Indiana Topics in Computer Science Syllabus

High School (150 Contact Hours)

Course Overview and Goals

The CodeHS Indiana Topics in Computer Science curriculum teaches a variety of computer science topics, emphasizing helping students develop logical thinking and problem-solving skills. Students who take this course will explore topics such as game design, cybersecurity, data science, and artificial intelligence. Once students complete the CodeHS Indiana Topics in Computer Science course, they will have learned material equivalent to a semester college introductory course in Computer Science and be able to program in JavaScript.

Learning Environment

The course utilizes a blended classroom approach. The content is fully web-based, with students writing and running code in the browser. Teachers utilize tools and resources provided by CodeHS to leverage time in the classroom and give focused 1-on-1 attention to students. Each unit of the course is broken down into lessons. Lessons consist of video tutorials, short quizzes, example programs to explore, and written programming exercises, adding up to over 100 hours of hands-on programming practice. Each unit ends with a comprehensive unit test that assesses students' mastery of that unit's material and challenge problems where students can display their understanding of the material.

Programming Environment

Students write and run JavaScript programs and Python programs in the browser using the CodeHS editor.

More Information

Browse the content of this course at https://codehs.com/course/21684/explore

Prerequisites

The Indiana Topics in Computer Science course is part of the new Next Level Programs of Study (NLPS) CTE computer science pathway for high schools in Indiana. Students should have completed the Indiana Principles of Computing course before enrolling in this course as it builds on fundamental programming concepts. This course is highly visual, dynamic, and interactive, making it engaging for students who have some experience writing code.

Course Breakdown

Module 1: Animation and Games (3 weeks/15 hours)

In this module, students will learn how to create JavaScript graphics objects to create animations and games. Students are expected to know basic JavaScript fundamentals and they are introduced to ES6 syntax.
Browse the full content of this unit at https://codehs.com/course/21684/explore/module/30884

Objectives / Topics Covered	● History of Video Games ● Elements of Good Games ● ES6 JavaScript Syntax Introduction

	- Timers - Stopping Timers - Collisions - Mouse Click Events - Key Events
Example Assignments / Labs	13 JavaScript Programming Exercises in total - Example exercise: Carnival Game Create three functions that will be used to make the weight of a move up and down the path, bouncing off the top and bottom. - ES6 Syntax update: Students are introduced to the new ES6 syntax that CodeHS has adopted for JavaScript programming. 1 guided project - Students iteratively build on a game throughout this module as they learn new concepts.

Module 2: Create a Game! (1 week/5 hours)

In this project, students will work in a group following the Software Development Life Cycle and Prototype Development Model to create a game using the JavaScript Graphics library.

Browse the full content of this module at https://codehs.com/course/21684/explore/module/30954

Objectives / Topics Covered	- The Software Development Life Cycle (SDLC) - The Prototype Development Model (PDM)
Example Assignments / Labs	- The Software Development Life Cycle - Students learn the benefits of the SDLC and PDM and apply them as they work in groups to build a game. - Develop Your Game - Students build a Game Design Document that helps them plan their game. - Students receive and provide feedback on games which is a crucial part of the PDM. - Students build prototypes of their games. - Students complete the implementation of feedback and finalize their game.

Module 3: Cybersecurity and You (3 weeks/15 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 module at https://codehs.com/course/21684/explore/module/31265

Objectives / Topics Covered	- Digital Footprint and Responsibility - Personal Data Collection and Security - Cyber Ethics and Laws - Cybersecurity Essentials - Common Cyber Attacks and Prevention

Example Assignments / Labs	- 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, 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 4: Python Basics (3 weeks/15 hours)

Students learn the basics of programming in Python by writing programs that interact with users through the keyboard. Students should have already learned fundamental programming concepts from the Principles of Computing course. This module helps introduce students to Python and Python syntax.
Browse the full content of this module at https://codehs.com/course/21684/explore/module/30462

Objectives / Topics Covered	- Introduction to Python - Printing in Python - Variables and Types - User Input - Mathematical Operators - String Operators - Comments - Programming Languages
Example Assignments / Labs	15 Python programming exercises in total. - Students learn the fundamentals of programming in Python by running example code and completing relevant coding exercises. - Printing in Python - Students write a program that prints their name and something about themselves. - Variables and Types - Write a program that does the following: - Creates a string variable. - Creates an integer variable. - Prints both variables, each on its own line. - User Input - Write a program that takes a user's name and says hello to them. Save their name in a variable.

Module 5: Functions in Python (2 weeks/10 hours)

Students learn about the various ways we represent information digitally including number systems, encoding data, and creating pixel images.

Browse the full content of this module at https://codehs.com/course/21684/explore/module/30469

Objectives / Topics Covered	- Functions - Functions and Parameters - Namespaces in Functions - Functions and Return Values
Example Assignments / Labs	- Functions - Ask the user about the weather outside with three options (sunny, rainy, or snowy) and give the correct footwear suggestion (sandals, galoshes, or boots). Each option should be written as its own function that prints a message based on the input. - Functions and Parameters - Write a function that takes two arguments - a string and an integer - and prints the string multiple times. The integer specifies how many times the string is printed. - Namespaces in Functions - Write a program that asks the user for two numbers. Then ask them if they would like to add, subtract, or multiply these numbers. Perform the chosen operation on the values, showing the operation being performed. - Functions and Return Values - Write a function that takes one parameter - a float which represents a temperature in Celsius - and returns a float which represents that temperature in Fahrenheit.

Module 6: Python Data Structures (3 weeks/15 hours)

Students explore the structure and design of the internet and how this design affects the reliability of network communication, the security of data, and personal privacy.

Browse the full content of this module at https://codehs.com/course/21684/explore/module/30467

Objectives / Topics Covered	- Tuples - Lists - For Loops and Lists - List Methods 2D Lists - Dictionaries
Example Assignments / Labs	- Tuples - Create coordinate pairs using tuples - Create citations using tuples - Explore sequential, heterogenous, and single-element tuples - Lists - Write a function that takes a name as its input, then returns a list where each character in their name is an element - Write a function that takes a string as input. That string will be formatted without any punctuation. 2D Lists - Create a program that stores numbers corresponding to checker

	pieces on a board. The goal is to make a grid that stores 1's and 0's, such that a 1 represents a checker piece and a 0 represents a blank square.

	● Dictionaries
	  ○ Write a program that keeps a dictionary of names and their corresponding phone numbers.
	  ○ Write a program that asks a user for some text. The program should split the string they enter into a list of words.

Module 7: Introduction to Data Science (5 weeks/25 hours)

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/21684/explore/module/30223

Objectives / Topics Covered	● What is Data Science? ● Gathering Data ● Exploring Data Using Python ● Modules, Packages & Libraries ● Series and Central Tendency ● Measures of Spread ● Pandas DataFrames ● Selecting Columns ● Using Functions

Example Assignments / Labs	● What is Data Science?
	  ○ This lesson introduces data science, detailing the role of a data scientist, exploring statistical questions, and engaging students in data analysis through hands-on activities and reflections on data exploration.
	● Gathering Data
	  ○ Data Sort: Sort the provided categories and place them in the quantitative or qualitative columns of a data set.
	● Exploring Data Using Python
	  ○ Practice with Lists: Students transform a data table so that each column has its list of values.
	● Modules, Packages & Libraries
	  ○ Wikipedia: Using the Wikipedia documentation and library, search for turtles and print out the results.

Module 8: Data Science for Business (5 weeks/25 hours)

Students will gather business data that can be used to make decisions about how to better the company or product. They will present their findings in a business report that suggests several action items that they predict will help the business's performance and growth.

Browse the full content of this module at https://codehs.com/course/21684/explore/module/30226

Objectives / Topics Covered	● Data Science for Business ● Importing and Filtering Data

	● Conditional Filtering ● Data Cleaning ● Data Visualizations ● Line and Bar Charts ● Quality Datasets ● Aggregating Data ● Combining Datasets ● Your Business Data ● Bias in Data Analytics ● Business Report

Example Assignments / Labs	● Data Science for Business
	   ○ Students take a look at how data is used in the business world to improve aspects of the business as well as predict future outcomes.
	● Importing and Filtering Data
	   ○ Filtering Book Data: Students use loc and iloc to print different information about a book.
	● Conditional Filtering
	   ○ Instagram Filters: Students use conditional filtering to print information about different accounts based on conditions.
	● Data Cleaning
	   ○ Cleaning Up the Zoo: Students use specific functions to clean a dataset (e.g. drop irrelevant columns, check for duplicates)

Module 9: The World of Artificial Intelligence (1 week/5 hours)

Students will explore the basics of Artificial Intelligence (AI) and Machine Learning, understand how neural networks power AI, and discuss its ethical implications.

Browse the full content of this module at https://codehs.com/course/21684/explore/module/31137

Objectives / Topics Covered	● Introduction to Artificial Intelligence ● Artificial Intelligence and Machine Learning ● Machine Learning and Neural Networks ● The Ethics of Artificial Intelligence

Example Assignments / Labs	● Introduction to Artificial Intelligence
	   ○ Students are introduced to the field of Artificial Intelligence. Students explore the definition of intelligence and the different types of artificial intelligence in computers.
	● Artificial Intelligence and Machine Learning
	   ○ In this lesson, students will learn more about the types of AI and dive deeper into the three most popular machine learning algorithms.
	● Machine Learning and Neural Networks
	   ○ In this lesson, students will learn about different subsets of Artificial Intelligence, specifically machine learning and neural networks.
	● The Ethics of Artificial Intelligence
	   ○ In this lesson, students discuss important ethical issues related to the development of Artificial Intelligence and debate the necessity of Artificial Intelligence in modern society.

Module 10: Creating an Image Recognizing AI (1 week/5 hours)

Students will learn to use TensorFlow to build image prediction models and select appropriate datasets. This module provides hands-on experience with TensorFlow, guiding through the creation of AI models and the critical process of dataset validation.

Browse the full content of this unit at https://codehs.com/course/21684/explore/module/31189

Objectives / Topics Covered	- Introduction to TensorFlow - Creating an Image Prediction Model - Selecting Valid Datasets
Example Assignments / Labs	- Introduction to TensorFlow - The Temperature Conversion Model: Students use a neural network model to predict temperature conversions, analyzing the impact of varying epochs, layers, and data points on accuracy and performance. - Creating an Image Prediction Model - Weather Image Classification: Students use a Colab Notebook to train a model for weather image classification, analyzing training/validation data split, accuracy, loss, and the effects of iterative model adjustments on prediction outcomes and learning efficiency. - Selecting Valid Datasets - Selecting Valid Datasets: Students explore face recognition focusing on validation accuracy, the impact of dataset size and balance on model performance, and the trade-offs associated with using larger datasets for improved accuracy.

Module 11: Using Natural Language Processing (1 week/5 hours)

Students will develop skills in creating sentiment analysis models and generating new text using machine learning techniques.

Browse the full content of this unit at https://codehs.com/course/21684/explore/module/31618

Objectives / Topics Covered	- Creating a Sentiment Model - Generating New Text
Example Assignments / Labs	- Creating a Sentiment Model - Tokenizing a Dataset: Students explore the basics of natural language processing by tokenizing text, understanding the role of padding, and implementing code to generate and analyze padded sequences. - Generating New Text - Creating a Movie Review: Students record the effects of varying sequence numbers on model training time, test hypotheses on factors affecting processing time, and evaluate changes in review quality after model adjustments and increased input data.

Module 12: AI Final Project (2 weeks/10 hours)

Students will work on a project to build their own AI, starting from selecting a topic that they are interested in, building an AI model, tracking progress, and reflecting on their learning experience.

Browse the full content of this unit at https://codehs.com/course/21684/explore/module/31619

Objectives / Topics	Final Project (Build an AI model)

Covered	
Example Assignments / Labs	- Choose your option - Students pick a topic that interests them and build an AI model that works with relevant data. They'll be adapting code they've learned to make the AI model. - Create A Plan - Students outline their AI projects, choose data and model features, and plan initial steps based on past work and project goals. - Build and Tracking Your Progress - Students begin building their AI model, iteratively improve it, and record their findings using CodeHS editor prompts, learning the value of adjustments. - Reflection - After finishing their project, students reflect on the data, model, and AI challenges, evaluate model accuracy, and identify limitations.