Computer Science Principles

The-Computer Science Principles course provides an introduction to the basic principles of computer science (CS) from the perspective of mobile computing, including programming in App Inventor, a graphical programming language for Android mobile devices. The lessons and materials used by students incorporate programming while also integrating all other CSP big ideas: creativity, abstraction, data and information, algorithms, the internet and global impact. The curriculum engages students and supports the development of problem solving skills honing in on the computational thinking practices as indicated in the CSP curriculum framework. Students learn to create socially useful computational artifacts using App Inventor as well as connect computing and learn about abstracting as they develop and analyze their programs. The curriculum also emphasizes communication and collaboration in a project-based approach and classroom environment. This course involves a strong writing component. Students will maintain a portfolio of their work, which will include several performance tasks in the areas of programming and the impact of computing technology. This is a year long course.

Course Overview

Course Goals	Essential Questions	Assessments
Students will • Design and implement solutions to problems by writing, running, and debugging computer programs. • Use and implement commonly used algorithms and data structures. • Develop and select appropriate algorithms and data structures to solve problems. • Code fluently in an object-oriented paradigm using the programming language. • Read and understand a large program consisting of several classes and interacting objects. Students should be able to read and understand a description of the design and development process leading to such a program. • Recognize the ethical and social implications of computer use.	• What is the value of computers in today's society? • What are the strengths and limitations of computers? • How does software affect our lives? • How do we breakdown a problem?	• Portfolios • Reading and Homework Assignments • Labs • Projects • Performance Task. • Oral and Video Presentations • Quizzes and Exams • Self-Check and Live Coding Exercises • AP CS Principles Exam (Optional)

Content Outline	Standards	Skills
- Unit 1 - Getting Started: Preview & Set up - Unit 2 - Introduction to Mobile Apps & Pair Programming - Unit 3 - Creating Graphics & Images Bit by Bit - Create - Programming Performance Task #1 (Practice) - Unit 4 - Exploring Computing: Animation, Simulation, & Modeling - Exam #1 - Explore - Impact of Computing Innovations Performance Task #1 (Practice) - Unit 5 - Algorithms & Procedural Abstraction - Explore - Impact of Computing Innovations Performance Task #2 - Unit 6 - Using and Analyzing Data & Information - Unit 7 - Communication Through The Internet - Create - Programming Performance Task #2 - Exam #2	**State of Connecticut Curriculum Frameworks** Connecticut State Standards are met in the following areas: CCRST2: Key Ideas and Details CCRST4: Craft and Structure CCRST7: Integration of Knowledge and Ideas CCRST9: Integration of Knowledge and Ideas CCWHST1: Text Types and Purposes CCWHST2: Text Types and Purposes CCWHST4: Production and Distribution of Writing CCWHST8: Research to Build and Present Knowledge CCWHST9: Research to Build and Present Knowledge	Students will - Evaluate information and synthesize a conclusive belief. - Use analytical skills and support conclusions with specificity. - Access and research information using the Internet. - Display creative thinking, problem solving, and decision-making. - Organize and maintain files. - Use computers to process information.

Pacing Guide			
1st Marking Period	2nd Marking Period	3rd Marking Period	4th Marking Period
Month 1-2	Month 3-4	Month 5-6	Month 7-8 Month 9 -10

Unit 1 - Getting Started: Preview & Set up *1 week*	*Unit 2 – Intro.to Mobile Apps & Pair Programming* *2 weeks*	*Unit 3 - Creating Graphics & Images Bit by Bit* *6 weeks*	*Create - Programming Performance Task #1 (Practice)* *2 weeks*	*Unit 4 - Exploring Computing: Animation, Simulation, & Modeling* *6 weeks*	Unit 5 - Algorithms & Procedural Abstraction 8 weeks	Unit 6 Computing Context 8 Weeks	*Unit 7 - Communication Through The Internet* 8 Weeks	*Create - Programming Performance Task #2* 8 Weeks

Unit 1 - Getting Started: Preview & Set up 1 weeks

This unit introduces the Computer Science Principles Curriculum Framework using Mobile CSP resources. Discussions of what computer science is, what a computer is, what the student expectations are in the course, what the course offers, and why students should take a computer science course, as well as a brief look at computer ethics, are supported with videos. A major activity is each student's creation of a Google Site, where he or she will host projects and reflections. The development and testing of the test app piques students' interest in the course.

Standards
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2. Work independently and collaboratively to solve problems and accomplish goals.
3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.

Connecticut Career and Technical Education – Computer Information Systems
Content Standard 1 – Impact on Society
- Assess the impact of information technology in a global society.
Content Standard 7 - Networking, Infrastructure, and Security Develop skills for networking and security.
- Design hardware and software network security solutions
- Distinguish among network environments (e.g., peer-to-peer, client server, thin client, n-tier, Internetworks, intranets, extranets).

National Standards: Information Technology
XI. Programming and Application Development:
- Achievement Standard: Design, develop, test, and implement programs
X. Systems Analysis and Design
- Achievement Standard: Analyze and design information systems using appropriate development tools

Unit Objectives	Focus Questions	Assessment
Students will: - Identify impacts of computing. - Describe connections between people and computing. - Explain connections between computing concepts. - Setup laptop and mobile devices to use App Inventor - Review the textbook, Blown to Bits	- Where do you see computers, and what do they do? - How do you prepare yourself for the jobs of the future? - What is the purpose of your favorite app and who created it??	- Project - Google Account and Portfolio Setup - App Inventor Setup - Diversity in CS

Skill Objectives	

Students will
 	
      Develop an algorithm for implementation in a program.
      Explain how programs implement algorithms.	

Technology Resources	Suggested Materials/Resources
• Computers • Internet • Projector or Interactive Whiteboard	• Google Account • Google Portfolio • MIT App Inventor • Appropriate websites and video tutorials Relevant News Articles or Videos

Unit 2 – Intro.to Mobile Apps & Pair Programming   2 weeks

Computing is a creative discipline in which creation takes many forms, such as remixing digital music, generating animations, developing Web sites, and writing programs. Students in this course engage in the creative aspects of computing by designing and developing interesting computational artifacts as well as by applying computing techniques to creatively solve problems.

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Unit Objectives	Focus Question	Assessments
Students will 1. Create an artifact with a practical, personal, or societal intent. 2. Select appropriate techniques to develop a computational artifact. 3. <u>Use appropriate algorithmic and information management principles.</u>	• What does it mean to program a computer? • What are some abstractions encountered in programming with App Inventor? • When can a conditional statement be used?	• Reading and Homework Assignments • Portfolios • Labs • Projects • Quizzes and Exams • Self-Check and Live Coding Exercises

Skill Objectives	
Students will • Create a computational artifact for creative expression. • Create a new computational artifact by combining or modifying existing artifacts. • Use computing tools and techniques for creative expression. • Develop a program for creative expression, to satisfy personal curiosity, or to create new knowledge. • Explain how programs implement algorithms. • Evaluate the correctness of a program.	
Technology Resources • Computers • Internet • Projector or Interactive Whiteboard	Suggested Materials/Resources • Google Account • Google Portfolio • MIT App Inventor • Appropriate websites and video tutorials Relevant News Articles or Videos

Unit 3 - Creating Graphics & Images Bit by Bit 6 weeks <u>top</u>

Computational thinking requires understanding and applying abstraction at multiple levels, such as privacy in social networking applications, logic gates and bits, and the human genome project. Students in this course use abstraction to develop models and simulations of natural and artificial phenomena, use them to make predictions about the world, and analyze their efficacy and validity.

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Unit Objectives	Focus Questions	Assessments
Students will - Explain how data, information, or knowledge is represented for computational use. - Explain how abstractions are used in computation or modeling. - Identify abstractions. - Describe modeling in a computational context.	- How can different types of data be represented in binary form? - What happens to data when they are deleted from a computer? - How is abstraction used in computer programming? - What might errors in stored or transmitted data look like?	- Portfolios - Reading and Homework Assignments - Labs - Projects - Quizzes and Exams - Self-Check and Live Coding Exercises

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Skill Objectives	
Students will • Apply a creative development process when creating computational artifacts. • Create a computational artifact for creative expression. • Create a computational artifact using computing tools and techniques to solve a problem. • Use computing tools and techniques for creative expression. • Develop an abstraction when writing a program or creating other computational artifacts. • Develop a program for creative expression, to satisfy personal curiosity, or to create new knowledge.] • Develop a correct program to solve problems. • Explain how programs implement algorithms. • Evaluate the correctness of a program. • Employ appropriate mathematical and logical concepts in programming.	
Technology Resources	Suggested Materials/Resources
• Computers • Internet • Projector or Interactive Whiteboard	• Google Account • Google Portfolio • MIT App Inventor • Appropriate websites and video tutorials Relevant News Articles or Videos

Create - Programming Performance Task #1 (Practice) 2 weeks

Computing is a creative activity. Creativity and computing are prominent forces in innovation; the innovations enabled by computing have had and will continue to have far-reaching impact. At the same time, computing facilitates exploration and the creation of computational artifacts and new knowledge that help people solve personal, societal, and global problems. This course emphasizes the creative aspects of computing. Students in this course use the tools

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Unit Objectives	Focus Questions	Assessments
Students will - How can a creative development process affect the creation of computational artifacts? - How can computing and the use of computational tools foster creative expression? - How can computing extend traditional forms of human expression and experience	- What are models, and why are they important? • What are the different ways in which computing affects our lives? - How possible is it for a computer to generate a truly random number? - How can one protect one's privacy in today's digital world??	- Portfolios - Labs - Projects - Performance Task. - Oral and Video Presentations - Self-Check and Live Coding Exercises

Computer Science Principles   BOE Approved 06/13/2017

Skill Objectives
Students will
- Create a computational artifact for creative expression.   - Create a new computational artifact by combining or modifying existing artifacts.   - Develop an abstraction when writing a program or creating other computational artifacts.   - Develop an algorithm for implementation in a program.   - Express an algorithm in a language.   - Develop a correct program to solve problems.   - Use abstraction to manage complexity in programs.   - Employ appropriate mathematical and logical concepts in programming

Technology Resources	Suggested Materials/Resources
- Computers - Internet - Projector or Interactive Whiteboard	- Google Account - Google Portfolio - MIT App Inventor - Appropriate websites and video tutorials Relevant News Articles or Videos

Unit 4 - Exploring Computing: Animation, Simulation, & Modeling 6 weeks

The results and artifacts of computation and the computational techniques and strategies that generate them can be understood both intrinsically for what they are as well as for what they produce. They can also be analyzed and evaluated by applying aesthetic, mathematical, pragmatic, and other criteria. Students in this course design and produce solutions, models, and artifacts, and they evaluate and analyze their own computational work as well as the computational work others have produced.

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Unit Objectives	Focus Questions	Assessments
Students will A. Evaluate a proposed solution to a problem. B. Locate and correct errors. C. Explain how an artifact functions. D. Justify appropriateness and correctness of a solution, model, or artifact.	• What are models, and why are they important? • What are the different ways in which computing affects our lives? • How possible is it for a computer to generate a truly random number? • How can one protect one's privacy in today's digital	• Portfolios • Reading and Homework Assignments • Labs • Projects • Performance Task. • Quizzes and Exams

	world?	• Self-Check and Live Coding Exercises

Skill Objectives
Students will • Use models and simulations to represent phenomena. • Use models and simulations to formulate, refine, and test hypotheses. • Collaborate when processing information to gain insight and knowledge. • Develop an algorithm for implementation in a program. • Develop a correct program to solve problems. • Employ appropriate mathematical and logical concepts in programming. • Use computing tools and techniques for creative expression.

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Unit 5 - Algorithms & Procedural Abstraction 8 weeks

Students in this course describe computation and the impact of technology and computation, explain and justify the design and appropriateness of their computational choices, and analyze and describe both computational artifacts and the results or behaviors of such artifacts. Communication includes written and oral descriptions supported by graphs, visualizations, and computational analysis.

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Unit Objectives	Focus Questions	Assessments
Students will - Explain the meaning of a result in context. - Describe computation with accurate and precise language, notations, or visualizations. - Summarize the purpose of a computational artifact.	- What is the fastest way to sort a deck of cards? - When should a loop within a loop be used? - How does the Google search engine work?	- Portfolios - Reading and Homework Assignments - Labs - Projects - Quizzes and Exams

		• Self-Check and Live Coding Exercises

Skill Objectives

Students will

- Collaborate when processing information to gain insight and knowledge.
- Develop an algorithm for implementation in a program.
- Express an algorithm in a language.
- Evaluate algorithms analytically and empirically for efficiency, correctness, and clarity.
- Collaborate when processing information to gain insight and knowledge.
- Develop an algorithm for implementation in a program.
- Explain the difference between algorithms that run in a reasonable time and those that do not run in a reasonable time.
- Explain the difference between solvable and unsolvable problems in computer science.
- Explain the existence of undecidable problems in computer science.
- Evaluate algorithms analytically and empirically for efficiency, correctness, and clarity..

Technology Resources	Suggested Materials/Resources
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Unit 6 Computing Context 8 Weeks

Innovation can occur when people work together or independently. People working collaboratively can often achieve more than individuals working alone. Learning to collaborate effectively includes drawing on diverse perspectives, skills, and the backgrounds of peers to address complex and open-ended problems. Students in this course collaborate on a number of activities, including investigation of questions using data sets and in the production of computational artifacts.

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Unit Objectives	Focus Questions	Assessment
• Unit Objectives • Students will: • Collaborate with another student in solving a computational problem. • Collaborate with another student in producing an artifact. • Share the workload by providing individual contributions to an overall collaborative effort.	• How do we interact with data? ._ • What is the difference between data and information? • What does the adage "A picture is worth a thousand words" mean in terms of data visualization?	• Portfolios • Reading and Homework Assignments • Labs • Projects • Performance Task.

• Foster a constructive, collaborative climate by resolving conflicts and facilitating the contributions of a partner or team member. • Exchange knowledge and feedback with a partner or team member. • Review and revise their work as needed to create a high-quality artifact.		• Quizzes and Exams • Self-Check and Live Coding Exercises

Skill Objectives

Students will
- Create a computational artifact for creative expression.
- Create a computational artifact using tools and techniques to solve a problem.
- Create a new computational artifact by combining or modifying existing artifacts.
- Find patterns and test hypotheses about digitally processed information to gain insight and knowledge.]
- Develop a correct program to solve problems.
- Use abstraction to manage complexity in programs.
- Employ appropriate mathematical and logical concepts in programming..

Technology Resources	Suggested Materials/Resources
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Unit 7 - Communication Through The Internet 8 Weeks

Focuses on the Internet, how it works, and how it is secured. Students take an in-depth look at cryptography. Three apps - No Texting While Busy, My Direction, and Broadcast Hub - are used to illustrate features of the Internet and its impact. Command-line features and some network architecture are introduced and discussed. Students complete the Create Performance Task at the end of this unit.

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Unit Objectives	Focus Questions	Assessment
- Unit Objectives - Students will: - Collaborate with another student in solving a computational problem. - Collaborate with another student in producing an artifact. - Share the workload by providing individual contributions to an overall collaborative effort.	- What do the Internet and the World Wide Web have in common? - How does an email go from one computer to the other? - What activities and tools support a secure Web experience?	- Portfolios - Reading and Homework Assignments - Labs - Projects - Performance Task. - Quizzes and Exams

• Foster a constructive, collaborative climate by resolving conflicts and facilitating the contributions of a partner or team member. • Exchange knowledge and feedback with a partner or team member. • Review and revise their work as needed to create a high-quality artifact. •		• Self-Check and Live Coding Exercises

Skill Objectives

Students will

- Create a computational artifact for creative expression.
- Create a computational artifact using tools and techniques to solve a problem.
- Create a new computational artifact by combining or modifying existing artifacts.
- Find patterns and test hypotheses about digitally processed information to gain insight and knowledge.]
- Develop a correct program to solve problems.
- Use abstraction to manage complexity in programs.
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Create - Programming Performance Task #2   8 Weeks

Abstraction reduces information and detail to facilitate focus on relevant concepts. Everyone uses abstraction on a daily basis to effectively manage complexity. In computer science, abstraction is a central problem-solving technique. It is a process, a strategy, and the result of reducing detail to focus on concepts relevant to understanding and solving problems. This course requires students to use abstractions to model the world and communicate with people as well as with machines. Students in this course learn to work with multiple levels of abstraction while engaging with computational problems and systems; use models and simulations that simplify complex topics in graphical, textual, and tabular formats; and use snapshots of models and simulation outputs to understand how data changes, identify patterns, and recognize abstractions.

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Unit Objectives	Focus Questions	Assessment
Students will: • Collaborate with another student in solving a computational problem. • Collaborate with another student in producing an artifact.	• How are vastly different kinds of data, physical phenomena, and mathematical concepts represented on a computer? • How does abstraction help us in writing programs, creating computational artifacts, and solving problems?	• Portfolios • Reading and Homework Assignments • Labs • Projects • Performance Task.

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• Share the workload by providing individual contributions to an overall collaborative effort. • Foster a constructive, collaborative climate by resolving conflicts and facilitating the contributions of a partner or team member. • Exchange knowledge and feedback with a partner or team member. • Review and revise their work as needed to create a high-quality artifact. •	• How can computational models and simulations help generate new understanding and knowledge?	• Oral and Video Presentations • Self-Check and Live Coding Exercises

Skill Objectives

Students will

- Create a computational artifact for creative expression.
- Create a computational artifact using tools and techniques to solve a problem.
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- Find patterns and test hypotheses about digitally processed information to gain insight and knowledge.]
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