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CODING THE STANDARDS

CODING SCHEME

SUBJECT.STANDARD.GradeLevel SUBSTANDARD.sub-substandard

CS = computer science (SUBJECT)

AP = algorithms and programming

CS = computing systems

DA = data and analysis

IC = impacts of computing

NI = computer science networks and the internet

Example

CS.DA.K	Computer science data and analysis standards for kindergarten are that each student will
CS.DA.K.1	collect and categorize data

K-12 STANDARDS

The following standards will go into effect on July 1, 2021.

Content	The content areas covered by the computer science standards may include
AP	algorithms and programming
CS	computing systems
DA	data and analysis
IC	impacts of computing
NI	computer science networks and the internet.

Skills	When a district incorporates or integrates computer science content into district curriculum or offers a course in computer science, the following skills at each grade level apply
CS.1.K12	fostering an inclusive computing culture
CS.2.K12	collaborating around computing
CS.3.K12	recognizing and defining computational problems
CS.4.K12	developing and using abstractions
CS.5.K12	creating computational artifacts
CS.6.K12	testing and refining computational artifacts
CS.7.K12	communicating about computing.

KINDERGARTEN

CS.K	COMPUTER SCIENCE CONTENT STANDARDS FOR KINDERGARTEN
CS.AP.K	Computer science algorithms and programming standards for kindergarten are that each student will
CS.AP.K.1	follow step-by-step instructions
CS.AP.K.2	recognize that numbers and symbols represent information.
CS.CS.K	Computer science computing systems standards for kindergarten are that each student will
CS.CS.K.1	identify computing devices
CS.CS.K.2	identify examples of common hardware and software
CS.DA.K	Computer science data and analysis standards to kindergarten are that each student will
CS.DA.K.1	collect and categorize data
CS.DA.K.2	retrieve information
CS.DA.K.3	identify patterns in data
CS.IC.K	Computer science impacts of computing standards for kindergarten are that each student will
CS.IC.K.1	work respectfully and responsibly in groups
CS.IC.K.2	keep login information private and log off devices appropriately

FIRST GRADE

CS.1	COMPUTER SCIENCE CONTENT STANDARDS FOR FIRST GRADE
CS.AP.1	Computer science algorithms and programming standards for first grade are that each student will
CS.AP.1.1	retell step-by-step instructions to complete a task
CS.AP.1.2	use numbers and symbols to represent information
CS.AP.1.3	arrange sequences and simple loops in correct order
CS.CS.1	Computer science computing systems standards for first grade are that each student will
CS.CS.1.1	identify tasks that can be performed by computing devices
CS.CS.1.2	use appropriate terminology in identifying common hardware and software problems
CS.CS.1.3	identify simple hardware and software problems.
CS.DA.1	Computer science data and analysis standards for first grade are that each student will
CS.DA.1.1	collect and categorize data in up to three categories
CS.DA.1.2	retrieve, arrange and modify information
CS.DA.1.3	identify patterns in data
CS.IC.1	Computer science impacts of computing standards for first grade are that each student will
CS.IC.1.1	work respectfully and responsibly in groups
CS.IC.1.2	keep login information private and log off devices appropriately

SECOND GRADE

CS.2	COMPUTER SCIENCE CONTENT STANDARDS FOR SECOND GRADE
CS.AP.2	The computer science algorithms and programming standards for second grade are that each student will
CS.AP.2.1	model daily processes by creating and following sets of step-by-step instructions to complete tasks
CS.AP.2.2	model the way programs store and manipulate data by using numbers or other symbols to represent information
CS.AP.2.3	develop programs with sequences and simple loops to express ideas or address a problem
CS.AP.2.4	break down the steps needed to solve a problem into a precise sequence of instructions.
CS.CS.2	Computer science computing systems standards for second grade are that each student will
CS.CS.2.1	select and operate appropriate tools to perform a variety of tasks
CS.CS.2.2	use appropriate terminology in identifying and describing the function of common hardware and software
CS.CS.2.3	describe basic hardware and software problems using accurate terminology.
CS.DA.2	Computer science data and analysis standards for second grade are that each student will
CS.DA.2.1	collect and present the data in various visual formats
CS.DA.2.2	define data as gathered and stored information
CS.DA.2.3	identify and describe patterns in data visualizations, such as charts or graphs, to make predictions
CS.IC.2	Computer science impacts of computing standards for second grade are that each student will
CS.IC.2.1	identify how computing technology has changed how people live and work
CS.IC.2.2	work respectfully and responsibly online
CS.IC.2.3	keep login information private and log off devices appropriately.
CS.NI.2	Computer science networks and the internet standards for second grade are that each student will
CS.NI.2.1	explain what passwords are and why they are used
CS.NI.2.2	recognize that computing devices and the internet enable people to connect with other people, places, information, and ideas



THIRD GRADE

CS.3	COMPUTER SCIENCE CONTENT STANDARDS FOR THIRD GRADE
CS.AP.3	Computer science algorithms and programming standards for third grade are that each student will
CS.AP.3.1	compare and contrast multiple algorithms to complete the same task
CS.AP.3.2	break down problems into smaller, manageable subproblems to facilitate the program development process
CS.AP.3.3	describe steps taken and choices made during the process of program development
CS.AP.3.4	identify intellectual property rights and give appropriate credit when creating or remixing programs
CS.CS.3	Computer science computing systems standards for third grade are that each student will
CS.CS.3.1	identify the internal and external parts of computing devices
CS.CS.3.2	determine potential solutions to solve simple hardware and software problems using common troubleshooting strategies.
CS.DA.3	Computer science data and analysis standards for the third grade are that each student will
CS.DA.3.1	collect data from multiple sources and display the data in graphs
CS.DA.3.2	describe multiple types of data
CS.DA.3.3	understand the accuracy of predictions and how they are influenced by the amount of data collected
CS.IC.3	Computer science impacts of computing standards for third grade are that each student will
CS.IC.3.1	collect diverse perspectives for the purpose of improving computational artifacts
CS.IC.3.2	identify rules associated with the appropriate use of digital information when creating computational artifacts
CS.IC.3.3	describe ethical issues that relate to computing devices and networks.
CS.NI.3	Computer science networks and the internet standards for third grade are that each student will identify how personal information can be protected

FOURTH GRADE

CS.4	COMPUTER SCIENCE CONTENT STANDARDS FOR FOURTH GRADE
CS.AP.4	Computer science algorithms and programming standards for fourth grade are that each student will
CS.AP.4.1	compare and refine multiple algorithms for the same task and determine which is the most appropriate
CS.AP.4.2	break down problems into smaller, manageable subproblems to facilitate the program development process
CS.AP.4.3	test and debug a program or algorithm to ensure it runs as intended.
CS.CS.4	Computer science computing systems standards for fourth grade are that each student will
CS.CS.4.1	explain the function of individual internal and external parts
CS.CS.4.2	determine potential solutions to solve simple hardware and software problems using common troubleshooting strategies.
CS.DA.4	Computer science data and analysis standards for fourth grade are that each student will
CS.DA.4.1	select and use appropriate non-digital and digital tools to collect and represent data
CS.DA.4.2	identify and use multiple types of data to complete a task
CS.DA.4.3	evaluate the validity of data based on accuracy and relevance
CS.IC.4	Computer science impacts of computing standards for fourth grade are that each student will
CS.IC.4.1	collect diverse perspectives for the purpose of improving computational artifacts
CS.IC.4.2	identify rules associated with the appropriate use of digital information when creating computational artifacts
CS.IC.4.3	describe ethical issues that relate to computing devices and networks.
CS.NI.4	Computer science networks and the internet standards for fourth grade are that each student will identify cybersecurity problems

FIFTH GRADE

CS.5	COMPUTER SCIENCE CONTENT STANDARDS FOR FIFTH GRADE
CS.AP.5	Computer science algorithms and programming standards for fifth grade are that each student will
CS.AP.5.1	compare and refine multiple algorithms for the same task and determine which is the most appropriate
CS.AP.5.2	create programs that use variables to store and modify data
CS.AP.5.3	create programs that include sequences, events, loops, and conditionals
CS.AP.5.4	modify, remix, or incorporate portions of an existing program to develop something new or add more advanced features
CS.AP.5.5	describe choices made during program development
CS.CS.5	Computer science computing systems standards for fifth grade are that each student will
CS.CS.5.1	describe how internal and external parts of computing devices function to form a system
CS.CS.5.2	model how computer hardware and software work together as a system to accomplish tasks
CS.CS.5.3	determine potential solutions to solve simple hardware and software problems using common troubleshooting strategies.
CS.DA.5	Computer science data and analysis standards for fifth grade are that each student will
CS.DA.5.1	organize and present collected data visually to highlight relationships and support a claim
CS.DA.5.2	demonstrate how to store, copy, search, retrieve, modify, and delete information using a computing device
CS.DA.5.3	use accurate and relevant data to highlight or propose cause-and-effect relationships, predict outcomes, or communicate an idea
CS.IC.5	Computer science impacts of computing standards for fifth grade are that each student will
CS.IC.5.1	explain how computing technologies have changed Montana and the world, and express how those technologies influence, and are influenced by, cultural practices
CS.IC.5.2	identify ways to improve the accessibility and usability of technology products for the diverse needs and wants of users
CS.IC.5.3	utilize diverse perspectives for the purpose of improving computational artifacts
CS.IC.5.4	apply laws associated with digital information and intellectual property
CS.IC.5.5	describe ethical issues that relate to computing devices and networks
CS.NI.5	Computer science networks and the internet standards for fifth grade are that each student will
CS.NI.5.1	explain cybersecurity problems
CS.NI.5.2	explain how personal information can be protected

SIXTH – EIGHTH GRADES

CS.6-8	COMPUTER SCIENCE CONTENT STANDARDS FOR SIXTH THROUGH EIGHTH GRADE
CS.AP.6-8	Computer science algorithms and programming standards for sixth through eighth grades are that each student will
CS.AP.6-8.1	use algorithms to address complex problems
CS.AP.6-8.2	create clearly named variables that represent different data types and perform operations on their values
CS.AP.6-8.3	develop programs that combine control structures, including nested loops and compound conditionals
CS.AP.6-8.4	decompose problems and subproblems into parts to facilitate the design, implementation, and review of programs
CS.AP.6-8.5	create procedures with parameters to organize code and make it easier to reuse
CS.AP.6-8.6	seek and incorporate feedback from team members and users to refine a solution that meets user needs
CS.AP.6-8.7	incorporate existing code, media, and libraries into original programs, and give attribution
CS.AP.6-8.8	systematically test and refine programs using a range of test cases
CS.AP.6-8.9	distribute tasks and maintain a project timeline when collaboratively developing computational artifacts
CS.AP.6-8.10	document programs in order to make them easier to follow, test, and debug
CS.CS.6-8	Computer science computing systems standards for sixth through eighth grades are that each student will
CS.CS.6-8.1	recommend improvements to the design of computing devices, based on an analysis of how users interact with the devices
CS.CS.6-8.2	design projects that combine hardware and software components to collect and exchange data
CS.CS.6-8.3	systematically identify and fix problems with computing devices and their components.
CS.DA.6-8	Computer science data and analysis standards for sixth through eighth grades are that each student will
CS.DA.6-8.1	collect data using computational tools and transform the data to make it more useful and reliable
CS.DA.6-8.2	represent data using multiple formats
CS.DA.6-8.3	refine computational models based on the data they have generated.
CS.IC.6-8	Computer science impacts of computing standards for sixth through eighth grades are that each student will
CS.IC.6-8.1	compare tradeoffs associated with computing technologies that affect people's everyday activities and career options in Montana and the world, urban, rural, and reservation communities

CS.6-8	COMPUTER SCIENCE CONTENT STANDARDS FOR SIXTH THROUGH EIGHTH GRADE
CS.IC.6-8.2	discuss issues of bias and accessibility in the design of existing technologies
CS.IC.6-8.3	collaborate with other contributors when creating a computational artifact
CS.IC.6-8.4	describe tradeoffs between allowing information, personal or intellectual, to be public and keeping information private and secure
CS.NI.6-8	Computer science networks and the internet standards for sixth through eighth grades are that each student will
CS.NI.6-8.1	explain how physical and digital security measures protect electronic information
CS.NI.6-8.2	apply multiple methods of encryption to demonstrate how to securely transmit information
CS.NI.6-8.3	demonstrate how information is broken down and transmitted through multiple devices over networks and the internet and reassembled at the destination

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NINTH – TWELFTH GRADES

CS.9-12	COMPUTER SCIENCE CONTENT STANDARDS FOR NINTH THROUGH TWELFTH GRADE
CS.AP.9-12	Computer science algorithms and programming standards for ninth through twelfth grades are that each student will
CS.AP.9-12.1	create prototypes that use algorithms to solve computational problems by leveraging prior student knowledge and personal interests
CS.AP.9-12.2	describe how artificial intelligence drives many software and physical systems
CS.AP.9-12.3	implement an artificial intelligence algorithm to play a game against a human opponent or solve a problem
CS.AP.9-12.4	use and adapt classic algorithms to solve computational problems
CS.AP.9-12.5	evaluate algorithms in terms of their efficiency, correctness, and clarity
CS.AP.9-12.6	use lists to simplify solutions, generalizing computational problems instead of repeatedly using simple variables
CS.AP.9-12.7	compare and contrast fundamental data structures and their uses
CS.AP.9-12.8	justify the selection of specific control structures when tradeoffs involve implementation, readability, and program performance, and explain the benefits and drawbacks of choices made
CS.AP.9-12.9	design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue by using events to initiate instructions
CS.AP.9-12.10	decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, or objects
CS.AP.9-12.11	create artifacts by using procedures within a program, combinations of data and procedures, or independent but interrelated programs
CS.AP.9-12.12	construct solutions to problems using student-created procedures, modules, or objects
CS.AP.9-12.13	analyze a large-scale computational problem and identify generalizable patterns that can be applied to a solution
CS.AP.9-12.14	demonstrate code reuse by creating programming solutions using libraries and application programming interfaces



MONTANA CONTENT STANDARDS FOR COMPUTER SCIENCE FOR K-12

CS.9-12	COMPUTER SCIENCE CONTENT STANDARDS FOR NINTH THROUGH TWELFTH GRADE
CS.AP.9-12.15	systematically design and develop programs for broad audiences by incorporating feedback from users
CS.AP.9-12.16	evaluate and refine computational artifacts to make them more usable and accessible
CS.AP.9-12.17	design and develop computational artifacts working in team roles using collaborative tools
CS.AP.9-12.18	document design decisions using text, graphics, presentations, or demonstrations in the development of complex programs
CS.AP.9-12.19	plan and develop programs for broad audiences using a software life cycle process
CS.AP.9-12.20	explain security issues that might lead to compromised computer programs
CS.AP.9-12.21	develop programs for multiple computing platforms
CS.AP.9-12.22	use version control systems, integrated development environments, and collaborative tools and practices in a group software project
CS.AP.9-12.23	develop and use a series of test cases to verify that a program performs according to its design specifications
CS.AP.9-12.24	modify an existing program to add additional functionality and discuss intended and unintended implications
CS.AP.9-12.25	evaluate key qualities of a program through a process such as a code review
CS.AP.9-12.26	compare multiple programming languages and discuss how their features make them suitable for solving different types of problems.
CS.CS.9-12	Computer science computing systems standards for ninth through twelfth grades are that each student will
CS.CS.9-12.1	explain how abstractions hide the underlying implementation details of computing systems embedded in everyday objects
CS.CS.9-12.2	compare levels of abstraction and interactions between application software, system software, and hardware layers
CS.CS.9-12.3	categorize the roles of operating system software
CS.CS.9-12.4	develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors



MONTANA CONTENT STANDARDS FOR COMPUTER SCIENCE FOR K-12

CS.9-12	COMPUTER SCIENCE CONTENT STANDARDS FOR NINTH THROUGH TWELFTH GRADE
CS.CS.9-12.5	illustrate ways computing systems implement logic, input, and output through hardware components.
CS.DA.9-12	Computer science data and analysis standards for ninth through twelfth grades are that each student will
CS.DA.9-12.1	create interactive data visualizations using software tools to help others better understand authentic phenomena
CS.DA.9-12.2	use data analysis tools and techniques to identify patterns in data representing complex systems
CS.DA.9-12.3	select data collection tools and techniques to generate data sets that support a claim or communicate information
CS.DA.9-12.4	translate between different bit representations of authentic phenomena, including characters, numbers, and images
CS.DA.9-12.5	evaluate the tradeoffs in how data elements are organized and where data is stored
CS.DA.9-12.6	create computational models that represent the relationships among different elements of data collected from a phenomenon or process
CS.DA.9-12.7	evaluate the ability of models and simulations to test and support the refinement of hypotheses.
CS.IC.9-12	Computer science impacts of computing standards for ninth through twelfth grades are that each student will
CS.IC.9-12.1	evaluate the ways computing technologies, globally and locally impact personal, ethical, social, economic, and cultural practices
CS.IC.9-12.2	evaluate the ways computing technologies impact American Indian communities in Montana
CS.IC.9-12.3	test and refine computational artifacts to reduce bias and equity deficits
CS.IC.9-12.4	demonstrate ways a given algorithm applies to problems across disciplines
CS.IC.9-12.5	evaluate computational artifacts to maximize their beneficial effects and minimize harmful effects on society
CS.IC.9-12.6	evaluate the impact of equity, access, and influence on the distribution of computing resources in a global society, including the impact on American Indians living in urban, rural, and reservation communities

CS.9-12	COMPUTER SCIENCE CONTENT STANDARDS FOR NINTH THROUGH TWELFTH GRADE
CS.IC.9-12.7	predict how computational innovations that have revolutionized aspects of our culture might evolve
CS.IC.9-12.8	use tools and methods to connect and work with others on a project including people in different cultures and career fields
CS.IC.9-12.9	explain the beneficial and harmful effects that intellectual property laws can have on innovation
CS.IC.9-12.10	explain the privacy concerns related to the collection and generation of data through automated processes that may not be evident to users
CS.IC.9-12.11	evaluate the social and economic implications of privacy in the context of safety, law, or ethics
CS.IC.9-12.12	debate laws and regulations that impact the development and use of software
CS.NI.9-12	Computer science networks and the internet standards for ninth through twelfth grades are that each student will
CS.NI.9-12.1	recommend security measures to address various scenarios based on factors including efficiency, feasibility, and ethical impacts
CS.NI.9-12.2	explain tradeoffs when selecting and implementing cybersecurity recommendations
CS.NI.9-12.3	compare ways software developers protect devices and information from unauthorized access
CS.NI.9-12.4	evaluate the scalability and reliability of networks by describing the relationship between routers, addressing, switches, servers, and topology
CS.NI.9-12.5	give examples to illustrate how sensitive data can be affected by malware and other attacks
CS.NI.9-12.6	compare various security measures, considering tradeoffs between the usability and security of a computing system
CS.NI.9-12.7	discuss the issues that impact functionality