STRANDS AND STANDARDS

COMPUTER SCIENCE INVESTIGATIONS

Course Description

Computer Science Investigations introduces students to the breadth of the field of computer science through an exploration of engaging and accessible topics. Rather than focusing the entire course on learning particular software tools or programming languages, the course is designed to focus the conceptual ideas of computing and help students understand why certain tools or languages might be utilized to solve particular problems. The goal of Computer Science Investigations is to develop in students the computational thinking practices of algorithm development, problem solving and programming within the context of problems that are relevant to the lives of today's students. Students will also be introduced to topics such as computing systems, networks, data & analysis, limits of computers, and societal and ethical issues.

Intended Grade Level	7-8
Units of Credit	0.5
Core Code	35.02.00.00.008
Concurrent Enrollment Core Code	N/A
Prerequisite	None
Skill Certification Test Number	None
Test Weight	None
License Area of Concentration	CTE and/or Secondary Education 6-12
Required Endorsement(s)	
Endorsement 1	Web Development
Endorsement 2	Introduction to Computer Science
Endorsement 3	Information Technology Systems
Endorsement 4	Programming & Software Development
Endorsement 5	Business & Marketing Basics

STRAND 1

CS Investigations Practices - Students will employ the following practices throughout the course. They provide a framework and serve as helpful reminders of the high-level skills and dispositions they should be continually developing.

Standard 1 - Critical Thinking
- Use the structured problem-solving process to help address new problems
- View challenges as solvable
- Break down larger problems into smaller components (decomposition?)

Standard 2 - Persistence
- Expect and value mistakes as a natural and productive part of problem solving
- Continue working towards solutions despite setbacks
- Iterate and continue to improve partial solutions

Standard 3 - Creativity
- Incorporate personal interests and ideas into activities and projects
- Experiment with new ideas and consider multiple possible approaches
- Extend or build upon the ideas and projects of others

Standard 4 - Collaboration
- Work with others to develop solutions that incorporate all contributors
- Mediate disagreements and help teammates agree on a common solution
- Actively contribute to the success of group projects

Standard 5 - Communication
- Structure work so that it can be easily understood by others
- Consider the perspective and background of your audience when presenting your work
- Provide and accept constructive feedback in order to improve your work

STRAND 2

Computing Systems - Human interaction with computing systems. Students will understand that computing systems (devices) are made up of a wide variety of computing components that collect, store, analyze, and act upon information in ways that can affect human capabilities both positively and negatively. The physical components (hardware) and instructions (software) that make up a computing system communicate and process information in digital form. They will also understand techniques that are useful when troubleshooting a computing system that does not work as intended.

Standard 1
Students will identify different types of computing devices they encounter in their everyday life including laptops, desktops, mobile devices, gaming systems, wearable technology and embedded systems (drones, car systems, smart houses, etc.).
- Identify required functions for a device to be classified as a computer (input, processing; output; storage)
- Identify examples of tasks that can and cannot be accomplished with a computer.

Standard 2
Students will explain the purpose of and interaction between key functional components of a computer

including processor, RAM, ROM, hard drive, and input and output devices.

Standard 3
Students will demonstrate an understanding of gigahertz, kilobyte, megabyte, gigabyte, and terabyte in relation to current computing devices.

Standard 4
Students will explain the interrelation of the operating system software, application software, and utility software, citing specific examples of each.

Standard 5
Students will diagnose and solve routine hardware and software problems that occur during everyday computer use. (e.g., reboot/restart, power, connections, cables, ports, network resources, video, sound)

STRAND 3

Networks & The Internet - **Students will understand that networks connect computing systems to share information and resources which are an increasingly integral part of computing. Data is transmitted across multiple networks to other computing devices. The confidential nature of data requires cybersecurity measures to continually monitor and protect computers, networks, programs, and data from unauthorized or unintentional access, manipulation, or destruction.**

Standard 1
Students will understand and describe the network system that makes up the Internet.

Standard 2
Students will investigate web search algorithms and how search engines work (crawling, indexing and ranking websites).

Standard 3
Students will describe how packets are used to send and receive data and what happens to the data when it experiences packet loss.

Standard 4
Students will evaluate how various physical and digital security measures protect electronic information and how a lack of such measures could lead to vulnerabilities. (cybersecurity)

Standard 5
Students will investigate multiple methods of secure transmission of information. (i.e.: encryption, firewalls, VPNs)

Performance Skills
- Students will model the steps a secure message takes to go from sender to recipient.
- Students will practice basic personal security measures. [HTTPS, secure passphrases, device security, password managers (avoiding password reuse), keystroke logger (software trojan and USB hardware)]

Career Investigation
- IT/Networking Specialist
- Network Architect/Administrator

- Cybersecurity Expert
- Security Engineer

STRAND 4

Impacts of Computing - Students will realize the effects that computing has on daily life in both positive and negative ways. Individuals and communities influence computing through their behaviors and cultural and social interactions, and in turn, computing influences new cultural practices at local, national, and global levels. An informed and responsible person should understand the social implications of the digital world, including validity, equity, and access to computing.

Standard 1

Students will evaluate the quality of digital sources for reliability, including currency, relevancy, authority, accuracy, and purpose of digital information.
- Relate the distribution of computing resources in a global society to issues of equity, access, and power.
- Evaluate the bias of digital information sources, including websites.
- Evaluate how media and technology can be used to distort, exaggerate, and misrepresent information.

Standard 2

Students will identify some of the tradeoffs associated with computing technologies that can affect people's everyday activities and career options.

Standard 3

Students will be able to identify issues of bias and accessibility in the design and functionality of existing technologies.

Standard 4

Students will understand the ethical responsibility to society when creating apps or programs- including the following: empathy with the end user, improving the world around you, efficiency-making things easier, potential liability for misuse, potential security issues.

Standard 5

Students will be able to explain the benefits and risks associated with sharing information digitally:
- Appropriate uses of social media in personal, educational, extra-curricular, professional, and community scenarios
- Permanence of online information
- Appropriate methods of communication for personal, educational, extra-curricular, professional, and community situations
- Online safety [password/passphrase, personal information, location (GPS), sharing images, talking to/ meeting up with strangers, financial information, names, and addresses]

Performance Skills
- Students will evaluate a current event/innovation/topic (within the last year) on the web using multiple viewpoints from a variety of sources for authority, purpose, coverage, accuracy, objectivity, currency, and accessibility.

Career Investigation
- Security Analyst

- Health Information Technician
- Information Researcher (fact checker)

STRAND 5

Problem Solving & Programming - Students will understand that an algorithm is a sequence of steps designed to accomplish a specific task. Algorithms are then translated into programs, or code, to provide instructions for computing devices. Programs control all computing systems and empower people to communicate with the world in new ways and solve compelling problems.

Standard 1 - Problem Solving

Solve a problem by applying appropriate problem-solving techniques
- Define - Understand the Problem
- Prepare - Plan the Solution (design via pseudocode/flowcharts)
- Try - Carry out the Plan (Code)
- Reflect - Review and Discuss your Solution (Testing / Feedback)

Standard 2 - Program Design

Students will identify how planning strategies (such as flowcharts, storyboards, prototypes or pseudocode) are used when creating a program.

Standard 3 - Algorithms

Define an algorithm as a set of clearly defined, logical steps to solve a problem.
- Students will describe the steps needed to efficiently solve a non-computing problem using a pseudo-code algorithm
- Students will examine traditional programming algorithms including searches, sorts, and/or minimal spanning trees.
- Students will examine and formulate algorithms that solve specific problems.

Standard 4 - Input / Output

Students will recognize a variety of different user input sources such as text input, sensors, mouse response, movement, or event. Students will recognize a variety of different outputs such as sounds, light, vibrations, movement, text and/or graphics.

Standard 5 - Variables

Students will understand that variables are named locations in memory.
Students will be able to identify variables and when they should be used in code.

Standard 6 - Loops

Students will understand that programs use loops (iteration) to be more efficient and avoid code duplication.

Standard 7 - Conditionals

Students will understand that programs use conditionals to perform different computations or actions based on whether a condition is true or false (Booleans).

Standard 8 - Operators

Students will understand that programs use mathematical symbols (+, -, *, /, >, <, ==, AND, OR) in a program to perform specific operations (mathematical, relational, or logical) and produce a single result.

Standard 9 - Functions
Students will understand that a function is a named block of code that performs a specific task. Functions encourage efficiency, reusability, and readability.

Standard 10 - Debugging
Students will understand that debugging is finding and removing errors from a program so it can operate as intended. Strategies students might learn for debugging could include:
- Guess and Check
- Deactivating sections to identify problematic code
- Looking for typos, missing tags, or incorrect syntax
- Making the problem smaller - identifying important points (changing variable values, getting input, etc.)
- Asking a friend or team member for help
- Printing, watching, or changing variable values while the program runs
- Using a debugging tool
- Thinking about when the code last worked and what you have added since then

Performance Skills
- Students will design algorithms and create programming solutions to a variety of computational problems using a block or text programming language.
- Students will develop a program or programs that:
  - makes a decision based on data or user input (conditionals)
  - accepts user and/or sensor input and stores the result in a variable.
  - uses variables that represent different data types.
  - uses structures that repeat blocks of code (loops)
  - uses operators
  - uses functions
- Students will analyze, test, improve and debug computer programs.

Career Investigation
- Software Engineer
- Video Game Developer
- Mobile App Developer
- Web Developer

STRAND 6
Data & Analysis - Students will recognize data exists in many formats and computing systems are used to process that data. Data is collected, stored, and analyzed to better understand the world, make decisions and make more accurate predictions.

Standard 1 - Binary Code
- Students will define a binary system as one that uses just two possible states to represent information
- Students will define a bit as a single piece of binary information
- Students will be familiar with common features of systems used to represent information in binary, ASCII, and images
  - Students will use the ASCII system to encode and decode text information in binary
  - Students will use a binary system to represent numbers
- Students will describe common features of systems used to represent information in binary

Standard 2 - Data Collection & Analysis

Students will collect and/or generate their own data related to local community issues and discuss appropriate methods for data collection and aggregation of data necessary to support making a case of facilitating a discovery.

Performance Skills

- Students will define a local issue in their community and will collect and compare data regarding that issue.
  - Students will analyze the collected data using computational tools such as charts, graphs, and/or spreadsheets.
  - Students will create a model based on that data that is meaningful and useful.
  - Students will present the data and the story it tells their peers.

Career Investigation

- Data Scientist
- Data Communications Analysts
- Database Administrators

References:

code.org CC license - Link to CS Discoveries Curriculum Guide - https://docs.google.com/document/d/1-O6o5yQ4I1dk0n4Qzh86quXGBtzDDtyJ3Skr6RpcpO4/preview#heading=h.8q043efykwpk

Arizona Computer Science 6-8 Standards
https://cms.azed.gov/home/GetDocumentFile?id=5bc90a3e1dcb2510102f55b1