Computer Science and Mathematics
Content Standards

2016

Course Title:	Computer Science and Mathematics
Course/Unit Credit:	1
Course Number:	439100 – Secondary Math License/Math Credit
	460050 – Business Teacher License/Career Focus Credit
Teacher Licensure:	Please refer to the Course Code Management System (https://adedata.arkansas.gov/ccms/) for the most current licensure codes.
Grades:	9-12
Prerequisite:	Students must have successfully completed coursework for Algebra I (or Algebra A&B) and Geometry (or Geometry A&B). In addition, students must have successfully completed Algebra II or be concurrently enrolled in Algebra II.

Computer Science and Mathematics

This course is designed to provide students with the opportunity to explore the uses of mathematics and computer programming as tools in creating effective solutions to complex problems. Students will develop and refine fundamental skills of computer science within a mathematical context. Computer Science and Mathematics may be counted as a fourth math credit course under Smart Core. Any reference to an algorithm or algorithms in this document includes both mathematics and computer science contexts. Throughout the course, students will use developmentally appropriate and accurate terminology when communicating about technology. Computer Science and Mathematics does not require Arkansas Department of Education approval.

Strand	Content Standards
Computational Thinking	
	1. Students will evaluate different data representations to solve problems.
	2. Students will connect the development cycle of algorithm construction to problem solving.
	3. Students will create and evaluate algorithms to solve problems.
Computing Practice and Programming	
	4. Students will evaluate the use of programming languages to solve problems and develop systems.
	5. Students will create, test, and use computer programs to solve problems.
Computers and Communication Devices	
	6. Students will classify electronic devices containing computational processors that execute programs.
	7. Students will analyze the relationship between hardware and software.
	8. Students will describe the major components and functions of networks.
Social and Ethical Impacts of Computing	
	9. Students will evaluate appropriate and inappropriate uses of technology.
	10. Students will investigate social and ethical issues relating to digital information.
	11. Students will explore security and privacy techniques.

Notes:
1. The examples given (e.g.,) are suggestions to guide the instructor.
2. This curriculum framework is intended to assist in district curriculum development and unit design.
3. This curriculum framework is not a progression document, nor is it intended to be a state-mandated curriculum designating how or when content is taught.

Strand: Computational Thinking

Content Standard 1: Students will evaluate different data representations to solve problems.

CT.1.CSM.1	Analyze the various mathematical bases (e.g., binary, decimal, hexadecimal) and convert between them
CT.1.CSM.2	Describe the relationship between binary and hexadecimal representations
CT.1.CSM.3	Convert information between various encoding formats (e.g., ASCII, Unicode, hexadecimal, binary)
CT.1.CSM.4	Express the relationship between matrices and arrays
CT.1.CSM.5	Compare techniques (e.g., sorting, statistics, searching) for analyzing massive data collections

Strand: Computational Thinking

Content Standard 2: Students will connect the development cycle of algorithm construction to problem solving.

CT.2.CSM.1	Describe how mathematical and statistical functions, sets, and logic are used in computation
CT.2.CSM.2	Utilize predefined mathematical functions and parameters to divide a complex problem into simpler parts, including parallel processing
CT.2.CSM.3	Interpret truth tables from basic statements using Boolean operators (AND, OR, XOR, and NOT)
CT.2.CSM.4	Explain ways in which sequence, selection, iteration, and recursion are building blocks of algorithms
CT.2.CSM.5	Evaluate concepts of different types of functions, numerically and algebraically • quadratic functions, including the analysis of the discriminant and complex numbers • recursively defined functions, series, and sequences, including arithmetic and geometric • exponential and logarithmic functions (including inverse relationship between exponents and logarithms) • trigonometric functions to model physical situations (including right triangle trig, laws of sines and cosines) • scenarios involving velocity and other quantities that can be represented by vectors
CT.2.CSM.6	Create systems of equations and matrices based on real-world situations
CT.2.CSM.7	Solve systems of equations and matrices by finding inverses, determinants, and other methods
CT.2.CSM.8	Analyze decisions and strategies using probability and statistical concepts

Strand: Computational Thinking

Content Standard 3: Students will create and evaluate algorithms to solve problems.

CT.3.CSM.1	Utilize modeling and simulation techniques to represent and understand natural phenomena
CT.3.CSM.2	Examine classical algorithms (e.g., discriminant in quadratic formula, matrix manipulation, searching, sorting, shortest path, minimum spanning tree)
CT.3.CSM.3	Manipulate formulas and equations and apply them to algorithm development
CT.3.CSM.4	Apply algorithm analysis and design techniques to solve problems
CT.3.CSM.5	Write algorithms to solve mathematical problems using formulas, equations, matrices, and functions
CT.3.CSM.6	Implement conditional statements that include if/then, if/then/else, case statements, and Boolean logic, in the design of algorithms
CT.3.CSM.7	Represent algorithms using flowcharts and pseudocode
CT.3.CSM.8	Combine standard function types using arithmetic operations
CT.3.CSM.9	Analyze algorithms for correctness, clarity, and efficiency

Strand: Computing Practice and Programming
     Content Standard 4: Students will evaluate the use of programming languages to solve problems and develop systems.

CPP.4.CSM.1	Compare and contrast computer programming languages and paradigms (e.g., compiled and interpreted languages, procedural and object-oriented paradigms)
CPP.4.CSM.2	Diagram the program execution process
CPP.4.CSM.3	Determine the output of a given sample program without the use of a computer

Strand: Computing Practice and Programming
     Content Standard 5: Students will create, test, and use computer programs to solve problems.

CPP.5.CSM.1	Implement computing applications using the following software development tools and techniques - branching (if, if-else) - declare, define, and reference variables - lists/arrays - looping (for, while, do/while) - matrices/two-dimensional arrays - primitive data types - recursion - sequencing
CPP.5.CSM.2	Use various debugging and testing methods (e.g., debugging statements, breakpoints, memory inspection, test cases, unit testing, white box, black box, integration testing) to ensure program correctness
CPP.5.CSM.3	Cite evidence to support or refute the correctness of software solutions
CPP.5.CSM.4	Use the following Application Program Interfaces (API) and libraries to create problem solving computer programs - file input/output - math libraries (e.g., absolute value, square root, quadratic, exponentiation, trigonometry) - utilities (e.g., random number generators)

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Strand: Computers and Communications Devices
   Content Standard 6: Students will classify electronic devices containing computational processors that execute programs.

CCD.6.CSM.1	Recognize that computers are devices that execute programs
CCD.6.CSM.2	Identify a variety of electronic devices (e.g., cell phones, desktops, laptops, vehicles, programmable thermostats, programmable kitchen appliances) that contain computational processors
CCD.6.CSM.3	Describe unique features of computers embedded in mobile devices and vehicles
CCD.6.CSM.4	Investigate the history of computers, identifying contributors and major milestones (e.g., Alan Turing, Charles Babbage, Ada Lovelace, Grace Hopper, analytical machine, ENIAC, IBM PC)

Strand: Computers and Communications Devices
   Content Standard 7: Students will analyze the relationship between hardware and software.

CCD.7.CSM.1	Demonstrate an understanding of the relationship between hardware and software
CCD.7.CSM.2	Develop criteria for purchasing or upgrading computer system hardware
CCD.7.CSM.3	Describe primary components of computer systems (e.g., input, output, processing, storage)
CCD.7.CSM.4	Explain multiple levels of hardware and software that support program execution (e.g., compilers, interpreters, operating systems, networks)
CCD.7.CSM.5	Apply strategies for identifying and solving routine hardware problems that occur during everyday computer use

Strand: Computers and Communications Devices
    Content Standard 8: Students will describe the major components and functions of networks.

CCD.8.CSM.1	Describe how the Internet facilitates global communication
CCD.8.CSM.2	Describe issues that impact network functionality (e.g., latency, bandwidth, firewalls, server capability)
CCD.8.CSM.3	Describe primary hardware and software components of a network (e.g., hosts, routers, switches, links, servers, network interface cards, applications, web browsers, HTTP, TCP, IP, CSMA)

Strand: Social and Ethical Impacts of Computing
　　　Content Standard 9. Students will evaluate appropriate and inappropriate uses of technology.

SEI.9.CSM.1	Summarize appropriate and inappropriate technological behaviors, including issues of privacy, copyright, security, legalities, and politics
SEI.9.CSM.2	Explore the ramifications of inappropriate uses of technology
SEI.9.CSM.3	Investigate the national and global economic impact of cybercrime

Strand: Social and Ethical Impacts of Computing
　　　Content Standard 10: Students will investigate social and ethical issues relating to digital information.

SEI.10.CSM.1	Discuss accessibility issues (e.g., adaptive technology for special needs individuals, censorship, geographical locations, economically-disadvantaged populations)
SEI.10.CSM.2	Compare the reliability of various online sources
SEI.10.CSM.3	Investigate information ownership topics • access • distribution rights • hacking • licensure • open source • public domain • software piracy
SEI.10.CSM.4	Describe security and privacy issues that relate to computer networks

Strand: Social and Ethical Impacts of Computing
    Content Standard 11: Students will explore security and privacy techniques.

SEI.11.CSM.1	Explain principles of network security and techniques that protect stored and transmitted data (e.g., encryption, cryptography, authentication)
SEI.11.CSM.2	Develop an algorithm that demonstrates a security technique
SEI.11.CSM.3	Debug an algorithm that demonstrates a security technique

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