# CS Standards Crosswalk: Summary Checklist
# CSTA K-12 Computer Science Standards and Oracle Java Fundamentals (2014)

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| **CSTA Website** | http://csta.acm.org/Curriculum/sub/K12Standards.html |
| **Oracle Website** | https://academy.oracle.com/oa-web-introcs-curriculum.html |
| **Oracle Contact** | academy_ww@oracle.com |

## *Level 2 (recommended for grades 6–9) Computer Science and Community*

Middle school/junior high school students begin using computational thinking as a problem-solving tool. They begin to appreciate the ubiquity of computing and the ways in which computer science facilitates communication and collaboration. Students begin to experience computational thinking as a means of addressing issues relevant, not just to them, but to the world around them.

***✓ = CSTA standard is met by one or a combination of Java Fundamentals objectives.***

***C = one or more Java Fundamentals objectives contribute to but are not sufficient for meeting the CSTA standard.***

| **CSTA Standard:** ***Level 2 (Grades 6-9)*** | **Course Meets Standard** |
|---|---|
| ***Strand: Computational Thinking*** | |
| Use the basic steps in algorithmic problem-solving to design solutions (e.g., problem statement and exploration, examination of sample instances, design, implementing a solution, testing and evaluation). | ✓ |
| Describe the process of parallelization as it relates to problem solving. | |
| Define an algorithm as a sequence of instructions that can be processed by a computer. | |
| Evaluate ways that different algorithms may be used to solve the same problem. | ✓ |
| Act out searching and sorting algorithms. | |
| Describe and analyze a sequence of instructions being followed (e.g., describe a character's behavior in a video game as driven by rules and algorithms). | |
| Represent data in a variety of ways including text, sounds, pictures and numbers. | |
| Use visual representations of problem states, structures and data (e.g., graphs, charts, network diagrams, flowcharts). | ✓ |
| Interact with content-specific models and simulations (e.g., ecosystems, epidemics, molecular dynamics) to support learning and research. | |
| Evaluate what kinds of problems can be solved using modeling and simulation. | |
| Analyze the degree to which a computer model accurately represents the real world. | |
| Use abstraction to decompose a problem into sub problems. | ✓ |
| Understand the notion of hierarchy and abstraction in computing including high level languages, translation, instruction set and logic circuits. | ✓ |
| Examine connections between elements of mathematics and computer science including binary numbers, logic, sets and functions. | **C** |
| Provide examples of interdisciplinary applications of computational thinking. | |
| ***Strand: Collaboration*** | |
| Apply productivity/ multimedia tools and peripherals to group collaboration and support learning throughout the curriculum. | |
| Collaboratively design, develop, publish and present products (e.g., videos, podcasts, websites) using technology resources that demonstrate and communicate curriculum concepts. | **C** |
| Collaborate with peers, experts and others using collaborative practices such as pair programming, working in project teams and participating in-group active learning activities. | **C** |
| Exhibit dispositions necessary for collaboration: providing useful feedback, integrating feedback, understanding and accepting multiple perspectives, socialization. | |

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| ***Strand: Computing Practice and Programming*** | |
| Select appropriate tools and technology resources to accomplish a variety of tasks and solve problems. | ✓ |
| Use a variety of multimedia tools and peripherals to support personal productivity and learning throughout the curriculum. | |
| Design, develop, publish and present products (e.g., web pages, mobile applications, animations) using technology resources that demonstrate and communicate curriculum concepts. | **C** |
| Demonstrate an understanding of algorithms and their practical application. | |
| Implement problem solutions using a programming language, including: looping behavior, conditional statements, logic, expressions, variables and functions. | ✓ |
| Demonstrate good practices in personal information security, using passwords, encryption and secure transactions. | **C** |
| Identify interdisciplinary careers that are enhanced by computer science. | |
| Demonstrate dispositions amenable to open-ended problem solving and programming (e.g., comfort with complexity, persistence, brainstorming, adaptability, patience, propensity to tinker, creativity, accepting challenge). | |
| Collect and analyze data that is output from multiple runs of a computer program. | |
| ***Strand: Computers and Communication Devices*** | |
| Recognize that computers are devices that execute programs. | |
| Identify a variety of electronic devices that contain computational processors. | |
| Demonstrate an understanding of the relationship between hardware and software. | |
| Use developmentally appropriate, accurate terminology when communicating about technology. | ✓ |
| Apply strategies for identifying and solving routine hardware problems that occur during everyday computer use. | |
| Describe the major components and functions of computer systems and networks. | |
| Describe what distinguishes humans from machines, focusing on human intelligence versus machine intelligence and ways we can communicate. | |
| Describe ways in which computers use models of intelligent behavior (e.g., robot motion, speech and language understanding, and computer vision). | |
| ***Strand: Community, Global, and Ethical Impacts*** | |
| Exhibit legal and ethical behaviors when using information and technology and discuss the consequences of misuse. | **C** |
| Demonstrate knowledge of changes in information technologies over time and the effects those changes have on education, the workplace and society. | |
| Analyze the positive and negative impacts of computing on human culture. | |
| Evaluate the accuracy, relevance, appropriateness, comprehensiveness and bias of electronic information sources concerning real-world problems. | |
| Describe ethical issues that relate to computers and networks (e.g., security, privacy, ownership and information sharing). | **C** |
| Discuss how the unequal distribution of computing resources in a global economy raises issues of equity, access and power. | |

***Level 3 (recommended for grades 9–12) Applying concepts and creating real-world solutions***

Level 3 is divided into three discrete courses, each of which focuses on different facets of computer science as a discipline. Throughout these courses, students can master more advanced computer science concepts and apply those concepts to develop virtual and real-world artifacts.

***Level 3A: (recommended for grades 9 or 10) Computer Science in the Modern World***

This course is recommended for all students. Its goal is to solidify students' understanding of computer science principles and practices so that they can make informed choices and use appropriate computational tools and techniques in whatever career they decide to pursue. They should also appreciate the breadth of computing and its influence in almost every aspect of modern life.

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| **CSTA Standard:** ***Level 3A (Grade 9 or 10)*** | **Course Meets Standard** |
|---|---|
| ***Strand: Computational Thinking*** | |
| Use predefined functions and parameters, classes and methods to divide a complex problem into simpler parts. | ✓ |
| Describe a software development process used to solve software problems (e.g., design, coding, testing, verification). | |
| Explain how sequence, selection, iteration, and recursion are building blocks of algorithms. | ✓ |
| Compare techniques for analyzing massive data collections. | |
| Describe the relationship between binary and hexadecimal representations. | |
| Analyze the representation and trade-offs among various forms of digital information. | |
| Describe how various types of data are stored in a computer system. | |
| Use modeling and simulation to represent and understand natural phenomena. | |
| Discuss the value of abstraction to manage problem complexity. | ✓ |
| Describe the concept of parallel processing as a strategy to solve large problems. | |
| Describe how computation shares features with art and music by translating human intention into an artifact. | |
| ***Strand: Collaboration*** | |
| Work in a team to design and develop a software artifact. | |
| Use collaborative tools to communicate with project team members (e.g., discussion threads, wikis, blogs, version control, etc.). | |
| Describe how computing enhances traditional forms and enables new forms of experience, expression, communication, and collaboration. | |
| Identify how collaboration influences the design and development of software products. | |
| ***Strand: Computing Practice and Programming*** | |
| Create and organize web pages through the use of a variety of web programming design tools. | |
| Use mobile devices/ emulators to design, develop, and implement mobile computing applications. | |
| Use various debugging and testing methods to ensure program correctness (e.g., test cases, unit testing, white box, black box, integration testing) | ✓ |
| Apply analysis, design, and implementation techniques to solve problems (e.g., use one or more software lifecycle models). | ✓ |
| Use Application Program Interfaces (APIs) and libraries to facilitate programming solutions. | ✓ |
| Select appropriate file formats for various types and uses of data. | |
| Describe a variety of programming languages available to solve problems and develop systems. | |
| Explain the program execution process. | |
| Explain the principles of security by examining encryption, cryptography, and authentication techniques. | |
| Explore a variety of careers to which computing is central. | |

| CSTA Standard: *Level 3A (Grade 9 or 10)* | Course Meets Standard |
|---|---|
| Describe techniques for locating and collecting small and large-scale data sets. | |
| Describe how mathematical and statistical functions, sets, and logic are used in computation. | |
| ***Strand: Computers and Communication Devices*** | |
| Describe the unique features of computers embedded in mobile devices and vehicles (e.g., cell phones, automobiles, airplanes). | |
| Develop criteria for purchasing or upgrading computer system hardware. | |
| Describe the principal components of computer organization (e.g., input, output, processing, and storage). | |
| Compare various forms of input and output. | |
| Explain the multiple levels of hardware and software that support program execution (e.g., compilers, interpreters, operating systems, networks). | |
| Apply strategies for identifying and solving routine hardware and software problems that occur in everyday life. | |
| Compare and contrast client-server and peer-to-peer network strategies. | |
| Explain the basic components of computer networks (e.g., servers, file protection, routing, spoolers and queues, shared resources, and fault-tolerance). | |
| Describe how the Internet facilitates global communication. | |
| Describe the major applications of artificial intelligence and robotics. | |
| ***Strand: Community, Global, and Ethical Impacts*** | |
| Compare appropriate and inappropriate social networking behaviors. | |
| Discuss the impact of computing technology on business and commerce (e.g., automated tracking of goods, automated financial transactions, e-commerce, cloud computing). | |
| Describe the role that adaptive technology can play in the lives of people with special needs. | |
| Compare the positive and negative impacts of technology on culture (e.g., social networking, delivery of news and other public media, and intercultural communication). | |
| Describe strategies for determining the reliability of information found on the Internet. | |
| Differentiate between information access and information distribution rights. | |
| Describe how different kinds of software licenses can be used to share and protect intellectual property. | |
| Discuss the social and economic implications associated with hacking and software piracy. | |
| Describe different ways in which software is created and shared and their benefits and drawbacks (commercial software, public domain software, open source development). | |
| Describe security and privacy issues that relate to computer networks. | |
| Explain the impact of the digital divide on access to critical information. | |

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### *Level 3B: (recommended for grades 10 or 11) Computer Science Concepts and Practices*

This course is a more in-depth study of computer science and its relation to other disciplines, and contains a significant amount of algorithmic problem solving and related activities. One way to realize this course is by following the Computer Science Principles course (www.apcsprinciples.org). Students should complete this course with a clear understanding of the application of computational thinking to real-world problems.

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| **CSTA Standard: *Level 3B (Grade 10 or 11)*** | **Course Meets Standard** |
|---|---|
| ***Strand: Computational Thinking*** | |
| Classify problems as tractable, intractable, or computationally unsolvable. | |
| Explain the value of heuristic algorithms to approximate solutions for intractable problems. | |
| Critically examine classical algorithms and implement an original algorithm. | **C** |
| Evaluate algorithms by their efficiency, correctness, and clarity. | ✓ |
| Use data analysis to enhance understanding of complex natural and human systems. | |
| Compare and contrast simple data structures and their uses (e.g., arrays and lists). | |
| Discuss the interpretation of binary sequences in a variety of forms (e.g., instructions, numbers, text, sound, image). | |
| Use models and simulations to help formulate, refine, and test scientific hypotheses. | |
| Analyze data and identify patterns through modeling and simulation. | |
| Decompose a problem by defining new functions and classes. | ✓ |
| Demonstrate concurrency by separating processes into threads and dividing data into parallel streams. | |
| ***Strand: Collaboration*** | |
| Use project collaboration tools, version control systems, and Integrated Development Environments (IDEs) while working on a collaborative software project. | |
| Demonstrate the software life cycle process by participating on a software project team. | |
| Evaluate programs written by others for readability and usability. | |
| ***Strand: Computing Practice and Programming*** | |
| Use advanced tools to create digital artifacts (e.g., web design, animation, video, multimedia). | **C** |
| Use tools of abstraction to decompose a large-scale computational problem (e.g., procedural abstraction, object-oriented design, functional design). | ✓ |
| Classify programming languages based on their level and application domain. | |
| Explore principles of system design in scaling, efficiency, and security. | |
| Deploy principles of security by implementing encryption and authentication strategies. | |
| Anticipate future careers and the technologies that will exist. | |
| Use data analysis to enhance understanding of complex natural and human systems. | |
| Deploy various data collection techniques for different types of problems. | |
| ***Strand: Computers and Communication Devices*** | |
| Discuss the impact of modifications on the functionality of application programs. | |
| Identify and describe hardware (e.g., physical layers, logic gates, chips, components). | |
| Identify and select the most appropriate file format based on trade-offs (e.g., accuracy, speed, ease of manipulation). | |
| Describe the issues that impact network functionality (e.g., latency, bandwidth, firewalls, server capability). | |
| Explain the notion of intelligent behavior through computer modeling and robotics. | |
| ***Strand: Community, Global, and Ethical Impacts*** | |
| Demonstrate ethical use of modern communication media and devices. | |
| Analyze the beneficial and harmful effects of computing innovations. | |

| **CSTA Standard:** ***Level 3B (Grade 10 or 11)*** | **Course Meets Standard** |
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| Summarize how financial markets, transactions, and predictions have been transformed by automation. | |
| Summarize how computation has revolutionized the way people build real and virtual organizations and infrastructures. | |
| Identify laws and regulations that impact the development and use of software. | |
| Analyze the impact of government regulation on privacy and security. | |
| Differentiate among open source, freeware, and proprietary software licenses and their applicability to different types of software. | |
| Relate issues of equity, access, and power to the distribution of computing resources in a global society. | |