

# Wyoming Department of Education Required Virtual Education Course Syllabus

## Niobrara County School District # 1

Program Name	Wyoming Virtual Academy	Content Area	VE
Course ID	D-TCH-110V1-CEN	Grade Level	9-12
Course Name	Introduction to Computer Science	# of Credits	0.5
SCED Code	10011G0.5011	Curriculum Type	K12 Inc

### COURSE DESCRIPTION

*This course provides a solid foundation using an algorithm driven approach that is ideal for students' first course in computer science. Students learn about emerging topics, such as privacy, drones, cloud computing, and net. Students also are introduced to programming languages such as C++, Java™, Python, C#, and Ada.*

### WYOMING CONTENT AND PERFORMANCE STANDARDS

STANDARD#	<a href="#">BENCHMARK (Standard/Indicator) Use the Standards and Benchmarks as Spreadsheets</a>
CV12.3.1	College and career-ready students identify and define authentic problems and significant questions for investigation.
CV12.3.2	College and career-ready students identify trends, forecast possibilities, and explore complex systems and issues.
CV12.3.3	College and career-ready students employ valid and reliable research strategies and apply prior knowledge to solve a problem or complete a project.
CV12.4.2	College and career-ready students determine the meaning of symbols, key terms, and other content-specific words and phrases as they are used in technical context. (*Adapted from CCSS RL.9.11)
CV12.4.3	College and career-ready students acquire, manipulate, analyze, diagnose, and/or report information, using the appropriate technology.
CV12.4.4	College and career-ready students precisely follow a complex multistep procedure when performing technical tasks. (*Adapted from CCSS RL.9.3)
CV12.5.1	College and career-ready students manage resources to develop, analyze, and implement systems and applications.
CV12.5.2	College and career-ready students productively complete tasks taking constraints, priorities and resources into account.
CV12.5.3	College and career-ready students safely and ethically use current industry-standard tools and emerging technologies.
CV12.5.4	College and career-ready students utilize technology to develop innovative solutions or products.

SCOPE AND SEQUENCE		
UNIT OUTLINE	STANDARD#	OUTCOMES OBJECTIVES/STUDENT CENTERED GOALS
Unit 1: An Introduction to Computer Science Lessons: Read and Study	CV12.3.1 CV12.4.2	Introduce the definition of computer science and surveys the history of the field.  Address common misconceptions about the field of computer science.  Examine the Gibbs-Tucker definition of computer science.  Focus on the idea of an algorithm.  Define the concept of an algorithm, gives examples of algorithms, and explains the importance of algorithmic problem-solving.  Survey the history of computing, beginning with calculating devices that pre-date modern computers by centuries, and including key developments from the 1940s on.
Unit 1: An Introduction to Computer Science Lessons: Lab	CV12.3.2 CV12.3.3 CV12.4.3 CV12.4.4 CV12.5.1 CV12.5.2 CV12.5.3 CV12.5.4	Practice chapter skills.
Unit 1: An Introduction to Computer Science Lessons: Test	CV12.3.1 CV12.4.2	Demonstrate comprehension of chapter objectives.
Unit 2: Algorithm Discovery and Design Lessons: Read and Study	CV12.3.1 CV12.4.2	Examine algorithmic problem solving as it is seen in computer science.  Define pseudocode, which uses statements in English and math notation, along with structure similar to a programming language.

		<p>Explain why pseudocode is better for algorithm design than a natural language like English or a programming language.</p> <p>Construct needed for pseudocode are sequential (computations, input, and output), conditional, and iterative statements.</p> <p>Use case studies, where the process of developing an algorithmic solution to a problem is carefully illustrated.</p>
<p>Unit 2: Algorithm Discovery and Design Lessons: Lab</p>	<p>CV12.3.2 CV12.3.3 CV12.4.3 CV12.4.4 CV12.5.1 CV12.5.2 CV12.5.3 CV12.5.4</p>	<p>Practice chapter skills.</p>
<p>Unit 2: Algorithm Discovery and Design Lessons: Test</p>	<p>CV12.3.1 CV12.4.2</p>	<p>Demonstrate comprehension of chapter objectives.</p>
<p>Unit 3: The Efficiency of Algorithms Lessons: Read and Study</p>	<p>CV12.3.1 CV12.4.2</p>	<p>Introduce to the kinds of attributes algorithms have, and the methods by which computer scientists evaluate and compare algorithms.</p> <p>Introduce to the concept of orders of magnitude, and examines a variety of algorithms to determine the order of magnitude of each algorithm's time efficiency.</p> <p>Discuss time/space tradeoff, and the existence of intractable problems with no known efficient solutions.</p>
<p>Unit 3: The Efficiency of Algorithms Lessons: Lab</p>	<p>CV12.3.2 CV12.3.3 CV12.4.3 CV12.4.4 CV12.5.1 CV12.5.2 CV12.5.3 CV12.5.4</p>	<p>Practice chapter skills.</p>
<p>Unit 3: The Efficiency of Algorithms Lessons: Test</p>	<p>CV12.3.1 CV12.4.2</p>	<p>Demonstrate comprehension of chapter objectives.</p>

<p>Unit 4: The Building Blocks: Binary Numbers, Boolean Logic, and Gates Lessons: Read and Study</p>	<p>CV12.3.1 CV12.4.2</p>	<p>Introduce to the hardware level of computer systems.</p> <p>Describe how binary representations of numbers and characters work, including sign-magnitude and two's complement representations for integers, and the ASCII table for mapping characters to binary numbers.</p> <p>Discuss how digitized sound and images work, through sampling and representation of wave magnitudes, for sounds, and colors or intensities, for images.</p> <p>Discuss the importance of Boolean logic, and the mapping between true/false values and 1/0 values.</p> <p>Show how to construct gates that implement Boolean operators from transistors.</p> <p>Use a specific algorithm, sum-of-products, for designing circuits, and illustrates the power of such circuits by building an adder, a compare-for-equality circuit, and multiplexor and decoder control circuits.</p>
<p>Unit 4: The Building Blocks: Binary Lessons: Lab</p>	<p>CV12.3.2 CV12.3.3 CV12.4.3 CV12.4.4 CV12.5.1 CV12.5.2 CV12.5.3 CV12.5.4</p>	<p>Practice chapter skills.</p>
<p>Unit 4: The Building Blocks: Binary Lessons: Test</p>	<p>CV12.3.1 CV12.4.2</p>	<p>Demonstrate comprehension of chapter objectives.</p>
<p>Unit 5: Computer Systems Organization Lessons: Read and Study</p>	<p>CV12.3.1 CV12.4.2</p>	<p>Discuss how the Von Neumann architecture works.</p> <p>Outline the characteristics of the Von Neumann architecture, and then looks in detail at each piece of the processor required to implement the architecture.</p> <p>Explain how information is organized, stored and retrieved from random access memory.</p> <p>Describe different I/O devices, particularly mass storage devices, and the need for I/O controllers to handle the slow speed of I/O devices.</p>

		<p>Describe the ALU and the control unit, and how all those pieces fit together to form a Von Neumann machine.</p> <p>Discuss some reasons why the Von Neumann architecture is becoming limited, and describes work in parallel processing to get around the Von Neumann bottleneck.</p>
<p>Unit 5: Computer Systems Organization Lessons: Lab</p>	<p>CV12.3.2 CV12.3.3 CV12.4.3 CV12.4.4 CV12.5.1 CV12.5.2 CV12.5.3 CV12.5.4</p>	<p>Practice chapter skills.</p>
<p>Unit 5: Computer Systems Organization Lessons: Test</p>	<p>CV12.3.1 CV12.4.2</p>	<p>Demonstrate comprehension of chapter objectives.</p>
<p>Unit 6: An Introduction to System Software and Virtual Machines Lessons: Read and Study</p>	<p>CV12.3.1 CV12.4.2</p>	<p>Introduces the programs and tasks that make up system software for a computer.</p> <p>Describes in detail how and why assembly language is used for programming a computer, rather than programming directly in machine language.</p> <p>Describes the main tasks an operating system needs to perform, and how the operating system interacts with the user and with other subsidiary programs to perform its tasks.</p> <p>Provides a historical overview of operating system development, emphasizing how each generation sought to improve on previous systems.</p>
<p>Unit 6: An Introduction to System Software and Virtual Machines Lessons: Lab</p>	<p>CV12.3.2 CV12.3.3 CV12.4.3 CV12.4.4 CV12.5.1 CV12.5.2 CV12.5.3 CV12.5.4</p>	<p>Practice chapter skills.</p>
<p>Unit 6: An Introduction to System Software and Virtual Machines Lessons: Test</p>	<p>CV12.3.1 CV12.4.2</p>	<p>Demonstrate comprehension of chapter objectives.</p>
<p>Unit 7: Computer Networks and Cloud Computing Lessons: Read and Study</p>	<p>CV12.3.1 CV12.4.2</p>	<p>Introduces the concept of computer networks.</p>

		<p>Describes the different kinds of networks, wired and wireless.</p> <p>Explains how local area networks, wide area networks, and the Internet function.</p> <p>Explains what a protocol is, and introduces the layers of protocol hierarchy that make networks functions.</p> <p>Describes sample protocols, for example, TCP/IP and HTTP, among others.</p> <p>Discusses the benefits and services we have come to take for granted, and a history of the development of the Internet and the World Wide Web.</p>
<p>Unit 7: Computer Networks and Cloud Computing Lessons: Lab</p>	<p>CV12.3.2 CV12.3.3 CV12.4.3 CV12.4.4 CV12.5.1 CV12.5.2 CV12.5.3 CV12.5.4</p>	<p>Practice chapter skills.</p>
<p>Unit 7: Computer Networks and Cloud Computing Lessons: Test</p>	<p>CV12.3.1 CV12.4.2</p>	<p>Demonstrate comprehension of chapter objectives.</p>
<p>Unit 8: Information Security Lessons: Read and Study</p>	<p>CV12.3.1 CV12.4.2</p>	<p>Introduce the issues of information security in the online world.</p> <p>Discuss methods for controlling access to information using authentication and authorization.</p> <p>Describe common kinds of attacks on a computer's security, including viruses, worms, Trojan horses, and zombie armies.</p> <p>Describe a range of techniques for encrypting messages, starting from simple Caesar ciphers and other symmetric encryption algorithms, and ending with an explanation of RSA public-key encryption.</p> <p>Discuss the importance of security protocols (SSL and TLS) for transmission of sensitive personal information over the web.</p> <p>Suggest the growing importance of computer security for small-scale, embedded systems that are connected to a network.</p>

<p>Unit 8: Information Security Lessons: Lab</p>	<p>CV12.3.2 CV12.3.3 CV12.4.3 CV12.4.4 CV12.5.1 CV12.5.2 CV12.5.3 CV12.5.4</p>	<p>Practice chapter skills.</p>
<p>Unit 8: Information Security Lessons: Test</p>	<p>CV12.3.1 CV12.4.2</p>	<p>Demonstrate comprehension of chapter objectives.</p>
<p>Unit 9: Intro to High Level Languages Lessons: Read and Study</p>	<p>CV12.3.1 CV12.4.2</p>	<p>Introduce the concept of a high-level programming language.</p> <p>Illustrate the similarities and differences through two details examples, and provides a table that compares the five languages for a wide range of language features.</p> <p>Introduce the software development life cycle, needed to make large-scale software development feasible.</p> <p>Introduce the stages of the life cycle, and explains what is done for each part.</p> <p>Describe the waterfall model of development, and compares it to agile software development.</p>
<p>Unit 9: Intro to High Level Languages Lessons: Lab</p>	<p>CV12.3.2 CV12.3.3 CV12.4.3 CV12.4.4 CV12.5.1 CV12.5.2 CV12.5.3 CV12.5.4</p>	<p>Practice chapter skills.</p>
<p>Unit 9: Intro to High Level Languages Lessons: Test</p>	<p>CV12.3.1 CV12.4.2</p>	<p>Demonstrate comprehension of chapter objectives.</p>
<p>Unit 10: The Tower of Babel: Multiple Programming Voices Lessons: Read and Study</p>	<p>CV12.3.1 CV12.4.2</p>	<p>Discuss why hundreds of different programming languages have been developed, emphasizing the special features of each language.</p> <p>Describe a wide range of languages within the procedural paradigm, along with the problems they are particularly good at solving.</p> <p>Introduce special-purpose languages, and other paradigms, including functional, logic, and parallel languages.</p> <p>Provide a set of language features that may differ from one language to another,</p>

		and that provide a framework for comparing languages.
Unit 10: The Tower of Babel: Multiple Programming Voices Lessons: Lab	CV12.3.2 CV12.3.3 CV12.4.3 CV12.4.4 CV12.5.1 CV12.5.2 CV12.5.3 CV12.5.4	Practice chapter skills.
Unit 10: The Tower of Babel: Multiple Programming Voices Lessons: Test	CV12.3.1 CV12.4.2	Demonstrate comprehension of chapter objectives.
Unit 11: Compilers and Language Translation Lessons: Read and Study	CV12.3.1 CV12.4.2	Describe how computers translate programs from high-level programming languages into assembly language or byte code.  Describe the phases of a compiler, including lexical analysis, parsing, code generation, and optimization.  Introduce Backus-Naur Form (BNF) for describing the grammatical structure of a programming language, and shows how to use it to parse programs into parse trees.  Explain a set of common optimizations performed on compiled code.
Unit 11: Compilers and Language Translation Lessons: Lab	CV12.3.2 CV12.3.3 CV12.4.3 CV12.4.4 CV12.5.1 CV12.5.2 CV12.5.3 CV12.5.4	Practice chapter skills.
Unit 11: Compilers and Language Translation Lessons: Test	CV12.3.1 CV12.4.2	Demonstrate comprehension of chapter objectives.
Unit 12: Models of Computation Lessons: Read and Study	CV12.3.1 CV12.4.2	Examine the nature of computation, and some important results from the theory of computation.  Introduce models of computing agents, and explains how Turing machines are good models of computing agents, and also capture the features of algorithms.

		<p>Describe how Turing machines work, and the thesis that Turing machines, as a model, capture all algorithms.</p> <p>Discuss unsolvable problems: in particular, the halting problem.</p>
<p>Unit 12: Models of Computation Lessons: Lab</p>	<p>CV12.3.2 CV12.3.3 CV12.4.3 CV12.4.4 CV12.5.1 CV12.5.2 CV12.5.3 CV12.5.4</p>	<p>Practice chapter skills.</p>
<p>Unit 12: Models of Computation Lessons: Test</p>	<p>CV12.3.1 CV12.4.2</p>	<p>Demonstrate comprehension of chapter objectives.</p>
<p>Unit 13: Simulation and Modeling Lessons: Read and Study</p>	<p>CV12.3.1 CV12.4.2</p>	<p>Introduce an important area of application for computing: computational modeling for quantitative fields including the sciences, mathematics, engineering, and even social sciences.</p> <p>Introduce the purposes and methods of model building and why computational models can be useful.</p> <p>Describe different features models can have, and provides a detailed case study for discrete event simulation, an important kind of computational model.</p> <p>Discuss methods for presenting and visualizing quantitative data, particularly when the amount of data becomes difficult to view.</p>
<p>Unit 13: Simulation and Modeling Lessons: Lab</p>	<p>CV12.3.2 CV12.3.3 CV12.4.3 CV12.4.4 CV12.5.1 CV12.5.2 CV12.5.3 CV12.5.4</p>	<p>Practice chapter skills.</p>
<p>Unit 13: Simulation and Modeling Lessons: Test</p>	<p>CV12.3.1 CV12.4.2</p>	<p>Demonstrate comprehension of chapter objectives.</p>
<p>Unit 14: Electronic Commerce Lessons: Read and Study</p>	<p>CV12.3.1 CV12.4.2</p>	<p>Examine electronic commerce, a field that has grown in importance tremendously over the past fifteen years.</p> <p>Introduce different purposes an organization might have for an ecommerce site.</p>

		<p>Discuss the positives and negatives of creating an ecommerce website.</p> <p>Explain the design process for deciding what an ecommerce site will contain, and how online transactions must be managed.</p> <p>Discuss a key system required by most or all ecommerce sites: databases.</p> <p>Describe the purpose of a database management system, and how SQL is used to retrieve data from tables within a database.</p> <p>Include a discussion of database integrity, and how that is maintained.</p> <p>Describe personal privacy in the era of data mining and massive databases.</p>
<p>Unit 14: Electronic Commerce Lessons: Lab</p>	<p>CV12.3.2 CV12.3.3 CV12.4.3 CV12.4.4 CV12.5.1 CV12.5.2 CV12.5.3 CV12.5.4</p>	<p>Practice chapter skills.</p>
<p>Unit 14: Electronic Commerce Lessons: Test</p>	<p>CV12.3.1 CV12.4.2</p>	<p>Demonstrate comprehension of chapter objectives.</p>
<p>Unit 15: Artificial Intelligence Lessons: Read and Study</p>	<p>CV12.3.1 CV12.4.2</p>	<p>Explore the field of artificial intelligence, or AI. People working in AI create programs that exhibit “intelligent behavior.”</p> <p>Define AI, and discusses a range of example techniques and applications.</p> <p>Discuss the issue of knowledge representation, and provides examples of some typical kinds of representation.</p> <p>Describe how artificial neural networks work, their inspiration from real neurons, and the kinds of problems they can solve.</p> <p>Explain how to describe problems in terms of a state space, and how state-space search algorithms work.</p> <p>Use the Watson program as a case study. Watson is a question-answering system designed to play the Jeopardy! game show; it competed successfully against champion players of the show.</p>

		Discuss the current and future applications of robots and drones.
Unit 15: Artificial Intelligence Lessons: Lab	CV12.3.2 CV12.3.3 CV12.4.3 CV12.4.4 CV12.5.1 CV12.5.2 CV12.5.3 CV12.5.4	Practice chapter skills.
Unit 15: Artificial Intelligence Lessons: Test	CV12.3.1 CV12.4.2	Demonstrate comprehension of chapter objectives.
Unit 16: Computer Graphics and Entertainment Lessons: Read and Study	CV12.3.1 CV12.4.2	<p>Explore the ways in which computing has become important in the development of movies, video games, and other computer-based entertainment.</p> <p>Describe traditional animation techniques, and the development of computer-generated animation methods.</p> <p>Describe the process of creating realistic images with computer graphics.</p> <p>Introduce the differing challenges of generating images for dynamic video games, rather than static movies or still images.</p> <p>Explain how GPUs inside modern computers enable higher-quality rendering of dynamic images.</p> <p>Examine the growing use of multiplayer online games, both competitive games like World of Warcraft, and online communities like Second Life.</p>
Unit 16: Computer Graphics and Entertainment Lessons: Lab	CV12.3.2 CV12.3.3 CV12.4.3 CV12.4.4 CV12.5.1 CV12.5.2 CV12.5.3 CV12.5.4	Practice chapter skills.
Unit 16: Computer Graphics and Entertainment Lessons: Test	CV12.3.1 CV12.4.2	Demonstrate comprehension of chapter objectives.
Unit 17: Make Ethical Decisions Lessons: Read and Study	CV12.3.1 CV12.4.2	Explore a variety of social and ethical issues relating to information technology.

		<p>Introduce a number of tools from ethics for use in evaluating social issues.</p> <p>Demonstrate the use of ethical reasoning methods on specific case studies about computing.</p> <p>Discuss issues including copyright, electronic surveillance, and hacking.</p> <p>Discuss issues an individual may face relating to computing, including cyberbullying, sexting, and the privacy of information online.</p>
<p>Unit 17: Make Ethical Decisions Lessons: Lab</p>	<p>CV12.3.2 CV12.3.3 CV12.4.3 CV12.4.4 CV12.5.1 CV12.5.2 CV12.5.3 CV12.5.4</p>	<p>Practice chapter skills.</p>
<p>Unit 17: Make Ethical Decisions Lessons: Test</p>	<p>CV12.3.1 CV12.4.2</p>	<p>Demonstrate comprehension of chapter objectives.</p>