Statewide Framework Document for: 110201

Standards may be added to this document prior to submission, but may not be removed from the framework to meet state credit equivalency requirements. Performance assessments may be developed at the local level. In order to earn state approval, performance assessments must be submitted within this framework. **This course is eligible for 1 credit of science.** The Washington State Science Standards performance expectations for high school blend core ideas (Disciplinary Core Ideas, or DCIs) with scientific and engineering practices (SEPs) and crosscutting concepts (CCCs) to support students in developing usable knowledge that can be applied across the science disciplines. These courses are to be taught in a three-dimensional manner. The details about each performance expectation can be found at Next Generation Science Standards and the supporting evidence statements can be found under Resources.

Computer Science & Programming	
Course Title: Computer Science & Programming – Science Equivalency	**Total Framework Hours up to: 180**
CIP Code: 110201 ☐**Exploratory** ☒**Preparatory**	**Date Last Modified: May 29, 2019**
Career Cluster: Information Technology	**Cluster Pathway: Programming and Software Development**
Eligible for Dual Credit in: ☐ **Math** ☒ **Science**	**Total Number of Units: 4**

Course Overview

Summary:
This course focuses on the general writing and implementation of generic and customized programs to drive operating systems. The course generally prepares individuals to apply the methods and procedures of software design and programming to software installation and maintenance. Instruction includes software design, low- and high-level languages and program writing; program customization and linking; prototype testing; troubleshooting; and related aspects of operating systems and networks.

Unit 1: Graphics	Total Learning Hours for Unit: 45

Performance Assessments:
Performance assessments on the following topics may be developed at the local level. In order to earn approval at the state level, performance assessments must be submitted within this framework.

It is expected that students will be able to:

- understand graphics technologies utilizing scientific principles: optics, light, and color
  *NASA source: https://www.nasa.gov/pdf/58258main_Optics.Guide.pdf

- understand the underlying mathematics, algorithms, and data structures that drive graphics utilizing models in population dynamics or epidemiology
  *National Center for Biotechnology Information source: https://www.ncbi.nlm.nih.gov/books/NBK221490/
- utilize scientific formulas to predict velocity, acceleration, and time regarding moving graphics
  *NASA source: https://history.nasa.gov/conghand/traject.htm
- program interactive 2D graphics programs in at least two languages

*For Science equivalency, assessments must have a scientific focus. Science content from the following resources could be included in assessments: NASA, HOAA, CDC, Dept. of Fish & Wildlife, and Dept. of Ecology.

Leadership Alignment:

- Students will connect with a school department or outside community member and design a graphic or moving graphic for their organization
- Students will be communicate with agricultural science or science related disciplines in our community to discuss scientific career choices regarding computer programming, graphics, or engineering
- 1.A.1 – Use a wide range of creation techniques
- 1.B.2 – Be open and responsive to new diverse perspectives.
- 3.A.3 – Use communication for a range of purposes
- 10.B.1.f – Collaborate and cooperate effectively with teams.

Industry Standards and Competencies

Computer Science Teachers Association Standards - Computer Science Concepts and Practices:

Collaboration

3. Evaluate programs written by others for readability and usability.

Computing Practice and Programming

1. Use advanced tools to create digital artifacts (e.g., web design, animation, video, multimedia).
6. Anticipate future careers and the technologies that will exist.

Computers and Communications Devices

3. Identify and select the most appropriate file format based on trade-offs (e.g., accuracy, speed, ease of manipulation).
4. Describe the issues that impact network functionality (e.g., latency, bandwidth, firewalls, server capability).

Community, Global, and Ethical Impacts

1. Demonstrate ethical use of modern communication media and devices.
5. Identify laws and regulations that impact the development and use of software.
7. Differentiate among open source, freeware, and proprietary software licenses and their applicability to different types of software.

Aligned Washington State Standards

Washington Science Standards (Next Generation Science Standards):

HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
HS-ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
HS-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.

Additional Science and Engineering Practices (SEPs), Disciplinary Core Ideas (DCIs), and Crosscutting Concepts (CCCs):
The local district must list one or more projects to be completed in this unit that will cumulatively address all of the following additional SEPs, DCIs, and CCCs.

Specific Project Title(s): MUST BE ADDED AT LOCAL LEVEL

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Obtaining, Evaluating, and Communicating Information	ETS1B: Developing Possible Solutions	Cause and Effect

Washington English Language Arts Standards (Common Core State Standards) – Science and Technology Literacy Standards (Grades 11-12):
RST.11-12.2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
RST.11-12.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
RST.11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
RST.11-12.10 By the end of grade 12, read and comprehend science/technical texts in the grades 11-CCR text complexity band independently and proficiently.

Unit 2: The Web | Total Learning Hours for Unit: 45

Performance Assessments:
Performance assessments on the following topics may be developed at the local level. In order to earn approval at the state level, performance assessments must be submitted within this framework.

It is expected the students will be able to:

- structure websites; students learn about the language behind HTML. Students learn about several different HTML tags as well as the basic structure of a web page. Students use HTML to develop several of their own creative web pages, which reports on or includes scientific data or data collection.
  *NOAA source: http://www.noaa.gov/resource-collections/classroom-ready-data-resources
- style websites; students learn the language CSS and use it to style their web pages.
- create webpages; students build their own website about scientific theory or practice. This site will be accessible on a public domain, and will be continually improved by the student as needed. Webpages will be modeled after the top 10 science sites of the year.
  *Real Clear Science source: https://www.realclearscience.com/blog/2017/12/04/the_top_10_websites_for_science_in_2017.html

- advance their HTML and CSS skills; students dive deeper into different areas of HTML and CSS including the science of social networking or web security / cryptography.
  *National Center for Biotechnology Information source: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2745217/

*For Science equivalency, assessments must have a scientific focus. Science content from the following resources could be included in assessments: NASA, NOAA, CDC, Dept. of Fish & Wildlife, and Dept. of Ecology.

Leadership Alignment:

- Students will demonstrate the ability to work effectively and respectfully in diverse scientific teams. Students will work creatively in laboratory activities of their particular interest while creating a webpage(s) regarding their laboratory experience. Students will access and evaluate information to place on their webpage as they collect and analyze their findings.
- Students will demonstrate the ability to communicate a scientific issue (clean drinking water, climate change, vaccinations, or approved student driven topic) through the creation of a web-based presence (webpage, app, blog).
- 10.B.1.f – Collaborate and cooperate effectively with teams.
- 10.B.1.g – Consistently listens to others' points of view; always uses appropriate and respectful language; tries to make a definite effort to understand other's ideas.

Industry Standards and Competencies

Computer Science Teachers Association Standards - Computer Science Concepts and Practices:

Collaboration

1. Use project collaboration tools, version control systems, and Integrated Development Environments (IDEs) while working on a collaborative software project.
3. Evaluate programs written by others for readability and usability.

Computing Practice and Programming

1. Use advanced tools to create digital artifacts (e.g., web design, animation, video, multimedia).
3. Classify programming languages based on their level and application domain.
4. Explore principles of system design in scaling, efficiency, and security.
6. Anticipate future careers and the technologies that will exist.
8. Deploy various data collection techniques for different types of problems.

Computers and Communications Devices

1. Discuss the impact of modifications on the functionality of application programs.
3. Identify and select the most appropriate file format based on trade-offs (e.g., accuracy, speed, ease of manipulation).
4. Describe the issues that impact network functionality (e.g., latency, bandwidth, firewalls, server capability).

Community, Global, and Ethical Impacts

1. Demonstrate ethical use of modern communication media and devices.
4. Summarize how computation has revolutionized the way people build real and virtual organizations and infrastructures.
5. Identify laws and regulations that impact the development and use of software.
6. Analyze the impact of government regulation on privacy and security.
7. Differentiate among open source, freeware, and proprietary software licenses and their applicability to different types of software.
8. Relate issues of equity, access, and power to the distribution of computing resources in a global society.

Aligned Washington State Standards

Washington Science Standards (Next Generation Science Standards):

Science and Engineering Practices (SEPs), Disciplinary Core Ideas (DCIs), and Crosscutting Concepts (CCCs):
The local district must list one or more projects to be completed in this unit that will cumulatively address all of the following additional SEPs, DCIs, and CCCs.

Specific Project Title(s): MUST BE ADDED AT LOCAL LEVEL
ALL BLANK DIMENSIONS BELOW MUST BE ADDED AT LOCAL LEVEL

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Analyzing and Interpreting Data	LS1D: Information Processing	Patterns
Asking Questions and Defining Problems	ETS1A: Defining and Delimiting an Engineering Problem	Systems and System Models
Asking Questions and Defining Problems	LS1D: Information Processing	Patterns
Analyzing and Interpreting Data	ETS1B: Developing Possible Solutions	
Asking Questions and Defining Problems	LS1A: Structure and Function	
Asking Questions and Defining Problems	LS2D: Social Interactions and Group Behavior	
Constructing Explanations and Designing Solutions	LS2D: Social Interactions and Group Behavior	
Developing and Using Models	ETS1B: Developing Possible Solutions	
Developing and Using Models	LS1D: Information Processing	
Obtaining, Evaluating, and Communicating Information	ETS1B: Developing Possible Solutions	
Planning and Carrying Out Investigations	ETS1C: Optimizing the Design Solution	

Washington English Language Arts Standards (Common Core State Standards) – Science and Technology Literacy Standards (Grades 11-12):
RST.11-12.2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
RST.11-12.3 Follow precisely a complex multi-step procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
RST.11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
RST.11-12.10 By the end of grade 12, read and comprehend science/technical texts in the grades 11-CCR text complexity band independently and proficiently.

Unit 3: Data Mining	Total Learning Hours for Unit: 45

Performance Assessments:
Performance assessments on the following topics may be developed at the local level. In order to earn approval at the state level, performance assessments must be submitted within this framework.

It is expected the students will be able to:

- visualize data and discover knowledge based on their findings. Student driven science research on data mining could include calculating epidemiology factors, using data from the US Census Bureau to predict population models, or calculating CO2 levels in the atmosphere.
  *US Census Bureau source: https://www.census.gov/topics/population/data.html or *NASA source: https://climate.nasa.gov/vital-signs/carbon-dioxide/
- invent an Android app which benefits your community with an agricultural or scientific benefit
  *Ideas stem from NASA or Skyview sources: http://www.sciencefocus.com/feature/tech/10-best-android-science-apps

*For science equivalency, assessments must have a scientific focus. Science content from the following resources could be included in assessments: NASA, NOAA, CDC, Dept. of Fish & Wildlife, and Dept. of Ecology.

Leadership Alignment:

- Students will apply a fundamental understanding of the ethical/legal issues surrounding scientific data mining and statistical analysis.
- Students will demonstrate a depth of knowledge appropriate to a beginning learning in the area of science they focus. Students will share with one another their new found scientific knowledge and critique one another's apps.
- 11.A.1 – Uses interpersonal and problem-solving skills to influence and guide others toward a goal.
- 11.A.4 – Demonstrates integrity and ethical behavior in using influence and power.
- 1.A.3 – Elaborate, refines, analyzes and evaluates their own ideas in order to improve and maximize creative efforts.
- 10.B1.a – Works positively and ethically.

Industry Standards and Competencies

Computer Science Teachers Association Standards - Computer Science Concepts and Practices:
Computational Thinking

3. Critically examine classical algorithms and implement an original algorithm.
4. Evaluate algorithms by their efficiency, correctness, and clarity.
6. Compare and contrast simple data structures and their uses (e.g., arrays and lists).
8. Use models and simulations to help formulate, refine, and test scientific hypotheses.
9. Analyze data and identify patterns through modeling and simulation.
10. Decompose a problem by defining new functions and classes.

Collaboration

3. Evaluate programs written by others for readability and usability.

Computing Practice and Programming

2. Use tools of abstraction to decompose a large-scale computational problem (e.g., procedural abstraction, object-oriented design, functional design).
6. Anticipate future careers and the technologies that will exist.
8. Deploy various data collection techniques for different types of problems.

Computers and Communications Devices

1. Discuss the impact of modifications on the functionality of application programs.
3. Identify and select the most appropriate file format based on trade-offs (e.g., accuracy, speed, ease of manipulation).

Community, Global, and Ethical Impacts

1. Demonstrate ethical use of modern communication media and devices.
2. Analyze the beneficial and harmful effects of computing innovations.

Aligned Washington State Standards

Washington Science Standards (Next Generation Science Standards):

HS-PS4-2. Evaluate questions about the advantages of using a digital transmission and storage of information.

HS-ETS1-1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Additional Science and Engineering Practices (SEPs), Disciplinary Core Ideas (DCIs), and Crosscutting Concepts (CCCs):

The local district must list one or more projects to be completed in this unit that will cumulatively address all of the following additional SEPs, DCIs, and CCCs.

Specific Project Title(s): MUST BE ADDED AT LOCAL LEVEL

ALL BLANK DIMENSIONS BELOW MUST BE ADDED AT LOCAL LEVEL

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Analyzing and Interpreting Data	ETS1A: Defining and Delimiting an Engineering Problem	Patterns
Analyzing and Interpreting Data	ETS1B: Developing Possible Solutions	Patterns
Asking Questions and Defining Problems	ETS1A: Defining and Delimiting an Engineering Problem	Patterns
Asking Questions and Defining Problems	ETS1A: Defining and Delimiting an Engineering Problem	Systems and System Models
Asking Questions and Defining Problems	ETS1B: Developing Possible Solutions	Systems and System Models
Constructing Explanations and Designing Solutions	ETS1B: Developing Possible Solutions	Stability and Change
Developing and Using Models	ETS1B: Developing Possible Solutions	Systems and System Models
Obtaining, Evaluating, and Communicating Information	ETS1A: Defining and Delimiting an Engineering Problem	Systems and System Models
Obtaining, Evaluating, and Communicating Information	ETS1B: Developing Possible Solutions	Systems and System Models

Analyzing and Interpreting Data	ETS1C: Optimizing the Design Solution	
Engaging in Argument from Evidence	ETS1B: Developing Possible Solutions	
Engaging in Argument from Evidence	ETS1C: Optimizing the Design Solution	

Washington English Language Arts Standards (Common Core State Standards) – Science and Technology Literacy Standards (Grades 11-12):

RST.11-12.2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

RST.11-12.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

RST.11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.

RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

RST.11-12.10 By the end of grade 12, read and comprehend science/technical texts in the grades 11-CCR text complexity band independently and proficiently.

Unit 4: Simulation | Total Learning Hours for Unit: 45

Performance Assessments:

Performance assessments on the following topics may be developed at the local level. In order to earn approval at the state level, performance assessments must be submitted within this framework.

It is expected the students will be able to:

- learn and design object or agent oriented programs based in JAVA; these programs will run simulations focused on a scientific process such as predicting how many relatives a person has after "x" generations including average lifespan differentiation or bacterial exponential growth.
  *National Center for Biotechnology Information source: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3264077/
- differentiate between discrete and continuous simulations; an example might include simulating how many deer are in a niche at a given time
  *Washington Department of Fish and Wildlife source: https://wdfw.wa.gov/publications/00497/
- solve a scientific equation or model based on a simulation program designed to solve the problem such as planetary alignment.
  *NASA source: https://spacemath.gsfc.nasa.gov/weekly/6Page41.pdf

*For science equivalency, assessments must have a scientific focus. Science content from the following resources could be included in assessments: NASA, NOAA, CDC, Dept. of Fish & Wildlife, and Dept. of Ecology.

Leadership Alignment:

- Students will be able to demonstrate proficiency in scientific problem-solving techniques using a computer simulation.
- Students will be able to demonstrate proficiency in the analysis of complex problems and the synthesis of scientific solutions to those problems.
- 1.A.1 – Use a wide range of idea creation techniques.
- 1.A.3 – Elaborates, refines, analyzes and evaluates their own ideas in order to improve and maximize creative efforts.
- 2.B.1 – Analyze how parts of a whole interact with each other to produce overall outcomes in complex systems.

Industry Standards and Competencies

Computer Science Teachers Association Standards - Computer Science Concepts and Practices:

Computational Thinking

3. Critically examine classical algorithms and implement an original algorithm.
4. Evaluate algorithms by their efficiency, correctness, and clarity.
6. Compare and contrast simple data structures and their uses (e.g., arrays and lists).
7. Discuss the interpretation of binary sequences in a variety of forms (e.g., instructions, numbers, text, sounds, images).
9. Analyze data and identify patterns through modeling and simulation.
10. Decompose a problem by defining new functions and classes.

Collaboration

1. Use project collaboration tools, version control systems, and Integrated Development Environments (IDEs) while working on a collaborative software project.
2. Demonstrate the software life cycle process by participating on a software project team.
3. Evaluate programs written by others for readability and usability.

Computing Practice and Programming

2. Use tools of abstraction to decompose a large-scale computational problem (e.g., procedural abstraction, object-oriented design, functional design).
4. Explore principles of system design in scaling, efficiency, and security.
6. Anticipate future careers and the technologies that will exist.

Computers and Communications Devices

1. Discuss the impact of modifications on the functionality of application programs.
2. Identify and describe hardware (e.g., physical layers, logic gates, chips, components).

Community, Global, and Ethical Impacts

2. Analyze the beneficial and harmful effects of computing innovations.
7. Differentiate among open source, freeware, and proprietary software licenses and their applicability to different types of software.

Aligned Washington State Standards

Washington Science Standards (Next Generation Science Standards):

HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.

HS-ESS3-5. Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.

HS-ESS3-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

HS-ETS1-1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and tradeoffs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

HS-ETS1-4. Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Additional Science and Engineering Practices (SEPs), Disciplinary Core Ideas (DCIs), and Crosscutting Concepts (CCCs):
The local district must list one or more projects to be completed in this unit that will cumulatively address all of the following additional SEPs, DCIs, and CCCs.

Specific Project Title(s): MUST BE ADDED AT LOCAL LEVEL
ALL BLANK DIMENSIONS BELOW MUST BE ADDED AT LOCAL LEVEL

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Constructing Explanations and Designing Solutions	ETS1A: Defining and Delimiting an Engineering Problem	Systems and System Models
Constructing Explanations and Designing Solutions	ETS1B: Developing Possible Solutions	Stability and Change
Constructing Explanations and Designing Solutions	ETS1B: Developing Possible Solutions	Systems and System Models
Developing and Using Models	ETS1A: Defining and Delimiting an Engineering Problem	Systems and System Models
Developing and Using Models	ETS1B: Developing Possible Solutions	Stability and Change
Developing and Using Models	ETS1B: Developing Possible Solutions	Systems and System Models
Developing and Using Models	ETS1C: Optimizing the Design Solution	Systems and System Models
Using Mathematics and Computational Thinking	ETS1A: Defining and Delimiting an Engineering Problem	Systems and System Models
Using Mathematics and Computational Thinking	ETS1B: Developing Possible Solutions	Systems and System Models
Analyzing and Interpreting Data	ETS1C: Optimizing the Design Solution	
Constructing Explanations and Designing Solutions	ETS1C: Optimizing the Design Solution	
Engaging in Argument from Evidence	ETS1C: Optimizing the Design Solution	
Planning and Carrying Out Investigations	ETS1B: Developing Possible Solutions	

Washington English Language Arts Standards (Common Core State Standards) – Science and Technology Literacy Standards (Grades 11-12):

RST.11-12.2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

RST.11-12.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

RST.11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.

RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

RST.11-12.10 By the end of grade 12, read and comprehend science/technical texts in the grades 11-CCR text complexity band independently and proficiently.

21st Century Skills

Students will demonstrate in this course:

LEARNING & INNOVATION

Creativity and Innovation
☒Think Creatively
☒Work Creatively with Others
☒Implement Innovations

Critical Thinking and Problem Solving
☒Reason Effectively
☒Use Systems Thinking
☒Make Judgments and Decisions
☒Solve Problems

Communication and Collaboration
☒Communicate Clearly
☒Collaborate with Others

INFORMATION, MEDIA & TECHNOLOGY SKILLS

Information Literacy
☒Access and Evaluate Information
☒Use and Manage Information

Media Literacy
☒Analyze Media
☒Create Media Products

Information, Communications and Technology (ICT Literacy)
☒Apply Technology Effectively

LIFE & CAREER SKILLS

Flexibility and Adaptability
☒Adapt to Change
☒Be Flexible

Initiative and Self-Direction
☒Manage Goals and Time
☒Work Independently
☒Be Self-Directed Learners

Social and Cross-Cultural
☒Interact Effectively with Others
☒Work Effectively in Diverse Teams

Productivity and Accountability
☒Manage Projects
☒Produce Results

Leadership and Responsibility
☒Guide and Lead Others
☒Be Responsible to Others