
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<td>22. Analyze the validity of a data set using a variety of sources</td>
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<td>23. Analyze the value of transferring/protocols and various types of visualization.</td>
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<td>24. Differentiate types of data storage and apply most efficient structure.</td>
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<td>Examples: Stack, array, queue, table, database.</td>
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<td>25. Create and decrypt varying data structures, including decimal, hexadecimal, octal, and binary.</td>
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<td>Examples: Using ASCII, bit representation, pixilation, decoding or encrypting characters.</td>
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<tr>
<td>27. Compare and contrast common methods of cybersecurity.</td>
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<th>Modeling and Simulation</th>
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<tr>
<td>28. Apply a model to system that best represents the system selected.</td>
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<td>29. Create a simulation that could test a specific model.</td>
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<th>Innovative Designer</th>
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<tr>
<td>Human/Computer Partnerships</td>
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<tr>
<td>30. Analyze assistive devices and how they improve the quality of life for users.</td>
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<td>31. Develop a logical argument for and against artificial intelligence.</td>
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<th>Design Thinking</th>
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<tr>
<td>32. Use the design process to solve non-routine problems or create innovative products or solutions while demonstrating perseverance.</td>
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Grades 9 – 12 Overview

Students in Grades 9-12 experience significant growth and development as they assume responsibilities that are more complex. They continue to develop unique personalities and begin to make important life decisions. In both school and community, high school students are strengthening and practicing the leadership and interpersonal communication skills that facilitate entrance into adulthood. They continue to experience physical and emotional changes and seek opportunities for realizing independence and individuality.

Grades 9-12 students have broadened their perspective regarding the importance of existing and developing technologies and have an understanding of the scope of technology in today’s world. As students progress through the high school years, they are able to address a variety of problems on a range of topics in a logical manner. Technology offers students an efficient means for solving many types of problems.

Many students have opportunities to interact with others whose backgrounds are different from their own because of cultural and ideological diversity in a technologically advanced global society. As the use of technology brings humankind closer together, concepts and skills utilizing digital literacy and computer science will assist students in becoming productive adults.

Grades 9 – 12 students will meet the following learning goals:

- **As Computational Thinkers**, students will understand how to make complex situations simple, developing algorithms that define the systematic processes needed to solve problems encountered in life.
- **As Citizens of a Digital Culture**, students will demonstrate an understanding of concepts involving safety and security, responsible use of technology, and ways it can influence people through social interactions.
- **As Global Collaborators**, students will utilize digital tools to collaborate and communicate with others to solve problems presented in today’s technical world.
- **As Computing Analysts**, students will analyze and create solutions to problems and challenges presented in the use of computer systems and data.
- **As Innovative Designers**, students make decisions and create solutions using the various digital tools available in today’s technical environments.

When these goals are facilitated, students will not only be digitally literate global citizens in a rapidly changing world but also individuals who are able to solve complex problems and find desirable solutions for both local and global issues. The design thinking process will allow students to use logic, intuition, imagination, and systematic reasoning to explore possibilities and create innovative solutions that benefit themselves and others, thus enabling them to be successful, productive citizens in a technical world.
Grades 9 – 12

Students can:

**Computational Thinker**

**Abstraction**
1. Break problems into component parts, extract key information, and develop descriptive models to understand complex systems or facilitate problem solving.
2. Explain how computing systems are often integrated with other systems and embedded in ways that may not be apparent to the user.
   Example: A medical device can be embedded inside a patient to monitor and regulate his or her health.

**Algorithms**
3. Differentiate between a generalized expression of an algorithm in pseudocode and its concrete implementation in a programming language.
   a. Recognize that some algorithms do not lead to exact solutions in a reasonable amount of time and thus approximations are acceptable.
   b. Compare and contrast the difference between specific control structures and explain the benefits and drawbacks of choices made.
      Examples: Tradeoffs involving implementation, readability, and program performance.
   c. Understand when a problem solution requires decisions to be made among alternatives, such as conditional “if” constructs, or when a solution needs to be iteratively processed to arrive at a result, such as iterative “loop” constructs.
   d. Evaluate and select algorithms based on performance, reusability, and ease of implementation.
   e. Relate and explain how more than one algorithm may solve the same problem and yet be characterized with different priorities.
      Examples: All self-driving cars have a common goal of taking a passenger to a designation but may have different priorities such as safety, speed, or conservation; web search engines have their own algorithms for search with their own priorities.
4. Use and adapt classic algorithms to solve computational problems.
   Examples: Sorting and searching.

**Programming and Development**
5. Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue by using events to initiate instructions.
6. Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects, with parameters, and which return a result.
7. Compare and contrast fundamental data structures and their uses.
   Examples: Strings, lists, arrays, stacks, queues.
8. Demonstrate code reuse by creating programming solutions using libraries and APIs.
9. Develop and use a series of test cases to verify that a program performs according to its design specifications.
10. Resolve errors encountered during testing using iterative design process.
    Example: Debug any errors in a program.
Citizen of a Digital Culture

Safety, Privacy, and Security
11. Model and demonstrate behaviors that are safe, legal, and ethical while living, learning, and working in an interconnected digital world.
   a. Recognize user tracking methods and hazards.
      Examples: Cookies, Wi-Fi packet sniffing.
   b. Understand how to apply techniques to mitigate effects of user tracking methods.
   c. Understand the ramifications of end user license agreements and terms of service associated with granting rights to personal data and media to other entities.
   d. Explore the inverse relationship between online privacy and personal security.
      Examples: Convenience and accessibility, data mining, digital marketing, online wallets, theft of personal information.
   e. Identify consequences (mental health, legal, personal and group reputation) of digital behaviors.
      Examples: Cyberbullying/harassment, inappropriate sexual communications.
   f. Construct strategies to lessen the impact of negative digital behaviors and understand when to apply them.
12. Illustrate how sensitive data can be affected by malware and other attacks.
13. Compare various security measures, considering tradeoffs between the usability and security of a computer system.
14. Compare ways to protect devices, software, and data.

Legal and Ethical Behavior
15. Justify all aspects of the school’s Acceptable Use Policy [AUP].
16. Identify laws regarding the use of technology and their consequences and implications.
   Examples: Drones, net neutrality/common carriers, hacking, intellectual property, piracy, plagiarism.
17. Discuss the ethical ramifications of malicious hacking and its impact on society.
   Examples: Wiki leaks, ransomware.
18. Explain the beneficial and harmful effects that intellectual property laws can have on innovation.

Digital Identity
19. Prove that digital identity is a reflection of persistent, publicly available artifacts.
20. Make decisions to manage digital identity and reputation with awareness of the permanent impact of actions in a digital world.

Impact of Computing
21. Explain how technology facilitates the disruption of traditional institutions and services.
   Examples: Bitcoin, Uber, autonomous vehicles, IoT.
22. Research the impact of computing technology on possible career pathways.
   Examples: Government, business, medicine, entertainment, education, transportation.
23. Analyze the beneficial and harmful effects of computing innovations.
   Examples: AI/machine learning, mobile applications, automation of traditional occupational skills.
24. Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices.
Global Collaborator

Creative Communication
25. Evaluate internet media publishing platforms to determine the best way to disseminate an original creation to others.

Digital Tools
26. Utilize a variety of digital tools to create authentic products in all content areas.

Collaborative Research
27. Use collaborative technologies to work with others including peers, experts, or community members to examine issues and problems from multiple viewpoints.

Social Interactions
28. Apply tools and methods for collaboration on a project to increase connectivity among people in different cultures and career fields.

Computing Analyst

Data
29. Translate between different bit representations of real-world phenomena.
   Examples: characters, numbers, sound, movies, and images.
30. Summarize the role of compression and encryption in modifying the structure of digital artifacts and the varieties of information carried in the metadata of these artifacts.
31. Evaluate the tradeoffs involved in choosing methods for the organization of data elements and the location of data storage, including the advantages and disadvantages of cloud computing.
32. Create interactive data visualizations using software tools to help others understand real-world phenomena better.
33. Use data analysis tools and techniques to identify patterns in data representing complex systems.

Systems
34. Evaluate the scalability and reliability of networks by describing the relationship between routers, switches, servers, topology, and addressing, as well as the issues that impact network functionality.
   Examples: Bandwidth, load, delay, topology.
35. Categorize the roles of operating system software.
36. Appraise the role of artificial intelligence in guiding software and physical systems.
37. Explain tradeoffs when selecting and implementing cybersecurity recommendations.
   Examples: Two-factor authentication, password requirements, geolocation requirements.

Modeling and Simulation
38. Evaluate the ability of models and simulations to test and support the refinement of hypotheses.
   a. Create and utilize models and simulations to help formulate, test, and refine a hypothesis.
   b. Form a model of a hypothesis, testing the hypothesis by the collection and analysis of data generated by simulations.
      Example: Science lab.
**Innovative Designer**

Human/Computer Partnerships
39. Systematically design and develop programs for broad audiences by incorporating feedback from users.  
   Examples: Games, utilities, mobile applications.
40. Identify a problem that cannot be solved by humans or machines alone and design a solution for it by decomposing the task into sub-problems suited for a human or machine to accomplish.  
   Examples: A human/computer team playing chess, forecasting weather, piloting airplanes.

Design Thinking
41. Use an iterative design process, including learning from mistakes, to gain a better understanding of a problem domain.