Catasauqua Area School District
Planned Course of Study

Course Title: Computer Science Discoveries

Grade Level(s): 9 - 12

Text: Code.org curriculum

Course Description

Computer Science Discoveries is an introductory computer science course for 9 - 12th grade students. Mapped to CTSA standards, the course takes a wide lens on computer science by covering topics such as problem solving, programming, physical computing, user centered design, and data, while inspiring students as they build their own websites, apps, animations, games, and physical computing systems.

Essential Questions & Competencies

Unit 1:
What strategies and processes can I use to become a more effective problem solver?
How do computers help people to solve problems?
How do people and computers approach problems differently?
What does a computer need from people in order to solve problems effectively?

Unit 2:
Why do people create websites?
How can text communicate content and structure on a web page?
How do I safely and appropriately make use of the content published on the internet?
What strategies can I use when coding to find and fix issues?
How can websites be used to address problems in the world?
What strategies can teams use to work better together?
How do I know what information can be trusted online?

Unit 3:
What is a computer program?
What are the core features of most programming languages?
How does programming enable creativity and individual expression?
What practices and strategies will help me as I write programs?
How do software developers manage complexity and scale?
How can programs be organized so that common problems only need to be solved once?
How can I build on previous solutions to create even more complex behavior?

Unit 4:
How do computer scientists identify the needs of their users?
How can we ensure that a user's needs are met by our designs?
What processes will best allow us to efficiently create, test, and iterate upon our design?
How do teams effectively work together to develop software?
What roles beyond programming are necessary to design and develop software?
How do designers incorporate feedback into multiple iterations of a product?

Unit 5:
Why is representation important in problem solving?
What features does a representation system need to be useful?
What is necessary to create usable binary representation systems?
How can we combine systems together to get more complex information?
How does data help us to solve problems?
How do computers and humans use data differently?
What parts of the data problem solving process can be automated?
What kinds of real world problems do computers solve by using data?

Unit 6:
How does software interact with hardware?
How can computers sense and respond to their environment?
What kind of information can be communicated with hardware outputs?
How do programmers work with larger amounts of similar values?
How can complex real-world information be represented in code?
How can simple hardware be used to develop innovative new products?

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Course Syllabus

Course Content	Tentative Timeframe (Block Schedule)	State Standards
Unit 1: Problem Solving & Computing	1.5 weeks	**CSTA AP:** 1B-AP-08 1B-AP-11 1B-AP-16 2-AP-10 2-AP-15 2-AP-17 2-AP-18 **CSTA CS:** 1B-CS-01 1B-CS-02 2-CS-02 **CSTA IC:** 1B-IC-20 2-IC-20
Unit 2: Web Development	3.5 weeks	**CSTA AP:** 1B-AP-11 1B-AP-12 1B-AP-14 1B-AP-15 1B-AP-16 2-AP-13 2-AP-15 2-AP-16 2-AP-17 2-AP-18 2-AP-19 3A-AP-20 **CSTA IC:** 1B-IC-18 1B-IC-20 1B-IC-21 2-IC-20 2-IC-21 2-IC-22 2-IC-23 **CSTA NI:** 1B-NI-05
Unit 3: Interactive Animations & Games	4.5 weeks	**CSTA AP:** 2-AP-10 2-AP-11 2-AP-12 2-AP-13

		2-AP-14 2-AP-15 2-AP-16 2-AP-17 2-AP-18 2-AP-19 **CSTA IC:** 2-IC-21
Unit 4: The Design Process	3 weeks	**CSTA AP:** 2-AP-10 2-AP-13 2-AP-14 2-AP-15 2-AP-16 2-AP-17 2-AP-18 2-AP-19 **CSTA CS:** 2-CS-01 2-CS-02 **CSTA DA:** 2-DA-08 2-DA-09 **CSTA IC:** 2-IC-20 2-IC-21 2-IC-22
Unit 5: Data & Society	2.5 weeks	**CSTA AP:** 2-AP-10 2-AP-13 2-AP-15 2-AP-18 **CSTA DA:** 2-DA-07 2-DA-08 **CSTA IC:** 2-IC-20 2-IC-22 2-IC-23 **CSTA NI:** 2-NI-05 2-NI-06
Unit 6: Physical Computing	3 weeks	**CSTA AP:** 2-AP-10 2-AP-11 2-AP-12 2-AP-13 2-AP-14 2-AP-15 2-AP-16 2-AP-17 2-AP-18 2-AP-19 3A-AP-16 **CSTA CS:** 2-CS-01 2-CS-02

		2-CS-03 **CSTA IC:** 2-IC-20 2-IC-21

Teaching Strategies Utilized
Direct Instruction Indirect Instruction Unplugged and Plugged Activities Pair Programming Classroom Discussion Think-Pair-Share Peer Feedback Debugging Journaling

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Objectives	Level of Ach.	Suggested Learning Activities	Forms of Assessment	PA Stand.
The student will be able to: **Unit 1: Problem Solving and Computing** ● Explore a problem solving process that they will return to repeatedly throughout the course. ● Learn how computers input, output, store, and process information to help humans solve problems within the context of apps. ● Design an app that helps solve a problem of their choosing. **Chapter 1 - The Problem Solving Process** *Lesson 1: Intro to Problem Solving* *Lesson 2: The Problem Solving Process* *Lesson 3: Exploring Problem Solving* **Chapter 2 - Computers and Problem Solving** *Lesson 4: What is a Computer?* *Lesson 5: Input and Output* *Lesson 6: Processing* *Lesson 7: Storage* *Lesson 8: Project - Propose an App*	AW K AP M R	Direct Instruction Indirect Instruction Unplugged and Plugged Activities Pair Programming Classroom Discussion Think-Pair-Share Peer Feedback Debugging Journaling	Observation of Work Graded Assignments Homework Assessments	**CSTA AP:** 1B-AP-08 1B-AP-11 1B-AP-16 2-AP-10 2-AP-15 2-AP-17 2-AP-18 **CSTA CS:** 1B-CS-01 1B-CS-02 2-CS-02 **CSTA IC:** 1B-IC-20 2-IC-20

Resources/Materials
Code.org Computer with internet iPad with internet Notebook/journal Printed Handouts from Code.org

Interdisciplinary Relationships
Career Readiness - Problem solving process, basics of computers Mathematics - Problem solving techniques, input and output, storage quantities English - Written coding, punctuation **21st Century Student Outcomes:** Creativity and Innovation Critical Thinking and Problem Solving Communication and Collaboration ICT Literacy Flexibility and Adaptability Initiative and Self-Direction Social and Cross-Cultural Skills Productivity and Accountability

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The student will be able to: **Unit 2: Web Development** ● Create Websites using HTML and CSS inside Code.org's Web Lab environment. ● Consider questions of privacy and ownership on the internet as they develop their own personal websites. **Chapter 1: Creating Web Pages** *Lesson 1: Exploring Websites* *Lesson 2: Intro to HTML* *Lesson 3: Headings* *Lesson 4: Mini-Project: HTML Web Page* *Lesson 5: Digital Footprint* *Lesson 6: Styling Text with CSS* *Lesson 7: Mini-Project: Your Personal Style* *Lesson 8: Intellectual Property* *Lesson 9: Using Images* *Lesson 10: Websites for Expression* *Lesson 11: Styling Elements with CSS* *Lesson 12: Your Web Page - Prepare* *Lesson 13: Project - Personal Web Page* **Chapter 2: Multi-page Websites** *Lesson 14: Websites for a Purpose* *Lesson 15: Team Problem Solving* *Lesson 16: Sources and Research* *Lesson 17: CSS Classes* *Lesson 18: Planning a Multi-Page Site* *Lesson 19: Linking Pages* *Lesson 20: Project - Website for a Purpose* *Lesson 21: Peer Review and Final Touches*	AW K AP M R	Unplugged Activities Plugged Activities Pair Programming Think-Pair-Share Peer Feedback Debugging Journaling	Observation of Work Graded Assignments Homework Assessments	**CSTA AP:** 1B-AP-11 1B-AP-12 1B-AP-14 1B-AP-15 1B-AP-16 2-AP-13 2-AP-15 2-AP-16 2-AP-17 2-AP-18 2-AP-19 3A-AP-20 **CSTA IC:** 1B-IC-18 1B-IC-20 1B-IC-21 2-IC-20 2-IC-21 2-IC-22 2-IC-23 **CSTA NI:** 1B-NI-05

Resources/Materials

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Interdisciplinary Relationships

Career Readiness - Creating and supporting your own brand, use of web pages, creation of web pages
Digital Footprint Education - Intellectual property, knowledge of the internet
21st Century Student Outcomes:
Creativity and Innovation
Critical Thinking and Problem Solving
Communication and Collaboration

Information Literacy Media Literacy ICT Literacy Flexibility and Adaptability Initiative and Self-Direction Social and Cross-Cultural Skills Productivity and Accountability Leadership and Responsibility Global Awareness

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The student will be able to: **Unit 3: Interactive Animations and Games** ● Learn fundamental programming constructs and practices in the JavaScript programming language while developing animations and games in Code.org's Game Lab environment. ● Design animations and games of their own making. **Chapter 1: Images and Animations** *Lesson 1: Programming for Entertainment* *Lesson 2: Plotting Shapes* *Lesson 3: Drawing in Game Lab* *Lesson 4: Shapes and Parameters* *Lesson 5: Variables* *Lesson 6: Random Numbers* *Lesson 7: Sprites* *Lesson 8: Sprite Properties* *Lesson 9: Text* *Lesson 10: Mini-Project - Captioned Scenes* *Lesson 11: The Draw Loop* *Lesson 12: Sprite Movement* *Lesson 13: Mini-Project - Animation* *Lesson 14: Conditionals* *Lesson 15: Keyboard Input* *Lesson 16: Mouse Input* *Lesson 17: Project - Interactive Card* Chapter 2: Building Games *Lesson 18: Velocity* *Lesson 19: Collision Detection* *Lesson 20: Mini-Project - Side Scroller* *Lesson 21: Complex Sprite Movement* *Lesson 22: Collisions* *Lesson 23: Mini-Project - Flyer Game* *Lesson 24: Functions* *Lesson 25: The Game Design Process* *Lesson 26: Using the Game Design Process* *Lesson 27: Project - Design a Game*	AW K AP M R	Unplugged Activities Plugged Activities Pair Programming Think-Pair-Share Peer Feedback Debugging Journaling	Observation of Work Graded Assignments Homework Assessments	**CSTA AP:** 2-AP-10 2-AP-11 2-AP-12 2-AP-13 2-AP-14 2-AP-15 2-AP-16 2-AP-17 2-AP-18 2-AP-19 **CSTA IC:** 2-IC-21

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Interdisciplinary Relationships
Mathematics - Geometric use of shapes and space, locations of cursor using coordinates, velocity, conditionals, and functions Science - Speed vs velocity, scientific method and process English - Literacy skills, grammar skills, spelling, punctuation, proper use of camel case and Javascript **21st Century Student Outcomes:** Creativity and Innovation Critical Thinking and Problem Solving Communication and Collaboration ICT Literacy Flexibility and Adaptability Initiative and Self-Direction Social and Cross-Cultural Skills Productivity and Accountability

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The student will be able to: **Unit 4: The Design Process** ● Apply the problem solving process to the problems of others, learning to empathize with the needs of a user and design solutions to address those needs. ● Form teams to prototype an app of their own design, first on paper and eventually in Code.org's App Lab environment. **Chapter 1: User Centered Design** *Lesson 1: Analysis of Design* *Lesson 2: Understanding Your User* *Lesson 3: User-Centered Design Micro Activity* *Lesson 4: User Interfaces* *Lesson 5: Feedback and Testing* *Lesson 6: Identifying User Needs* *Lesson 7: Project - Paper Prototype* **Chapter 2: App Prototyping** *Lesson 8: Designing Apps for Good* *Lesson 9: Market Research* *Lesson 10: Paper Prototypes* *Lesson 11: Prototype Testing* *Lesson 12: Digital Design* *Lesson 13: Linking Screens* *Lesson 14: Testing the App* *Lesson 15: Improving and Iterating* *Lesson 16: Project - App Presentation*	AW K AP M R	Unplugged Activities Plugged Activities Pair Programming Think-Pair-Share Peer Feedback Debugging Journaling	Observation of Work Graded Assignments Homework Assessments	**CSTA AP:** 2-AP-10 2-AP-13 2-AP-14 2-AP-15 2-AP-16 2-AP-17 2-AP-18 2-AP-19 **CSTA CS:** 2-CS-01 2-CS-02 **CSTA DA:** 2-DA-08 2-DA-09 **CSTA IC:** 2-IC-20 2-IC-21 2-IC-22

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Interdisciplinary Relationships

Mathematics- Problem solving process
Science - Scientific method of steps to produce final project; idea, prototype, testing, improving, iteration, final project
English - Literacy skills, grammar skills, spelling, punctuation, proper use of camel case and Javascript
21st Century Student Outcomes:
Creativity and Innovation
Critical Thinking and Problem Solving

Communication and Collaboration ICT Literacy Flexibility and Adaptability Initiative and Self-Direction Social and Cross-Cultural Skills Productivity and Accountability Leadership and Responsibility Global Awareness Financial, Economic, Business and Entrepreneurial Literacy

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The student will be able to: **Unit 5: Data and Society** ● Explore different systems used to represent information in a computer and the challenges and tradeoffs posed by using them. ● Learn how collections of data are used to solve problems and how computers help to automate the steps of this process. **Chapter 1: Representing Information** *Lesson 1: Representation Matters* *Lesson 2: Patterns and Representation* *Lesson 3: ASCII and Binary Representation* *Lesson 4: Representing Images* *Lesson 5: Representing Numbers* *Lesson 6: Keeping Data Secret* *Lesson 7: Combining Representations* *Lesson 8: Project - Create a Representation* **Chapter 2: Solving Data Problems** *Lesson 9: Problem Solving and Data* *Lesson 10: Problem Solving with Big Data* *Lesson 11: Structuring Data* *Lesson 12: Making Decisions with Data* *Lesson 13: Interpreting Data* *Lesson 14: Automating Data Decisions* *Lesson 15: Project - Make a Recommendation*	AW K AP M R	Unplugged Activities Plugged Activities Pair Programming Think-Pair-Share Peer Feedback Debugging Journaling	Observation of Work Graded Assignments Homework Assessments	**CSTA AP:** 2-AP-10 2-AP-13 2-AP-15 2-AP-18 **CSTA DA:** 2-DA-07 2-DA-08 **CSTA IC:** 2-IC-20 2-IC-22 2-IC-23 **CSTA NI:** 2-NI-05 2-NI-06

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Mathematics - Data analyzing, problem solving English - Literacy skills, grammar skills, spelling, punctuation, proper use of camel case and Javascript **21st Century Student Outcomes:** Creativity and Innovation Critical Thinking and Problem Solving Communication and Collaboration Information Literacy Media Literacy ICT Literacy Flexibility and Adaptability Initiative and Self-Direction Social and Cross-Cultural Skills Productivity and Accountability Global Awareness Financial, Economic, Business and Entrepreneurial Literacy

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The student will be able to: **Unit 6: Physical Computing** ● Use Code.org's App Lab environment, in conjunction with the Adafruit Circuit Playground, to explore the relationship between hardware and software. ● Develop prototypes that mirror existing innovative computing platforms, before ultimately designing and prototyping one of their own. **Chapter 1: Programming with Hardware** *Lesson 1: Innovations in Computing* *Lesson 2: Designing Screens with Code* *Lesson 3: The Circuit Playground* *Lesson 4: Input Unplugged* *Lesson 5: Board Events* *Lesson 6: Getting Properties* *Lesson 7: Analog Input* *Lesson 8: The Program Design Process* *Lesson 9: Project - Make a Game* **Chapter 2: Building Physical Prototypes** *Lesson 10: Arrays and Color LEDs* *Lesson 11: Making Music* *Lesson 12: Arrays and For Loops* *Lesson 13: Accelerometer* *Lesson 14: Functions with Parameters* *Lesson 15: Circuits and Physical Prototypes* *Lesson 16: Project - Prototype an Innovation*	AW K AP M R	Unplugged Activities Plugged Activities Pair Programming Think-Pair-Share Peer Feedback Debugging Journaling	Observation of Work Graded Assignments Homework Assessments	**CSTA AP:** 2-AP-10 2-AP-11 2-AP-12 2-AP-13 2-AP-14 2-AP-15 2-AP-16 2-AP-17 2-AP-18 2-AP-19 3A-AP-16 **CSTA CS:** 2-CS-01 2-CS-02 2-CS-03 **CSTA IC:** 2-IC-20 2-IC-21

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