

FOLSOM CORDOVA UNIFIED SCHOOL DISTRICT

COMPUTER SCIENCE AND PROGRAMMING

Date: December 2017

Proposed Grade Level(s): 10-12

Grading: A-F

CTE Sector / Pathway: Information and Communication Technologies / Systems Programming

Course Length: 1 year

Subject Area: Career Technical Education

Credits: 5.0 per semester

Prerequisite(s): Grade C or better in Integrated Math 1 and C or better in Exploring Computer Science

Intent to Pursue 'A-G' College Prep Status: Yes

A-G Course Identifier: G: Elective

COURSE DESCRIPTION:

Computer Science and Programming is a second year computer science course with an emphasis on programming concepts and methodology. Students will learn algorithmic thinking, expression, and be able to understand basic principles of programming logic. They will learn to communicate complex ideas simply and solve problems logically. Topics include computer hardware, troubleshooting, computer security, networking, and program development. Students will engage in several in-depth projects to demonstrate the real-world application of computing and programming.

GENERAL GOALS/ESSENTIAL QUESTIONS:

- Develop computational practices of algorithm development, problem solving, and programming.
- Understand networking concepts, privacy, and security.
- Understand fundamental computer science concepts like objects, classes, and efficiency.
- Understand object-oriented programming languages using Alice programming.
- Analyze a problem, design, implement, and evaluate programs to solve small problems.
- Understand beginning concepts of electronic circuits and electrical wiring.
- Write code for the Arduino to communicate with sensors, graphics, and sound.
- Learn processing language between the Arduino and the computer.
- Learn about connectivity and wireless communication using Bluetooth.
- Build fully-functional projects with Arduino 101.
- Understand the purpose of data sets and how industry utilizes "big data."
- Learn networking concepts and how multiple computers communicate.
- Understand career options in the field of computer science.
- Enhance collaboration, leadership, and teamwork skills.

COMMON CORE STATE ANCHOR STANDARDS FOR READING (K-12):

Key Ideas and Details

1. Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.

2. Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
3. Analyze how and why individuals, events, or ideas develop and interact over the course of a text.

Craft and Structure

4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.
5. Analyze the structure of texts, including how specific sentences, paragraphs, and larger portions of the text (e.g., a section, chapter, scene, or stanza) relate to each other and the whole.
6. Assess how point of view or purpose shapes the content and style of a text.

Integration of Knowledge and Ideas

7. Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.
8. Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.
9. Analyze how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take.

Reading Range / Text Complexity

10. Read and comprehend complex literary and informational texts independently and proficiently.

COMMON CORE STATE ANCHOR STANDARDS FOR WRITING (K-12):

Text Types and Purposes

1. Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.
2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
3. Write narratives to develop real or imagined experiences or events using effective technique, well-chosen details and well-structured event sequences.

Production and Distribution of Writing

4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach.
6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

Research to Build Knowledge

7. Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.
8. Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.
9. Draw evidence from literary or informational texts to support analysis, reflection, and research.

Range of Writing

10. Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.

COMMON CORE STATE ANCHOR STANDARDS FOR SPEAKING AND LISTENING (K-12):

Comprehension and Collaboration

1. Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
2. Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.
3. Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric.

Presentation of Knowledge and Ideas

4. Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and ensure that the organization, development, and style are appropriate to task, purpose, and audience.
5. Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations.
6. Adapt speech to a variety of contexts and communicative tasks, demonstrating command of formal English when indicated or appropriate.

CTE STANDARDS FOR CAREER READY PRACTICE:

1. Apply appropriate technical skills and academic knowledge.
Career-ready individuals readily access and use the knowledge and skills acquired through experience and education. They make connections between abstract concepts with real-world applications and recognize the value of academic preparation for solving problems, communicating with others, calculating measures, and other work-related practices.
2. Communicate clearly, effectively, and with reason.
Career-ready individuals communicate thoughts, ideas, and action plans with clarity, using written, verbal, electronic, and/or visual methods. They are skilled at interacting with others, are active listeners who speak clearly and with purpose, and are comfortable with the terminology common to the workplace environment. Career-ready individuals consider the audience for their communication and prepare accordingly to ensure the desired outcome.
3. Develop an education and career plan aligned with personal goals.
Career-ready individuals take personal ownership of their own educational and career goals and manage their individual plan to attain these goals. They recognize the value of each step in the educational and experiential process and understand that nearly all career paths require ongoing education and experience to adapt to practices, procedures, and expectations of an ever-changing work environment. They seek counselors, mentors, and other experts to assist in the planning and execution of education and career plans.
4. Apply technology to enhance productivity.
Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring and using new technology. They understand the inherent risks—personal and organizational—of technology applications and they take actions to prevent or mitigate these risks.
5. Utilize critical thinking to make sense of problems and persevere in solving them.
Career-ready individuals recognize problems in the workplace, understand the nature of the problems, and devise effective plans to solve the problems. They thoughtfully investigate the root cause of a problem prior to introducing solutions. They carefully consider options to solve the problem and, once agreed upon, follow through to ensure the problem is resolved.
6. Practice personal health and understand financial literacy.
Career-ready individuals understand the relationship between personal health and workplace performance. They contribute to their personal well-being through a healthy diet, regular exercise, and mental health

activities. Career-ready individuals also understand that financial literacy leads to a secure future that enables career success.

7. Act as a responsible citizen in the workplace and the community.

Career-ready individuals understand the obligations and responsibilities of being a member of a community and demonstrate this understanding every day through their interactions with others. They are aware of the impacts of their decisions on others and the environment around them and think about the short-term and long-term consequences of their actions. They are reliable and consistent in going beyond minimum expectations and in participating in activities that serve the greater good.

8. Model integrity, ethical leadership, and effective management.

Career-ready individuals consistently act in ways that align with personal and community-held ideals and principles. They employ ethical behaviors and actions that positively influence others. They have a clear understanding of integrity and act on this understanding in every decision. They use a variety of means to positively impact the direction and actions of a team or organization, and they recognize the short-term and long-term effects that management's actions and attitudes can have on productivity, morale, and organizational culture.

9. Work productively in teams while integrating cultural and global competence.

Career-ready individuals positively contribute to every team as both team leaders and team members. They apply an awareness of cultural differences to avoid barriers to productive and positive interaction. They interact effectively and sensitively with all members of the team and find ways to increase the engagement and contribution of other members.

10. Demonstrate creativity and innovation.

Career-ready individuals recommend ideas that solve problems in new and different ways and contribute to the improvement of the organization. They consider unconventional ideas and suggestions by others as solutions to issues, tasks, or problems. They discern which ideas and suggestions may have the greatest value. They seek new methods, practices, and ideas from a variety of sources and apply those ideas to their own workplace practices.

11. Employ valid and reliable research strategies.

Career-ready individuals employ research practices to plan and carry out investigations, create solutions, and keep abreast of the most current findings related to workplace environments and practices. They use a reliable research process to search for new information and confirm the validity of sources when considering the use and adoption of external information or practices.

12. Understand the environmental, social, and economic impacts of decisions.

Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact other people, organizations, the workplace, and the environment. They are aware of and utilize new technologies, understandings, procedures, and materials and adhere to regulations affecting the nature of their work. They are cognizant of impacts on the social condition, environment, workplace, and profitability of the organization.

CTE KNOWLEDGE AND PERFORMANCE ANCHOR STANDARDS:

- 1.0 Academics: Students will analyze and apply appropriate academic standards required for successful industry sector pathway completion leading to postsecondary education and employment.
- 2.0 Communications: Students will acquire and accurately use Information and Communications Technology sector terminology and protocols at the career and college readiness level for communicating effectively in oral, written, and multimedia formats.
- 3.0 Career Planning and Management: Students will integrate multiple sources of career information from diverse formats to make informed career decisions, solve problems, and manage personal career plans.
- 4.0 Technology: Students will use existing and emerging technology, to investigate, research, and produce products and services, including new information, as required in the Information and Communication Technologies sector workplace environment.

- 5.0 Problem Solving and Critical Thinking: Students will conduct short, as well as more sustained, research to create alternative solutions to answer a question or solve a problem unique to the Information and Communication Technologies sector using critical and creative thinking, logical reasoning, analysis, inquiry, and problem-solving techniques.
- 6.0 Health and Safety: Students demonstrate health and safety procedures, regulations, and personal health practices and determine the meaning of symbols, key terms, and domain-specific words and phrases as related to the Information and Communication Technologies sector workplace environment.
- 7.0 Responsibility and Flexibility: Students will initiate, and participate in, a range of collaborations demonstrating behaviors that reflect personal and professional responsibility, flexibility, and respect in the Information and Communication Technologies sector workplace environment and community settings.
- 8.0 Ethics and Legal responsibilities: Students will practice professional, ethical, and legal behavior, responding thoughtfully to diverse perspectives and resolving contradictions when possible, consistent with applicable laws, regulations, and organizational norms.
- 9.0 Leadership and Teamwork: Students will work with peers to promote divergent and creative perspectives, effective leadership, group dynamics, team and individual decision making, benefits of workforce diversity, and conflict resolution as practiced in the SkillsUSA career technical student organizations.
- 10.0 Technical Knowledge and Skills: Students will apply essential technical knowledge and skills common to all pathways in the Information and Communication Technologies sector, following procedures when carrying out experiments or performing technical tasks.
- 11.0 Demonstration and Application: Students demonstrate and apply the knowledge and skills contained in the Information and Communication Technologies anchor standards, pathway standards, and performance indicators in classroom, laboratory, and workplace settings.

DETAILED UNITS OF INSTRUCTION:

Unit I: Human Computer Interaction

Human computer interaction is the study of how we interact with different types of computers. In this unit, students will be introduced to the Internet of Things (IoT); the concept where everyday objects are connected and share data over the Internet. Students will research and present on various technology inventions and/or pioneers in computer science, and how they have impacted society and our daily lives.

Unit II: Programming

The intention of this unit is to highlight what can be created by using programming as a tool. Students will be introduced to object-oriented and event-driven programming concepts. Students will use the Alice 3 animation program to create projects that reflect the diversity of interests in the classroom and are personal to individual students.

Understand and demonstrate:

- Classes, objects, methods and parameters
- Events and events handling
- Functions and control statements
- Repetition: Definite and conditional loops, and recursion
- Arrays
- Sorting
- Searching
- Variables and revisiting inheritance
- Debugging techniques
- Analyze, plan, design, implement, and test computer programs

Unit III: Cyber Ethics, Laws, Networking, and Security

Students will be introduced to the CyberPatriot National Youth Cyber Education program through a series of lessons of online safety, cyber ethics, and principles of cyber security. Students will be able to demonstrate ethical use of communication media and devices, recognize basic security risks/procedures and how to prevent them, describe the major components and functions of computer systems and networks, and identify laws and regulations that impact computer users.

Unit IV: Computing and Data Analysis

Students will explore the use of data to answer questions. Using the Data Analysis Process, students will create algorithmic solutions to questions. Over the course of the unit students will compile, analyze, and report the results of their work with data.

Unit V: Invention/Maker Project

Students will be introduced to the Intel Maker Project. Students will experiment with electronic kits, software tools, and everyday objects to explore the world of "hands-on" learning and programming. Students will analyze a problem, specify the requirements, design, implement, and evaluate a computer-based program utilizing computer concepts learned in class.

TEXTBOOKS AND RESOURCE MATERIALS:

Primary Textbook:

Dann, Wanda. *Alice 3 to Java: Learning Creative Programming through Storytelling and Gaming*. Pearson, 2018.

Resource Materials:

Dann, Wanda P., et al. *Learning to Program with Alice*. Prentice Hall, 2012.

Oracle Academy On-Line Curriculum. iLearning.oracle.com/ilearn/en/learner/jsp/logn.jsp?site=OracleAcad.

CTE PATHWAY STANDARDS TO BE ADDRESSED:

C1.0 Identify and apply the systems development process.

C1.1 Identify the phases of the systems development life cycle, including analysis, design, programming, testing, implementation, maintenance, and improvement.

C1.2 Identify and describe models of systems development, systems development life cycle (SDLC), and agile computing.

C1.3 Identify and describe how specifications and requirements are developed for new and existing software applications.

C1.4 Work as a member of, and within the scope and boundaries of, a development project team.

C1.5 Track development project milestones using the concept of versions.

C1.6 Diagram processes using flowcharts and the Unified Modeling Language.

C2.0 Define and analyze systems and software requirements.

C2.1 Describe the major purposes and benefits of development, including automation, improving productivity, modeling and analysis, and entertainment.

C2.2 Recognize and prevent unintended consequences of development work: programming errors, security issues, health and environmental risks, and privacy concerns.

- C2.3 Develop strategies that target the specific needs and desires of the customer.
- C2.4 Analyze customers' needs for development.
- C2.5 Determine and document the requirements and alternative solutions to fulfill the customers' needs.
- C4.0 Develop software using programming languages.
 - C4.1 Identify and describe the abstraction level of programming languages from low-level, hardware-based languages to high-level, interpreted, Web-based languages.
 - C4.3 Identify and use different authoring tools and integrated development environments (IDEs).
 - C4.4 Identify and apply data types and encoding.
 - C4.5 Demonstrate awareness of various programming paradigms, including procedural, object oriented, event-driven, and multithreaded programming.
 - C4.6 Use proper programming language syntax.
 - C4.7 Use various data structures, arrays, objects, files, and databases.
 - C4.8 Use object oriented programming concepts, properties, methods, and inheritance.
 - C4.9 Create programs using control structures, procedures, functions, parameters, variables, error recovery, and recursion.
 - C4.10 Create and know the comparative advantages of various queue, sorting, and searching algorithms.
 - C4.11 Document development work for various audiences, such as comments for other programmers, and manuals for users.
- C5.0 Test, debug, and improve software development work.
 - C5.1 Identify the characteristics of reliable, effective, and efficient products.
 - C5.2 Describe the ways in which specification changes and technological advances can require the modification of programs.
 - C5.3 Use strategies to optimize code for improved performance.
 - C5.4 Test software and projects.
 - C5.5 Evaluate results against initial requirements.
 - C5.6 Debug software as part of the quality assurance process.
- C6.0 Integrate a variety of media into development projects.
 - C6.1 Identify the basic design elements necessary to produce effective print, video, audio, and interactive media.
 - C6.4 Develop a presentation or other multimedia project: video, game, or interactive Web sites, from storyboard to production.
 - C6.5 Analyze the use of media to determine the appropriate file format and level of compression.
 - C6.6 Integrate media into a full project using appropriate tools.
 - C6.7 Create and/or capture professional-quality media, images, documents, audio, and video clips.
- C7.0 Develop Web and online projects.
 - C7.5 Create an online project, Web-based business, and e-portfolio.

C8.0 Develop databases.

C8.1 Describe the critical function of databases in modern organizations.

C8.2 Identify and use the basic structures of databases, fields, records, tables, and views.

C8.4 Use data modeling techniques to create databases based upon business needs.

C8.5 Use queries to extract and manipulate data (select queries, action queries).

C8.7 Export and import data to and from other applications and a database recognizing the limitations and challenges inherent in the process.

C8.8 Analyze and display data to assist with decision making using methods like cross tabulations, graphs, and charts.

C9.0 Develop software for a variety of devices, including robotics.

C9.1 Demonstrate awareness of the applications of device development work, including personalized computing, robotics, and smart appliances. C9.2 Install equipment, assemble hardware, and perform tests using appropriate tools and technology.

C9.3 Use hardware to gain input, process information, and take action.

C9.5 Program a micro-controller for a device or robot.

DISTRICT ESLRS TO BE ADDRESSED:

- **Self-Directed Learners:** Students will utilize their knowledge of design and manufacturing to effectively complete learning goals and objectives. This will require students to apply multiple attempts to test and verify concepts through application.
- **Constructive Thinkers:** Design and product development will need to be accomplished with a group setting where communication and group accountability will be critical for success. Students will also learn how to effectively apply learned curriculum to real world applications; how best to research and request information, interpret, and display information correctly.
- **Effective Communicators:** Students will be expected to design original products, and students will provide information on designing and developing creative and efficient ways to develop products.
- **Collaborative Workers:** Using curriculum fundamentals of designing and manufacturing, students will collaboratively work in groups to design and develop original products; as a team they will need to develop their own unique product. They will establish group responsibilities and processes to function effectively and develop within a timely manner.
- **Quality Producers/Performers:** Students will use knowledge from the course to safely and appropriately design and develop original products.
- **Responsible Citizens:** Students will develop and practice processes to develop products within their groups.

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