Idaho High School Computer Science Syllabus

High School (145 Contact Hours)

Course Overview and Goals

In this Idaho High School Computer Science course, students will explore and gain a comprehensive understanding of many foundational computer science concepts. First, students will learn about cybersecurity and how to protect themselves online. Then, students will be exposed to IT concepts including software, binary, networks, physical devices, and how these all work together. Next, students will learn about Artificial Intelligence, how it works, how it is being used, and the ethical implications. Students will then be introduced to the Python programming language, which they will use to explore fundamental computer science skills. After building a strong set of skills in Python, they will learn about the field of data science, and use Python to explore and understand data. Finally, students will learn about real world applications of computer science. This wide-ranging course will equip students with essential knowledge for understanding our increasingly digital world and prepare them for future computer science studies.

Learning Environment

The course utilizes a blended classroom approach. The content is a mix of web-based and physical activities. Each module of the course is broken down into lessons. Lessons are composed of short video tutorials, interactive learning pages, quizzes, explorations, simulations, and free-response prompts. Each module ends with a comprehensive quiz, project, or presentation that assesses students' mastery of that module's material.

More Information

Browse the content of this course at https://codehs.com/course/27169/overview

Prerequisites

The Idaho High School Computer Science course is designed for complete beginners with no previous background in computer science. The course is highly visual, dynamic, and interactive, making it engaging for those new to computer science.

Course Breakdown

Module 1: Cybersecurity and You (1.5 weeks/7 hours)

In this module, students delve into key areas such as personal data collection, the reliability of online information, cyber ethics and laws, personal data security, cybersecurity essentials, and strategies to combat common cyber threats and their prevention, equipping individuals with the knowledge to navigate the digital landscape responsibly and securely.

Browse the full content of this unit at https://codehs.com/course/27169/explore/module/38825

Topics Covered	• Digital Footprint and Responsibility • Can All Information Be Trusted • Cyber Ethics and Laws

	• Personal Data Security • Cybersecurity Essentials • Common Cyber Attacks and Prevention

Example Assignments	• Digital Footprint and Responsibility
	  ○ Students explore the impact of social media and technology on teenagers, covering topics like digital footprints, the rise of social media screenings, cyberbullying, and the importance of updating privacy settings.
	• Personal Data Collection and Security
	  ○ This lesson delves into the use and security of personal data, discussing how companies like Google utilize user information, the implications of location tracking, and legal aspects of privacy, and encourages critical thinking through reflections, checks for understanding, and explorations of browser security settings and the trade-offs of security measures.
	• Cyber Ethics and Laws
	  ○ This lesson navigates through cyber ethics, differentiating between ethics and laws, exploring legal consequences, copyright in education, the process of obtaining permissions, and the pros and cons of intellectual property laws.
	• Cybersecurity Essentials
	  ○ This lesson covers cybersecurity, featuring activities on the AAA Security Framework and the CIA Triad, along with exploring the impact of the Internet of Things on data security.

Module 2: Cryptography (1 week/6 hours)

In this module, students will dive into the history of cryptography systems, the motivation behind using encryption systems, and modern cryptography systems. This includes explaining the core concepts of Public Key Infrastructure and hash functions. Students will also explore the importance of digital certificates, and authentication methods.

Browse the full content of this module at https://codehs.com/course/27169/explore/module/38826

Topics Covered	• Cryptography: Then, Now and Future • Symmetric Encryption • Asymmetric Encryption • Public Key Encryption • Authentication Methods • Digital Certificates
Example Assignments	• Symmetric Encryption ○ *Rail Fence Cipher:* The Rail Fence Cipher is a form of transposition cipher that uses columns and rows. The plaintext is written downwards and bounces back and forth on a diagonal. The 'rails' refer to the number of rows. Decrypt the message below using 5 rails. Using the Rail Fence Cipher, encrypt your own message and trade with a partner. See if you can decrypt the message without knowing how many rails your partner used. How could you make this cipher even stronger?

	• Asymmetric Encryption
	  ○ *Public Key Encryption Exploration*: You would like to send a message to your friend. Your friend will need a private key as well to add to the encryption. Complete the chart according to the rules of the public key and the two private keys.
	• Authentication Methods
	  ○ *Guess The Hash:* Work with a partner and take turns hiding a password, and trying to guess the password. Without letting your partner see, type in a simple word (about 3-7 letters long) as your password. You'll see the corresponding hash in the output box. Using the scrambled letters, attempt to guess the password. You will only know if you have guessed the password if the hashes shown match.

Module 3: System Administration (1 week/5 hours)

In this module, students will learn about the role of an operating system and the resources they manage. They will investigate accessibility and understand its importance in the online space. Students will learn about software licenses and the purpose of them.

Browse the full content of this module at https://codehs.com/course/27169/explore/module/38827

Topics Covered	• Operating Systems • Computing Resources • Laptops and Tablets • Software and Accessibility • Software Licenses

Example Assignments	• Computing Resources
	  ○ *Your Computer's Resources:* After you learn about the fundamental computing resources, you use your computer's system monitoring program to see how your computer manages its resources in real time.
	• Accessibility
	  ○ *Accessibility Features:* In this activity, you review accessibility features provided by major tech companies. You analyze how these features are helpful, and identify accessibility features that may be helpful to you.
	• Software Licenses
	  ○ *Do I Need a Software License?:* You have built a new picture-taking app complete with new original filters for iOS phones and you are excited to start selling it in the app store! Brainstorm and create a software agreement for your new app.

Module 4: IT Concepts (2.5 weeks/12 hours)

In this module, students explore the structure and design of the internet and networks, and how this design affects the reliability of network communication, the security of data, and personal privacy. Students will learn how the Internet connects computers all over the world by use of networking protocols. They will see how information is conveyed in binary over the Internet.

Browse the full content of this module at https://codehs.com/course/27169/explore/module/38828

Topics Covered	• Computers Speak Binary • Encoding Text and Images in Binary • Compression • IP Addresses • Routing and Packets • Protocols: TCP, UDP, HTTP/HTTPS • How do Websites Work? • OSI Model • Impact of the Internet

Example Assignments	• Encoding Images in Binary
	  ○ *Create a Color Pixel Image:* In this activity, you will use binary to create pixel art. Students use RGB color encoding and our bit interpreter to make an image of their choosing.
	• OSI Model
	  ○ *Troubleshooting with the OSI Model:* You have been hired as a network engineer for Tea-Riffic Blends Co., a small business that sells specialty teas. You are in charge of setting up their network, configuring it, and solving any issues that arise. The OSI model can help with troubleshooting because it can isolate the layer causing the issue. Read through the following three scenarios. Based on the problem and what you know about the OSI layers, identify which layer you should target to solve the issue. Then, explain your reasoning.
	• Impact of the Internet
	  ○ *Compass Points: The Internet:* In this activity, students use the Compass Points thinking routine to examine their feelings about the Internet and its impact on society.

Module 5: IT Infrastructure (1.5 weeks/7 hours)

In this module, students will learn about the physical elements of computers and networking such as motherboards, RAM, routers, and the use of port numbers, ethernet, and wireless devices.

Browse the full content of this module at https://codehs.com/course/27169/explore/module/38830

Topics Covered	• Internal Components of a Computer • Peripheral Devices • Network Devices • Storage and Network Options • Network Communication • Network Management

Example Assignments	• Network Devices
	  ○ *Network Troubleshooting:* Jamal's computer is able to connect to the Wi-Fi signal, but there is no Internet access. Which device do you think might be causing the problem and why?
	• Network Options
	  ○ *Wireless Network Setup:* In this activity, students will draw a diagram that represents a wireless network setup that will be implemented for a fictitious house, office, or apartment building. The teacher will either assign them a building or they can create one from their own imagination.

	○ Network Communication ■ *Setting up a Firewall:* Students explore a simulation of how a firewall blocks incoming network traffic. They interact with the simulation to see how certain files get through a firewall, and others do not.

Module 6: Artificial Intelligence (2 weeks/10 hours)

In this module, students explore key aspects of AI, including large language models, bias in models, and the impacts they have on our society. They will gain an understanding of how AI works and will be equipped with the skills to use AI responsibly.

Browse the full content of this module at https://codehs.com/course/27169/explore/module/38914

Topics Covered	● Introduction to AI ● Large Language Models ● Reinforcement Learning ● How Are AI Models Trained ● Bias in Training ● Ethics of AI ● Impact of AI
Example Assignments	● Reinforcement Learning ○ *Reinforcement Learning Game:* Students engage with a visual depiction of reinforcement learning. ● How Are AI Models Trained ○ *Turning on a Light:* Students train and use an AI model to control a program ● AI Models in Industry ○ Students pick an industry to explore use cases of AI ● Bias in Training ○ *AI in Human Resources:* Students explore how bad training data can create cycles of inequality in the hiring process. ● Ethics of AI ○ *Project: AI on Trial:* Students explore the legal challenges that generative AI faces and they prepare for and engage in a debate around this topic

Module 7: Basic Python and Console Interaction (1.5 weeks/8 hours)

In this module, students will learn the basics of programming by writing programs that interact with users through the keyboard. They will explore foundational computer science concepts including variables and comments. This module introduces students to Python, which they use for the remainder of the course.

Browse the full content of this module at https://codehs.com/course/27169/explore/module/38936

Topics Covered	● Printing ● Variables ● Types ● User Input ● Converting Input Types ● Arithmetic Expressions

	• String Operators • Comments • Programming Languages

Example Assignments	• Printing
	  ○ *Hello, world!:* Students explore a classic introductory program and make changes to the code to see the impact.
	• Variables
	  ○ *Undefined Variables:* Students debug code with variables that are not properly defined or initialized.
	• User Input
	  ○ *Hello <name>:* Students ask the user for their name then print out a simple message.
	• Arithmetic Expressions & Converting Input Types
	  ○ *Rectangle, part 1:* Students make variables for length and width and compute area and perimeter
	  ○ *Rectangle, part 2:* Students ask the user for length and width and compute area and perimeter

Module 8: Control Structures (2 weeks/10 hours)

In this module, students will learn how to use control structures, such as if statements, for loops, and while loops, in their programs. Students teach their programs to make decisions based on the information it receives and learn how to write more efficient code by using loops as shortcuts.

Browse the full content of this module at https://codehs.com/course/27169/explore/module/38937

Topics Covered	• Booleans • If Statements • Comparison Operators • Logical Operators • While Loops • For Loops • Nested Control Structures • Code Flowcharts • Keywords Break and Continue

Example Assignments	• If Statements and Booleans
	  ○ *Is it raining?:* Students write a program that uses a boolean variable to determine whether or not it is raining.
	  ○ *Legally allowed to vote:* Students write a program where a user reports age and the program tells them whether or not they can vote in the US
	• While Loops
	  ○ *Divisibility:* Students write a program that asks the user to enter a numerator and denominator, and re-prompt until the denominator is non-zero
	• For Loops
	  ○ *Average test score:* Students compute the average of several test scores using a loop.
	  ○ *Counting 10 to 100 by Tens:* Students practice using parameters to customize the iterations of a for loop.
	• Nested Control Structures

	○ *Rolling Dice:* Write the code to print out all combinations that can be made when 2 dice are rolled. ● Code Flowcharts ○ *Pre-written Program Flowchart:* Students are given a program to convert into a code flowchart. ● Break and Continue ○ *Higher/ Lower:* Ask the user to guess a particular number between 1 and 100. If the user's guess was too high or too low, they should be notified.

Module 9: Functions and Exceptions (2 weeks/9 hours)

In this module, students will learn how to decompose problems into smaller pieces that work together to solve a problem. Students explore the value and purpose of functions while writing some of their own. They then utilize namespaces, parameters, and exceptions to write more specialized functions.

Browse the full content of this module at https://codehs.com/course/27169/explore/module/38938

Topics Covered	● Functions ● Namespaces ● Parameters ● Return Values ● Recursion ● Exceptions
Example Assignments	● Functions ○ *Add, Subtract, or Multiply:* Students write a program that asks the user for two numbers and a mathematical operation, then uses functions to calculate the result. ○ *Temperature Converter:* Students write functions to convert from Fahrenheit to Celsius and vice versa. The functions utilize return values. ● Recursion ○ *Treasure Hunt:* Students write a recursive function to simulate collecting coins in a video game. ● Exceptions ○ *Temperature Converter, part 2:* Students add exception handling to their temperature conversion program.

Module 10: Data Structures (1.5 weeks/7 hours)

In this module, students learn how to utilize more complex data structures, including tuples, lists, and dictionaries, in their code. They learn how to construct and use data structures, as well as some common methods to modify data structures.

Browse the full content of this module at https://codehs.com/course/27169/explore/module/38945

Topics Covered	● String Methods ● Tuples ● Lists ● List Methods ● Dictionaries

Example Assignments	• String methods
	  ○ *ENTHUSIAM!:* Students write a function that takes a string and returns that string in all upper case and adds an exclamation point to the end.
	  ○ *Remove All From String:* Students write a function that takes two strings and returns a string that consists of the first string with all instances of the second string removed.
	• Tuples
	  ○ *Diving Contest:* Given a tuple of diving scores, students write a program that adds them all up to display the final score.
	• Lists
	  ○ *Listed Greeting:* Students ask a user to enter their name, age, and favorite sport, then split their response into list elements and use index values to greet them by name and respond that you enjoy that sport as well!
	  ○ *Librarian:* Students ask the user for the last names of the authors of the five books they are returning. They then use list methods to print a list of those names in sorted order.
	• Dictionaries
	  ○ *Phone Book:* Students write code for a user to repeatedly enter a name, and the program either asks for the person's phone number or reports the phone number already provided

Module 11: Group Project (2 weeks/10 hours)

In this module, students will learn about the software development life cycle and how coding projects are planned and implemented in the real world. Then, students will work on an open-ended group project to practice their programming skills, the development life cycle, and working on a team.

Browse the full content of this module at https://codehs.com/course/27169/explore/module/39008

Topics Covered	• Software Development Life Cycle • Working With a Team

Example Assignments	• Software Development Life Cycle
	  ○ Lesson on the stages of the software development cycle and how they are used to make different development models.
	• Group Project
	  ○ This lesson includes the instructions for the project, a place to plan, submit, and reflect on their work.

Module 12: Classes and Objects (1.5 weeks/6 hours)

In this module, students will learn the basics of object oriented programming. Students will learn what objects are, create classes, use methods, overload operators, and understand the difference between class and instance variables.

Browse the full content of this module at https://codehs.com/course/27169/explore/module/38947

Topics Covered	• Classes • Objects • Methods • Built-In Methods

	• Operator Overloading • Class Variables vs. Instance Variables

Example Assignments	• Classes
	  ○ *The Rectangle Class:* Over the course of several activities spread across multiple lessons, students will create a class to represent rectangles. They will build the class and add methods to increase the functionality and become acquainted with Python classes.
	  ○ *Names In a Hat:* Students are given a pre-written class and are tasked with testing it to ensure it works correctly.
	• Class Variables vs. Instance Variables
	  ○ *Cars:* Students are given a class that represents cars. They analyze and tweak it to use the correct variables in the correct sections of the code.

Module 13: The Data Science Life Cycle (3 weeks/15 hours)

In this module, students are introduced to data science and how they can use Python to analyze and use data. Students will learn and apply the process of the data science life cycle. This includes asking statistical questions, collecting or obtaining reliable raw data, analyzing the data using measures of central tendency and spread and interpreting, and summarizing the results.

Browse the full content of this module at https://codehs.com/course/27169/explore/module/38942

Topics Covered	• What is Data Science?
	• Gathering Data
	  ○ Quantitative/Qualitative
	• Modules and Libraries
	• Using the Pandas Library
	  ○ Series
	  ■ Measures of Central Tendency
	  ■ Measures of Spread
	  ○ DataFrames
	  ■ Selecting Columns
	  ■ Using Functions

Example Assignments	• Mini-Project
	  ○ Students will go through the first two steps of the data cycle using data of their choosing.
	  ■ Ask Questions: Formulate a statistical question that can be answered with data.
	  ■ Consider Data: Collect or find data that will aid in answering your question.
	  ■ Analyze Data: Perform statistical analysis, run calculations and/or create data displays to identify patterns and relationships
	  ■ Interpret Data: Answer questions and summarize the results.
	• Series, Central Tendency, Measures of Spread
	  ○ *Hot Dog Plots:* Use the correct Python functions to create a boxplot of the data. Using the graph, determine the summary statistics and the spread.

	• DataFrames
	  ○ *Roller Coaster Rankings:* Define a function that will compute a score for each roller coaster. Use this function to store the results in a new column.
	  ○ *Student Test Scores:* Create a function that finds the maximum test score between test one and test two for each student. Create a function that finds the maximum test score between all three tests for each student. Decide which calculations, along with these two new columns, can help you answer the original statistical question? Explore and further analyze your data until you come to a conclusion.

Module 14: Data Science for Change (3 weeks/15 hours)

In this module, students will use and analyze data to better understand a problem, measure the scope of a problem, or understand how people are affected by the problem. They will learn more about cleaning a dataset and filtering by column, rows, and conditions.

Browse the full content of this module at https://codehs.com/course/27169/explore/module/38943

Topics Covered	• What is Big Data?
	  ○ Cognitive Bias
	• Importing and Filtering Data
	• Data Cleaning
	  ○ Dropping Data
	  ○ Fixing Data Types
	• Exploring with Data Visualizations

Example Assignments	• Project
	  ○ *Data Science for Change*: Students will run through the data science life cycle with the intent to use data to better understand a problem, to measure the scope of a problem, and to understand how people are affected by the problem.
	• Filtering Data
	  ○ *Instagram Filters:* This dataset consists of popular Instagram accounts and their number of followers (in millions). Students use conditional filtering to print the rows where followers are greater than 230 (million), print only the account columns of those from the United States, print the account and followers columns of the row with the maximum number of followers.
	• Data Cleaning
	  ○ *Cleaning Book Data:* Students check the data types of the dataset. Do they look okay? Do they need to be changed at all? Permanently drop the publisher and published_date columns. Print the shape of the data and check for duplicate rows. How many are there? Permanently drop duplicate rows from the dataset. Determine the number of missing values in the dataset. What would be the best decision for dealing with the missing values? Make the call and change the data.

Module 15: Data Storytelling (2 weeks/10 hours)

In this module, students will understand how data can be used to tell a story. They will review infographics to understand how they utilize data. Students will learn how to use Python to make visualizations of data.

Browse the full content of this module at https://codehs.com/course/27169/explore/module/39012

Topics Covered	• Types of Data Stories • Data Visualizations ○ Univariate and Bivariate Data • Normal Distribution • Trends and Correlations • Linear Regression

Example Assignments	• Data Visualizations
	  ○ *State Education:* The pie chart displayed has an error, which makes it a misleading visual. Find the bug in the program and fix it so that the program displays an accurate pie chart.
	• Normal Distribution
	  ○ *Professor's Salaries:* This dataset lists professor salaries. Other fields collected were the type of degree, years since their Ph.D. was earned, years of service, and sex (gender). Create filtered tables. Do any of the filtered tables follow a normal distribution?
	• Linear Regression
	  ○ *Swim Time Regression:* This dataset lists the gold medalist time for the women's 400-meter freestyle swimming finals. Plot the scatterplot. Create a model using the `polyfit()` function and use the model to plot the line of best fit. Use the model equation to make predictions based on different values.

Module 16: Applications of Computer Science (1.5 weeks/8 hours)

In this module, students will learn about several examples of real world applications of computer science. Students will research specific examples of how computing has revolutionized industry and society.

Browse the full content of this module at https://codehs.com/course/27169/explore/module/38946

Topics Covered	• File I/O • Embedded Systems • Simulations • Creating Art • Solvable and Unsolvable Problems • The Computing Revolution

Example Assignments	• Embedded Systems
	  ○ *Design Your Own System:* Students diagram their idea for an embedded system.
	• Simulations
	  ○ *Predation Simulation Experiment:* Students make predictions then run an experiment using a sheep and wolf predation simulator.
	• Creating Art
	  ○ *Draw a Picture!*: Students learn the basics of drawing in Python with Tracy the turtle, then they draw a picture of their own.