# Computer Science

## Computational Thinking

* Data Representation
  + Compare and constrast simple data structures and their uses.
  + Convert values between binary, octal, hexadecimal, and decimal representations.
* Algorithms
  + Define an algorithm as a sequence of instructions that are processed by a computer.
  + Evaluate ways that different algorithms may be used to solve the same problem.
  + Describe and analyze a sequence of instructions being followed.
  + Explain how sequence, selection, iteration, and recursion are building blocks of algorithms.
  + Evaluate algorithms by their efficiency, correctness, and clarity.
* Problem Solving
  + Use the basic steps in algorithmic problem-solving.
  + Describe software development methods to solve software problems.
  + Classify problems as tractable, intractable, or computationally unsolvable.
  + Explain the value of heuristic algorithms to approximate solutions for intractable problems.
* Modeling And Simulation
  + Interact with content-specific models and simulations to support learning and research.
  + Evaluate what kinds of problems can be solved using modeling and simulation.
  + Analyze the degree to which a model accurately represents the real world.
  + Use modleing and simulation to represent and understand natural phenomena.
  + Use models and simulation to help formulate, refine, and test scientific hypotheses.
  + Analyze data and identify patterns through modeling and simulation.
* Abstraction
  + Understand the notion of hierarchy and abstraction in computing including high-level languages, translation, instruction sets, and logic circuits.
  + Discuss the value of abstraction to manage problem complexity.
  + Decompose a problem by defining new functions and classes.
* Connections To Other Fields
  + Understnad the connections between other fields and computer science.
  + Examine connections between elements of mathematics and computer science including binary numbers, logic, sets, and functions.
  + Provide examples of interdisciplinary applications of computational thinking.
  + Describe how mathematical and statistical functions, set, and logic are used in computation.
  + Describe how computation shares features with art and music by translating human intention into an artifact.

## Collaboration

* Using Technology Tools And Resrouces For Collaboration
* Level 2 Performance Indicators:
  + Collaborate with peers, experts, and others using collaborative practices such as pair programming, working in project teams, and participating in group active learning activities.
* Level 3 Performance Indicators:
  + Work in a team to design and dvelop a software artifact.
  + Use collaborative tools to create software artifacts and to communicate with team members.
  + Use project collaboration tools, version control systems, and ides while workikng on a collaborative software project.
  + Demonstrate the software life cycle and agile development process through participating on a software project team.
* Computing As A Collaborative Endeavor
* Level 1 Performance Indicators:
  + Work cooperatively and collaboratively with peers, teachers, and others using technology.
  + Identify ways that teamwork and collaboration can support problem solving and innovation.
* Level 2 Performance Indicators:
  + Exhibit dispositions necessary for collaboration: providing useful feedback, understanding and accepting multiple perspectives, socialization.
* Level 3 Performance Indicators:
  + Describe how computing enhances traditional forms and enables new forms of experience, expression, communication and collaboration.
  + Identify how collaboration influences the design and development of software products.
  + Evaluate programs written by others for readability and useability.

## Computing Practice & Programming

* Using Techonology Resources For Learning
* Level 1 Performance Indicators:
  + Use technology resources for problem-solving and self-directed learning.
* Use Technology Tools For The Creation Of Digital Artifacts
* Level 1 Performance Indicators:
  + Determine which technology is useful and select appropriate technology resources to address a variety of tasks and problems.
* Level 2 Performance Indicators:
  + Design, develop, publish and present products using technology resources that demonstrate and communicate curriculum concepts.
* Level 3 Performance Indicators:
  + Create and organize web pages through the use of a variety of design tools.
  + Use advanced tools to create digital artifacts.
* Programming
* Level 1 Performance Indicators:
  + Implement problem solutions in a block-based visual programming environment.
* Level 2 Performance Indicators:
  + Demonstrate an understanding of algorithms, and their practical applications.
  + Implement problem solutions in a programming environment using: looping behavior, conditional statements, logic, expressions, variables, and functions.
* Level 3 Performance Indicators:
  + Use debugging and unit testing to verify programs.
  + Solve problems using analysis, design and implementation techniques.
  + Use apis and libraries to facilitate programming solutions.
  + Use functions and classes to decompose large scale computational problems.
  + Use object oriented principles in program design.
  + Select appropriate file formats for various types of data.
  + Describe the variety of programming languages available.
  + Explain the program execution process.
  + Classify programming languages by level and application domain.
  + Explore principles of system design in scaling, efficiency, and security.
* Interacting With Remote Information
* Level 1 Performance Indicators:
  + Use computing devices, including mobile devices, to access remote information, communicate with others in support of direct and independent learning and pursue personal interests.
  + Understnad the organizations of internet elements and web pages.
* Level 2 Performance Indicators:
  + Demonstrate good practices in personal information security: using passwords, encryption, secure transactions.
* Level 3 Performance Indicators:
  + Explain the principles of security by examining encryption, cryptography, and authentication techniques.
  + Deploy principles of security by examining encryption and authentication techniques.
* Careers
* Level 1 Performance Indicators:
  + Identify careers (across a wide spectrum) that use computing and technology.
  + Idenitfy different careers in computing and the interdisciplinary nature of computing in the 21st century.
* Level 2 Performance Indicators:
  + Identify interdisciplinary careers that are enhanced by computer science.
  + Develop dispositions amenable to open-ended problem solving and programming.
* Level 3 Performance Indicators:
  + Explore a variety of careers in computing (it specialist, web designer, systems analyst, programmer, cio, computer scientist.
  + Anticipate future careers and the technologies that will exist.
* Data Collection And Analysis
* Level 1 Performance Indicators:
  + Gather and organize information with concept mapping tools.
  + Gather and organize information using a variety of digital concept mapping tools.
* Level 2 Performance Indicators:
  + Collect and analyze data that is output from multiple runs of a computer program.
* Level 3 Performance Indicators:
  + Describe techniques for locating and collecting small and large scale data sets.
  + Compare techniques for analyzing massive data collections.
  + Use data analysis to enhance understanding of complex natural and human systems.
  + Deploy various data collection techniques for differnt types of problems.

## Computers And Communications Devices

* Computers
* Level 1 Performance Indicators:
  + Demonstrate an appropriate level of proficiency with keyboards and other input and output devices.
* Level 2 Performance Indicators:
  + Recognize that computers are devices that execute programs.
  + Demonstrate an understanding of concepts underlying hardware and software, and their practical applications.
* Level 3 Performance Indicators:
  + Describe the unique features of computers embedded in mobile devices and vehicles.
  + Describe how various types of data are stored in a computer system.
  + Descirbe the principal components of computer organization.
  + Compare various forms of input and output media.
  + Explain the mutlple levels of hardward and software that support program execution.
* Troubleshooting
* Level 1 Performance Indicators:
  + Apply strategies for identifying and solving simple hardware problems that occur during everyday use.
* Level 2 Performance Indicators:
  + Apply strategies for identifying and solving routine hardware problems that occur during everyday life.
* Level 3 Performance Indicators:
  + Apply strategies for identifying and solving routine hardware and software problems that occur during everyday use.
* Networks
* Level 1 Performance Indicators:
  + Identify that information is coming to the computer from many sources over a network.
* Level 2 Performance Indicators:
  + Describe the major components and functions of computer systems and networks.
* Level 3 Performance Indicators:
  + Compare and contrast client-server and peer-to-peer network strategies.
  + Explain the basic components of computer networks (e.g. servers, file protection, routing, spoolers and queues, shared resources, and fault-tolerance).
  + Describe how the internet facilitates global communication.
  + Describe the issues that impact network functionality (e.g. latency, bandwidth, firewalls and server capability).
* Human Vs. Computers
* Level 2 Performance Indicators:
  + Describe what distinguishes humans from machines with a focus on human intelligence vs. machine intellgience and ways we can communicate.
  + Recognize that computers use models of intelligent behavior.
* Level 3 Performance Indicators:
  + Describe the major applications of artificial intelligence and robotics.
  + Explain the notion of intelligent behavior through computer modeling and robotics.

## Community Global, And Ethical Impacts

* Responsible Use
* Level 1 Performance Indicators:
  + Practice reponsible digital citizenship in the use of technology systems and software.
  + Discuss basic issues related to responsible use of technology and infromation, and the consequences of inappropriate use.
* Level 2 Performance Indicators:
  + Exhibit legal and ethical behaviors when using information and technology and discuss the consequences of misuse.
* Level 3 Performance Indicators:
  + Compare appropriate and inappropriate social networking behaviors.
  + Demonstrate etchical use of modern communication media and devices.
* Impacts Of Technology
* Level 1 Performance Indicators:
  + Identify the impact of technology (e.g. social networking, cyberbullying, mobile and web technologies, cyber-security, and virtualization) on personal life and society.
* Level 2 Performance Indicators:
  + Demonstrate knowledge of changes in information over time and the effects those changes may have on education, the workplace, and society.
  + Analyze the positive and negative impacts of technology on human culture.
* Level 3 Performance Indicators:
  + Compare the positive and negative impacts of technology on culture.
  + Discuss the impact of computer technology on business and commerce.
  + Describe the role that adaptive technology can play in the lives of people with special needs.
  + Analyze the beneficial and harmful effects of computing innovations.
  + Summarize how financial markets, transactions, and predictions have been transformed by automation.
  + Summarize how computation has revolutionized the way people build real and virtual organizations and infrastructures.
* Information Accuracy
* Level 1 Performance Indicators:
  + Evaluate the accuracy, relevance, appropriateness, comprehensiveness, and biases that occur in electronic information sources.
* Level 2 Performance Indicators:
  + Evaluate the accuracy, relevance, appropriateness, comprehensiveness, and bias of electronic information sources concerning real-world problems.
* Level 3 Performance Indicators:
  + Describe a variety of strategies for determining the reliability of infomration found on the internet.
* Ethics, Laws, And Security
* Level 1 Performance Indicators:
  + Identify positive social and ethical behaviors for using technology.
  + Understand ethical issues that relate to computers and networks (eg equity of access, security, privacy, copyright, and intellectual property).
* Level 2 Performance Indicators:
  + Describe ethical issues that relate to comptuers & networks (e.g. security, privacy, information sharing, ownership).
* Level 3 Performance Indicators:
  + Differentiate between information access and distribution rights.
  + Describe how different kinds of software licenses can be used to share and protect intellectual property.
  + Discuss the social and economic implications associated with hacking and software piracy.
  + Identify laws and regulations that impact the development and use of software.
  + Analyze the impact of government regulations on privacy and security.
  + Differentiate among open source, freeware, and proprietary licenses and their applicability to different types of software.
* Equity
* Level 2 Performance Indicators:
  + Discuss how the unequal distribution of computing resources in a global economy raises issues of equity, access, and power.
* Level 3 Performance Indicators:
  + Explain the impact of the digital divide on access to critical information.
  + Relate issues of equity, access, and power to the distribution of computing resources in a global economy.