Advanced Computer Science Standards

This document was prepared by:

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Vision

All Nevada students are equipped and feel empowered to attain their vision of success

Mission

To improve student achievement and educator effectiveness by ensuring opportunities, facilitating learning, and promoting excellence

Nevada Department of Education
Nevada Ready!

Table of Contents

Acknowledgements

The development of Nevada career and technical education (CTE) standards and assessments is a collaborative effort sponsored by the Nevada Department of Education (NDE) Office of Career Readiness, Adult Learning, and Education Options. The Nevada Department of Education relies on educators and industry representatives who have the technical expertise and teaching experience to develop standards and performance indicators that truly measure student skill attainment. More importantly, the NDE would like to recognize the time and commitment by the writing team members in developing the career and technical standards for Computer Science.

Standards Development Members

Name	Occupation/Title	Stakeholder Affiliation	School/Organization
Fran Bromley-Norwood	Administrator	District Administrator	Clark County School District
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Business and Industry Validation

All CTE standards developed through the Nevada Department of Education are validated by business and industry through one or more of the following processes: (1) the standards are developed by a team consisting of business and industry representatives, or (2) a separate review panel is coordinated with industry experts to ensure the standards include the proper content, or (3) nationally recognized standards currently endorsed by business and industry.

The Computer Science standards were validated through active participation of business and industry representatives on the development team.

Introduction

The standards in this document are designed to clearly state what the student should know and be able to do upon completion of an advanced high school Computer Science program. These standards are designed for a two-credit course sequence that prepares the student for a technical assessment directly aligned to the standards.

These exit-level standards are designed for the student to complete all standards through their completion of a program of study. These standards are intended to guide curriculum objectives for a program of study.

The standards are organized as follows:

- **Content Standards** are general statements that identify major areas of knowledge, understanding, and the skills students are expected to learn in key subject and career areas by the end of the program.
- **Performance Standards** follow each content standard. Performance standards identify the more specific components of each content standard and define the expected abilities of students within each content standard.
- **Performance Indicators** are very specific criteria statements for determining whether a student meets the performance standard. Performance indicators may also be used as learning outcomes, which teachers can identify as they plan their program learning objectives.

The crosswalks and alignment sections of the document show where the performance indicators support the Nevada Academic Content Standards. Where correlation with an academic content standard exists, students in the Computer Science program perform learning activities that connect with and support the academic content standards that are listed. The crosswalks and alignments are not intended to teach academic standards.

All students are encouraged to participate in the career and technical student organization (CTSO) that relates to the Computer Science program. CTSOs are co-curricular national organizations that directly reinforce learning in the CTE classroom through curriculum resources, competitive events, and leadership development. CTSOs provide students the ability to apply academic and technical knowledge, develop communication and teamwork skills, and cultivate leadership skills to ensure college and career readiness.

The Employability Skills for Career Readiness identify the skills needed to be successful in all careers and must be taught as an integrated component of all CTE course sequences. These standards are available in a separate document.

The **Standards Reference Code** is only used to identify or align performance indicators listed in the standards to daily lesson plans, curriculum documents, or national standards. The Standards Reference Code is an abbreviated name for the program, and the content standard, performance standard, and performance indicator are referenced in the program standards. This abbreviated code for identifying standards uses each of these items. For example, ADVCS is the Standards Reference Code for Advanced Computer Science. For Content Standard 2, Performance Standard 3, and Performance Indicator 4, the Standards Reference Code would be ADVCS.2.3.4.

CONTENT STANDARD 1.0: INTEGRATE CAREER AND TECHNICAL STUDENT ORGANIZATIONS (CTSOs)*

Performance Standard 1.1: Explore the History and Organization of CTSOs

1.1.1 Discuss the requirements of CTSO participation/involvement as described in Carl D. Perkins Law

1.1.2 Research nationally recognized CTSOs

1.1.3 Investigate the impact of federal and state government regarding the progression and operation of CTSOs (e.g., Federal Statutes and Regulations, Nevada Administrative Code [NAC], Nevada Revised Statutes [NRS])

Performance Standard 1.2: Develop Leadership Skills

1.2.1 Discuss the purpose of parliamentary procedure

1.2.2 Demonstrate the proper use of parliamentary procedure

1.2.3 Differentiate between an office and a committee

1.2.4 Discuss the importance of participation in local, regional, state, and national conferences, events, and competitions

1.2.5 Participate in local, regional, state, or national conferences, events, or competitions

1.2.6 Describe the importance of a constitution and bylaws to the operation of a CTSO chapter

Performance Standard 1.3: Participate in Community Service

1.3.1 Explore opportunities in community service-related work-based learning (WBL)

1.3.2 Participate in a service learning (program related) and/or community service project or activity

1.3.3 Engage with business and industry partners for community service

Performance Standard 1.4: Develop Professional and Career Skills

1.4.1 Demonstrate college and career readiness (e.g., applications, resumes, interview skills, presentation skills)

1.4.2 Describe the appropriate professional/workplace attire and its importance

1.4.3 Investigate industry-standard credentials/certifications available within this Career Cluster™

1.4.4 Participate in authentic contextualized instructional activities

1.4.5 Demonstrate technical skills in various student organization activities/events

Performance Standard 1.5: Understand the Relevance of Career and Technical Education (CTE)

1.5.1 Make a connection between program standards to career pathway(s)

1.5.2 Explain the importance of participation and completion of a program of study

1.5.3 Promote community awareness of local student organizations associated with CTE programs

*Refer to the program of study Curriculum Framework for appropriate CTSO(s).

CONTENT STANDARD 2.0: UNDERSTAND ALGORITHMS AND PROGRAMMING

Performance Standard 2.1: Apply Algorithms

2.1.1 Create prototypes that use algorithms to solve computational problems by leveraging prior student knowledge and personal interests

2.1.2 Describe how artificial intelligence drives many software and physical systems

2.1.3 Implement an artificial intelligence algorithm (e.g., machine learning) to play a game against a human opponent or solve a problem

2.1.4 Use and adapt classic algorithms to solve computational problems

2.1.5 Develop classic algorithms in code to solve computational problems

2.1.6 Evaluate algorithms in terms of their efficiency, correctness, and clarity

Performance Standard 2.2: Implement Controls

2.2.1 Justify the selection of specific control structures when tradeoffs involve implementation, readability, and program performance, and explain the benefits and drawbacks of choices made

2.2.2 Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue by using events to initiate instructions

2.2.3 Illustrate the flow of execution of a recursive algorithm

2.2.4 Implement conditional controls in code

2.2.5 Implement recursive algorithms in code

Performance Standard 2.3: Utilize Variables

2.3.1 Demonstrate the use of both LinkedLists and ArrayLists to simplify solutions, generalizing computational problems instead of repeatedly using simple variables

2.3.2 Compare and contrast fundamental data structures and their uses

2.3.3 Implement arrays in code

2.3.4 Implement ArrayLists and LinkedLists in code

2.3.5 Implement type-safe variables

Performance Standard 2.4: Construct Solutions Using Modularity

2.4.1 Decompose problems into smaller components through systematic analysis using constructs such as procedures, modules, and/or objects

2.4.2 Create artifacts by using procedures within a program, combinations of data and procedures, or independent but interrelated programs

2.4.3 Construct solutions to problems using student-created components such as procedures, modules, and/or objects

2.4.4 Analyze a large-scale computational problem and identify generalizable patterns that can be applied to a solution

2.4.5 Demonstrate code reuse by creating programming solutions using libraries and APIs

Performance Standard 2.5: Demonstrate Programming and Development

2.5.1 Systematically design and develop programs for broad audiences by incorporating feedback from users

2.5.2 Evaluate software licenses that limit or restrict the use of computational artifacts when using resources such as libraries

2.5.3 Evaluate and refine computational artifacts to make them more usable by all and accessible to people with disabilities

2.5.4 Design and develop computational artifacts while working in team roles and using collaborative tools

2.5.5 Document design decisions using text, graphics, presentations, and/or demonstrations in the development of complex programs

2.5.6 Plan and develop programs for broad audiences using a software life cycle process (e.g., requirements, design, coding, testing, and deployment)

2.5.7 Explain security issues that might lead to compromised computer programs (e.g., public vs. private, encryption, buffer overflows, cybersecurity)

2.5.8 Develop programs for multiple computing platforms

2.5.9 Use version control systems, integrated development environments (IDEs), and collaborative tools and practices (code documentation) in a group software project

2.5.10 Develop and use a series of test cases to verify that a program performs according to its design specifications

2.5.11 Modify an existing program to add additional functionality and discuss intended and unintended implications (e.g., breaking other functionality)

CONTENT STANDARD 3.0: UNDERSTAND COMPUTING SYSTEMS

Performance Standard 3.1: Describe Devices

3.1.1 Explain how abstractions hide the underlying implementation details of computing systems embedded in everyday objects

Performance Standard 3.2: Compare Hardware and Software

3.2.1 Compare levels of abstraction and interactions between application software, system software, and hardware layers

3.2.2 Categorize the roles of operating system software

3.2.3 Discuss the use of computer virtualization

Performance Standard 3.3: Explain Troubleshooting

3.3.1 Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors

3.3.2 Illustrate ways computing systems implement logic, input, and output through hardware components

CONTENT STANDARD 4.0: UNDERSTAND DATA AND ANALYSIS

Performance Standard 4.1: Evaluate Storage Solutions

4.1.1 Translate between different bit representations of real-world phenomena, such as characters, numbers, and images (e.g., convert hexadecimal colors to decimal percentages, ASCII/Unicode representation)

4.1.2 Demonstrate the ability to store bit representation of real-world phenomena, characters, numbers, and images

Performance Standard 4.2: Create Using Collection, Visualization, and Transformation

4.2.1 Create interactive data visualizations or alternative representations using software tools to help others better understand real-world phenomena

4.2.2 Use data analysis tools and techniques to identify patterns in data representing complex systems

4.2.3 Select data collection tools and techniques to generate data sets that support a claim or communicate information

CONTENT STANDARD 5.0: UNDERSTAND IMPACTS OF COMPUTING

Performance Standard 5.1: Evaluate the Impact of Computing on Culture

5.1.1 Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices

5.1.2 Test and refine computational artifacts to reduce bias and equity deficits

5.1.3 Demonstrate ways a given algorithm applies to problems across disciplines

5.1.4 Explain the potential impacts of artificial intelligence on society

5.1.5 Evaluate computational artifacts to maximize their beneficial effects and minimize harmful effects on society

5.1.6 Discuss how computational innovations that have revolutionized aspects of our culture might evolve

Performance Standard 5.2: Increase Social Interactions

5.2.1 Use tools and methods for collaboration on a project to increase connectivity of people in different cultures and career fields

5.2.2 Use tools and methods for collaboration to increase the productivity of a team

Performance Standard 5.3: Explain Safety, Law, and Ethics Related to Computing

5.3.1 Explain the beneficial and harmful effects that intellectual property laws can have on innovation

5.3.2 Explain the privacy concerns related to the collection and generation of data through automated processes that may not be evident to users

5.3.3 Evaluate the social and economic implications of privacy in the context of safety, law, or ethics

5.3.4 Discuss the role of ethics in technologies

5.3.5 Discuss laws and regulations that impact the development and use of software

CONTENT STANDARD 6.0: UNDERSTAND NETWORKS AND THE INTERNET

Performance Standard 6.1: Evaluate Network, Communication, and Organization

6.1.1 Evaluate the scalability and reliability of networks by describing the relationship between routers, switches, servers, topology, and addressing

6.1.2 Describe the issues that impact network functionality (e.g., bandwidth, load, delay, topology)

6.1.3 Discuss the difference between deploying software to the cloud versus the standard model (i.e., running software locally on a PC)

Performance Standard 6.2: Describe Cybersecurity

6.2.1 Illustrate how sensitive data can be affected by malware and other attacks

6.2.2 Recommend security measures to address various scenarios based on factors such as efficiency, feasibility, and ethical impacts

6.2.3 Compare various security measures, considering tradeoffs between the usability and security of a computing system

6.2.4 Explain tradeoffs when selecting and implementing cybersecurity recommendations

6.2.5 Compare ways software developers protect devices and information from unauthorized access (e.g., password protection, 2 factor authentication)

6.2.6 Utilize industry tools and best practices (e.g., code scanning tools, automated security scans during the development process) to create secure code that prevents vulnerabilities

CONTENT STANDARD 7.0: UNDERSTAND EMERGING TECHNOLOGIES

Performance Standard 7.1: Explain Workforce and Society Needs Related to New and Emerging Technologies

7.1.1 Describe job skills needed for potential careers in new and emerging technologies

7.1.2 Explore potential uses for and industries that may use emerging technologies

7.1.3 Explain the role of ethics as it relates to security and emerging technologies

Crosswalks and Alignments

Crosswalks and alignments are intended to assist the teacher make connections for students between the technical skills within the program and academic standards. The crosswalks and alignments are not intended to teach the academic standards but to assist students in making meaningful connections between their CTE program of study and academic courses.

Crosswalks (Academic Standards)

The crosswalks of the Computer Science Standards show connections with the Nevada Academic Content Standards. The crosswalk identifies the performance indicators in which the learning objectives in the Computer Science program connect with and support academic learning. The performance indicators are grouped according to their content standard and are crosswalked to the Nevada Academic Content Standards in English Language Arts, Mathematics, and Science.

Alignments (Mathematical Practices)

In addition to connections with the Nevada Academic Content Standards for Mathematics, many performance indicators support the Mathematical Practices. The following table illustrates the alignment of the Computer Science Standards Performance Indicators and the Mathematical Practices. This alignment identifies the performance indicators in which the learning objectives in the Computer Science program connect with and support academic learning.

Alignments (Science and Engineering Practices)

In addition to connections with the Nevada Academic Content Standards for Science, many performance indicators support the Science and Engineering Practices. The following table illustrates the alignment of the Computer Science Standards Performance Indicators and the Science and Engineering Practices. This alignment identifies the performance indicators in which the learning objectives in the Computer Science program connect with and support academic learning.

Crosswalks (Common Career Technical Core)

The crosswalks of the Computer Science Standards show connections with the Common Career Technical Core. The crosswalk identifies the performance indicators in which the learning objectives in the Computer Science program connect with and support the Common Career Technical Core. The Common Career Technical Core defines what students should know and be able to do after completing instruction in a program of study. The Computer Science Standards are crosswalked to the Information Technology Career Cluster™ and the Programming and Software Development Career Pathway.

Crosswalk of Computer Science Standards and the Nevada Academic Content Standards

Content Standard 1.0: Integrate Career and Technical Student Organizations (CTSOs)

Performance Indicators	Nevada Academic Content Standards
1.1.1	**English Language Arts: Speaking and Listening Standards** SL.11-12.1a Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas. SL.11-12.2 Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data. SL.11-12.4 Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.
1.1.2	**English Language Arts: Speaking and Listening Standards** SL.11-12.1a Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas. SL.11-12.2 Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data. SL.11-12.4 Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. **English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.
1.1.3	**English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.

Performance Indicators	Nevada Academic Content Standards
1.2.1	**English Language Arts: Speaking and Listening Standards** SL.11-12.1a Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas. SL.11-12.2 Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data. SL.11-12.4 Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.
1.2.4	**English Language Arts: Speaking and Listening Standards** SL.11-12.1a Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas. SL.11-12.2 Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data. SL.11-12.4 Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.
1.2.5	**English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
1.4.1	**English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Performance Indicators	Nevada Academic Content Standards
1.4.2	**English Language Arts: Speaking and Listening Standards** SL.11-12.1a Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas. SL.11-12.2 Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data. SL.11-12.4 Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. **English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.
1.4.3	**English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.
1.4.4	**English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
1.4.5	**English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.6 Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.

Performance Indicators	Nevada Academic Content Standards
1.5.2	**English Language Arts: Language Standards** L.11-12.6 Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression. **English Language Arts: Speaking and Listening Standards** SL.11-12.1a Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas. SL.11-12.4 Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. **English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.

Content Standard 2.0: Understand Algorithms and Programming

Performance Indicators	Nevada Academic Content Standards
2.1.1	**English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. **Science: HS-Engineering Design** HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. **K-12 Computer Science: Algorithms and Programming** 9-12.AP.A.1 Create prototypes that use algorithms to solve computational problems by leveraging prior student knowledge and personal interests.
2.1.2	**English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.1b Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases. **Science: HS. Engineering Design** HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. **K-12 Computer Science: Algorithms and Programming** 9-12.AP.A.1 Create prototypes that use algorithms to solve computational problems by leveraging prior student knowledge and personal interests.
2.1.3	**K-12 Computer Science: Algorithms and Programming** A9-12.AP.A.2 Implement an artificial intelligence algorithm to play a game against a human opponent or solve a problem.
2.1.6	**K-12 Computer Science: Algorithms and Programming** A9-12.AP.A.2 Implement an artificial intelligence algorithm to play a game against a human opponent or solve a problem.
2.2.1	**English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.1 Write arguments focused on discipline-specific content.
2.2.3	**Science: HS. Engineering Design** HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts. **K-12 Computer Science: Algorithms and Programming** A9-12.AP.C.1 Illustrate the flow of execution of a recursive algorithm.
2.3.1	**English Language Arts: Language Standards** L.11-12.1b Resolve issues of complex or contested usage, consulting references (e.g., Merriam-Webster's Dictionary of English Usage, Garner's Modern American Usage) as needed. **K-12 Computer Science: Algorithms and Programming** 9-12.AP.V.1 Demonstrate the use of both linked lists and arrays to simplify solutions, generalizing computational problems instead of repeatedly using simple variables.
2.3.2	**K-12 Computer Science: Algorithms and Programming** A9-12.AP.V.1 Compare and contrast fundamental data structures and their uses.

Performance Indicators	Nevada Academic Content Standards
2.3.3	**English Language Arts: Reading Standards for Literacy in Science and Technical Subjects** RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. **English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.2a Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.
2.4.1	**English Language Arts: Reading Standards for Literacy in Science and Technical Subjects** RST.11-12.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. **Science: HS. Engineering Design** HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. **K-12 Computer Science: Algorithms and Programming** A9-12.AP.M.1 Construct solutions to problems using student-created components, such as procedures, modules, and/or objects.
2.4.2	**K-12 Computer Science: Algorithms and Programming** A9-12.AP.M.2 Analyze a large-scale computational problem and identify generalizable patterns that can be applied to a solution.
2.4.3	**Science: HS. Engineering Design** HS-ETS1-4 Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem. **K-12 Computer Science: Algorithms and Programming** A9-12.AP.M.3 Demonstrate code reuse by creating programming solutions using libraries and APIs.
2.4.4	**K-12 Computer Science: Algorithms and Programming** A9-12.AP.M.2 Analyze a large-scale computational problem and identify generalizable patterns that can be applied to a solution.
2.4.5	**K-12 Computer Science: Algorithms and Programming** A9-12.AP.M.3 Demonstrate code reuse by creating programming solutions using libraries and APIs.
2.5.1	**English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. **Science: HS. Engineering Design** HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts. **K-12 Computer Science: Algorithms and Programming** 9-12.AP.PD.1 Systematically design and develop programs for broad audiences by incorporating feedback from users.

Performance Indicators	Nevada Academic Content Standards
2.5.2	**English Language Arts: Reading Standards for Literacy in Science and Technical Subjects** RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. **K-12 Computer Science: Algorithms and Programming** 9-12.AP.PD.2 Evaluate licenses that limit or restrict use of computational artifacts when using resources such as libraries.
2.5.3	**K-12 Computer Science: Algorithms and Programming** 9-12.AP.PD.3 Evaluate and refine computational artifacts to make them more usable by all and accessible to people with disabilities.
2.5.4	**K-12 Computer Science: Algorithms and Programming** 9-12.AP.PD.4 Design and develop computational artifacts working in team roles using collaborative tools.
2.5.6	**English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.1b Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases. **Science: HS. Engineering Design** HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts. **K-12 Computer Science: Algorithms and Programming** A9-12.AP.PD.1 Plan and develop programs for broad audiences using a software life cycle process.
2.5.7	**English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. **K-12 Computer Science: Algorithms and Programming** A9-12.AP.PD.2 Explain security issues that might lead to compromised computer programs.
2.5.8	**K-12 Computer Science: Algorithms and Programming** A9-12.AP.PD.3 Develop programs for multiple computing platforms.
2.5.9	**K-12 Computer Science: Algorithms and Programming** A9-12.AP.PD.4 Use version control systems, integrated development environments (IDEs), and collaborative tools and practices (code documentation) in a group software project.
2.5.10	**K-12 Computer Science: Algorithms and Programming** A9-12.AP.PD.5 Develop and use a series of test cases to verify that a program performs according to its design specifications.
2.5.11	**K-12 Computer Science: Algorithms and Programming** A9-12.AP.PD.6 Modify an existing program to add additional functionality and discuss intended and unintended implications (e.g., breaking other functionality).

Content Standard 3.0: Understand Computing Systems

Performance Indicators	Nevada Academic Content Standards
3.1.1	**English Language Arts: Reading Standards for Literacy in Science and Technical Subjects** RST.11-12.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. **K-12 Computer Science: Computing System** 9-12.CS.D.1 Explain how abstractions hide the underlying implementation details of computing systems embedded in everyday objects.
3.2.1	**English Language Arts: Reading Standards for Literacy in Science and Technical Subjects** RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. **K-12 Computer Science: Computing Systems** 9-12.CS.HS.1 Compare levels of abstraction and interactions between application software, system software, and hardware layers.
3.2.2	**K-12 Computer Science: Computing Systems** A9-12.CS.HS.1 Categorize the roles of operating system software.
3.3.1	**English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.1b Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases. **K-12 Computer Science: Computing Systems** 9-12.CS.T.1 Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors.
3.3.2	**K-12 Computer Science: Computing Systems** A9-12.CS.T.1 Illustrate ways computing systems implement logic, input, and output through hardware components.

Content Standard 4.0: Understand Data and Analysis

Performance Indicators	Nevada Academic Content Standards
4.1.1	**K-12 Computer Science: Data and Analysis** 9-12.DA.S.1 Translate between different bit representations of real-world phenomena, such as characters, numbers, and images (e.g., convert hexadecimal colors to decimal percentages, ASCII/Unicode representation).
4.2.1	**Science: HS. Life Sciences – HS. Interdependent Relationships in Ecosystem** HS-LS2-1 Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. HS-LS2-2 Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. **Science: HS. Engineering Design** HS-ETS1-4 Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem. **K-12 Computer Science: Data and Analysis** 9-12.DA.CVT.1 Create interactive data visualizations or alternative representations using software tools to help others better understand real-world phenomena.
4.2.2	**K-12 Computer Science: Data and Analysis** A9-12.DA.CVT.1 Use data analysis tools and techniques to identify patterns in data representing complex systems.
4.2.3	**English Language Arts: Reading Standards for Literacy in Science and Technical Subjects** RST.11-12.5 Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. **Science: HS. Life Sciences – HS. Interdependent Relationships in Ecosystem** HS-LS4-6 Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity. **Science: HS. Life Sciences – HS. Interdependent Relationships in Ecosystem** HS-LS2-2 Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. **K-12 Computer Science: Data and Analysis** A9-12.DA.CVT.2 Select data collection tools and techniques to generate data sets that support a claim or communicate information.

Content Standard 5.0: Understand Impacts of Computing

Performance Indicators	Nevada Academic Content Standards
5.1.1	**K-12 Computer Science: Impacts of Computing** 9-12.IC.C.1 Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices.
5.1.2	**K-12 Computer Science: Impacts of Computing** 9-12.IC.C.2 Test and refine computational artifacts to reduce bias and equity deficits.
5.1.3	**K-12 Computer Science: Impacts of Computing** 9-12.IC.C.3 Demonstrate ways a given algorithm applies to problems across disciplines.
5.1.4	**English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. **Science: HS. Engineering Design** HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. **K-12 Computer Science: Impacts of Computing** 9-12.IC.C.4 Explain the potential impacts of artificial intelligence on society.
5.1.5	**English Language Arts: Reading Standards for Literacy in Science and Technical Subjects** RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. **Science: HS. Engineering Design** HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
5.1.6	**K-12 Computer Science: Impacts of Computing** A9-12.IC.C.3 Predict how computational innovations that have revolutionized aspects of our culture might evolve.
5.2.1	**English Language Arts: Speaking and Listening Standards** SL.11-12.1b Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed. **K-12 Computer Science: Impacts of Computing** 9-12.IC.SI.1 Use tools and methods for collaboration on a project to increase connectivity of people in different cultures and career fields.
5.3.1	**English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. **Science: HS. Engineering Design** HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts. **K-12 Computer Science: Impacts of Computing** 9-12.IC.SLE.1 Explain the beneficial and harmful effects that intellectual property laws can have on innovation.

Performance Indicators	Nevada Academic Content Standards
5.3.2	**English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. **K-12 Computer Science: Impacts of Computing** 9-12.IC.SLE.2 Explain the privacy concerns related to the collection and generation of data through automated processes that may not be evident to users.
5.3.3	**English Language Arts: Reading Standards for Literacy in Science and Technical Subjects** RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. **Science: HS. Engineering Design** HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
5.3.5	**K-12 Computer Science: Impacts of Computing** A9-12.IC.SLE.1 Debate laws and regulations that impact the development and use of software.

Content Standard 6.0: Understand Networks and the Internet

Performance Indicators	Nevada Academic Content Standards
6.1.1	**English Language Arts: Reading Standards for Literacy in Science and Technical Subjects** RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. **Science: HS. Engineering Design** HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. **K-12 Computer Science: Networks and the Internet** 9-12.NI.NCO.1 Evaluate the scalability and reliability of networks by describing the relationship between routers, switches, servers, topology, and addressing.
6.1.2	**English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.6 Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information. **Science: HS. Engineering Design** HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. **K-12 Computer Science: Networks and the Internet** 9-12.NI.C.2 Recommend security measures to address various scenarios based on factors such as efficiency, feasibility, and ethical impacts.
6.2.1	**English Language Arts: Reading Standards for Literacy in Science and Technical Subjects** RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. **K-12 Computer Science: Networks and the Internet** 9-12.NI.C.1 Give examples to illustrate how sensitive data can be affected by malware and other attacks.
6.2.2	**Science: HS. Engineering Design** HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. **K-12 Computer Science: Networks and the Internet** 9-12.NI.C.2 Recommend security measures to address various scenarios based on factors such as efficiency, feasibility, and ethical impacts.
6.2.3	**Science: HS. Engineering Design** HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts. **K-12 Computer Science: Networks and the Internet** 9-12.NI.C.3 Compare various security measures, considering tradeoffs between the usability and security of a computing system.

Performance Indicators	Nevada Academic Content Standards
6.2.4	**Science: HS. Engineering Design** HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts. **K-12 Computer Science: Networks and the Internet** 9-12.NI.C.4 Explain tradeoffs when selecting and implementing cybersecurity recommendations.
6.2.5	**K-12 Computer Science: Networks and the Internet** A9-12.NI.C.1 Compare ways software developers protect devices and information from unauthorized access.

Content Standard 7.0: Understand Emerging Technologies

Performance Indicators	Nevada Academic Content Standards
7.1.1	**English Language Arts: Speaking and Listening Standards** SL.11-12.4 Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.

Alignment of Computer Science Standards and the Mathematical Practices

Mathematical Practices	Computer Science Performance Indicators
1. Make sense of problems and persevere in solving them.	2.1.1, 2.1.2; 2.5.6, 2.5.10
2. Reason abstractly and quantitatively.	2.1.1, 2.1.2; 2.2.1, 2.2.3; 2.4.3; 2.5.6, 2.5.10
3. Construct viable arguments and critique the reasoning of others.	2.2.1, 2.2.3; 2.3.3; 2.5.6, 2.5.8 3.3.1
4. Model with mathematics.	2.1.1, 2.1.2; 2.3.1, 2.3.3; 2.5.6, 2.5.9, 2.5.10 4.1.1; 4.2.1, 4.2.3 5.1.2
5. Use appropriate tools strategically.	2.3.1, 2.3.3 4.1.1; 4.2.1, 4.2.3 5.2.1
6. Attend to precision.	2.4.3; 2.5.8, 2.5.9
7. Look for and make use of structure.	2.1.1, 2.1.2; 2.3.1, 2.3.3; 2.4.3 4.1.1 5.1.3
8. Look for and express regularity in repeated reasoning.	2.1.1, 2.1.2

Alignment of Computer Science Standards and the Science and Engineering Practices

Science and Engineering Practices	Computer Science Performance Indicators
1. Asking questions (for science) and defining problems (for engineering).	2.2.2; 2.5.1
2. Developing and using models.	3.1.1; 3.2.1, 3.2.2; 3.3.1, 3.3.2 4.1.1; 4.2.1 5.1.2 6.2.1, 6.2.5
3. Planning and carrying out investigations.	5.1.2
4. Analyzing and interpreting data.	4.1.1
5. Using mathematics and computational thinking.	2.5.4, 2.5.9
6. Constructing explanations (for science) and designing solutions (for engineering).	5.1.4; 5.3.1, 5.3.5
7. Engaging in argument from evidence.	2.2.3 5.3.1, 5.3.3, 5.3.5
8. Obtaining, evaluating, and communicating information.	2.5.3-2.5.5, 2.5.8 - 2.5.10 3.1.1; 3.2.1, 3.2.2; 3.3.1, 3.3.2 5.1.2; 5.2.1; 5.3.1, 5.3.5 6.1.1, 6.1.2

Crosswalks of Computer Science Standards and the Common Career Technical Core

Information Technology Career Cluster	Performance Indicators
1. Demonstrate effective professional communication skills and practices that enable positive customer relationships.	1.3.3; 5.1.2
2. Use product or service design processes and guidelines to produce a quality information technology (IT) product or service.	2.5.1, 2.5.3, 2.5.6
3. Demonstrate the use of cross-functional teams in achieving IT project goals.	2.5.4; 5.2.1, 5.2.2
4. Demonstrate positive cyber citizenry by applying industry accepted ethical practices and behaviors.	2.5.7; 5.3.1, 5.3.2, 5.3.4
5. Explain the implications of IT on business development.	5.3.1, 5.3.5
6. Describe trends in emerging and evolving computer technologies and their influence on IT practices.	5.1.1
7. Perform standard computer backup and restore procedures to protect IT information.	3.2.1; 3.3.1
8. Recognize and analyze potential IT security threats to develop and maintain security requirements.	6.2.1 - 6.2.6
9. Describe quality assurance practices and methods employed in producing and providing quality IT products and services.	2.5.10
10. Describe the use of computer forensics to prevent and solve information technology crimes and security breaches.	6.2.1, 6.2.3
11. Demonstrate knowledge of the hardware components associated with information systems.	6.1.2
12. Compare key functions and applications of software and determine maintenance strategies for computer systems.	3.3.1, 3.3.2

Programming and Software Development Career Pathway	Performance Indicators
1. Analyze customer software needs and requirements.	3.1.1; 6.1.2
2. Demonstrate the use of industry standard strategies and project planning to meet customer specifications.	5.1.2
3. Analyze system and software requirements to ensure maximum operating efficiency.	3.2.1, 3.2.2
4. Demonstrate the effective use of software development tools to develop software applications.	4.2.1
5. Apply an appropriate software development process to design a software application.	5.1.5
6. Program a computer application using the appropriate programming language.	2.5.6
7. Demonstrate software testing procedures to ensure quality products.	3.3.1, 3.3.2
8. Perform quality assurance tasks as part of the software development cycle.	4.2.2, 4.2.3
9. Perform software maintenance and customer support functions.	3.3.1
10. Design, create and maintain a database.	2.3.2; 2.4.2