Exploring Computer Science Curriculum Maps

Grade: 9-12 **Subject:** Exploring Computer Science	**Unit 1: Human Computer Interaction**
Big Idea/Rationale	**Big Idea:** The study, planning, design, and use of various interfaces between people (users) and computers. **Rationale:** In this unit students are introduced to the concepts of computer and computing while investigating the major components of computers and the suitability of these components for particular applications. Students will experiment with Internet search techniques, explore a variety of websites and web applications and discuss issues of privacy and security. Students will learn that "intelligent" machine behavior is not "magic" but is based on algorithms applied to useful representations of information, including large data sets. Students will learn the characteristics that make certain tasks easy or difficult for computers, and how these differ from those that humans characteristically find easy or difficult.
Enduring Understanding (Mastery Objective)	• Analyze the characteristics of hardware components to determine the applications for which they can be used • Use appropriate tools and methods to execute Internet searches which yield requested data • Evaluate the results of web searches and the reliability of information found on the Internet • Explain the differences between tasks that can and cannot be accomplished with a computer • Analyze the effects of computing on society within economic, social, and cultural contexts • Communicate legal and ethical concerns raised by computing innovation • Explain the implications of communication as data exchange
Essential Questions (Instructional Objective)	• What is a computer? What is meant by the term *computing*? • What are the uses for the various hardware components of a computer? • How does a person choose hardware components for various uses? • How can I search the Internet to retrieve information efficiently and effectively? • What resources can be used besides search engines to find information on the Internet? • How can a rubric be used to evaluate websites? • How are computers used for communication? • What is data exchange? What are the implications of data exchange on social interactions? • What are the privacy implications of the data that you create? • How can different views of the same data tell a different story?

	• What are the limits of measurement with data? What can and can't be captured in data? • How can computers be used as tools for visualizing data, modeling and design, and art? • What is the concept of a computer program? • What is intelligence? Are computers intelligent? What does it mean for a machine to "learn?"
Content (Subject Matter)	*Student will know…* • Key terms – computer, computing, hardware, components, processor, operating system, memory, hard drive, optical drive, video card, sound card, privacy, data, program, intelligence *Student will be able to…* • Explain and give examples of the concepts of *computer* and *computing* • Describe the uses for computer hardware components • Choose hardware components for various types of users • Perform searches and explain how to refine searches to retrieve better information • Identify resources for finding information in addition to ranking-based search engines • Develop and use a rubric to evaluate websites • Explain how computers are used for communications • Recognize various forms of communication as data exchange • Describe the implications of data exchange on social interactions • Consider privacy of data that they create • Explain how different views of data can tell a different story • Recognize that data is an incomplete record of reality • Describe the limits of measurement (what can and can't be captured in data) • Explain how computers can be used as tools for visualizing data, modeling and design, and art • Identify mathematical connections in the output of the tools • Edit an image using Photoshop • Explain the concept of a computer program • Explain the idea of intelligence especially as it relates to computers • Explain what it means for a machine to "learn" • Discuss whether computers are intelligent or whether they only behave intelligently
Skills/Benchmarks (CCSS Standards)	• CCSS.ELA-Literacy.CCRA.R.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. • CCSS.ELA-Literacy.CCRA.R.2: Determine central ideas or

	themes of a text and analyze their development; summarize the key supporting details and ideas. • CCSS.ELA-Literacy.CCRA.W.4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. • CCSS.ELA-Literacy.CCRA.W.6: Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others. • CCSS.ELA-Literacy.CCRA.W.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. • CCSS.ELA-Literacy.CCRA.W.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. • CCSS.ELA-Literacy.CCRA.SL.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. • CCSS.ELA-Literacy.CCRA.SL.2: Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally. • CCSS.ELA-Literacy.CCRA.SL.4: Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience. • CCSS.ELA-Literacy.CCRA.L.6: Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when encountering an unknown term important to comprehension or expression. • CCSS.Math.Practice.MP1: Make sense of problems and persevere in solving them. • CCSS.Math.Practice.MP4: Model with mathematics. • CCSS.Math.Practice.MP5: Use appropriate tools strategically. • 8.2.12.E.1: Demonstrate an understanding of the problem-solving capacity of computers in our world • 8.2.12.E.2: Analyze the relationships between internal and external computer components • 8.2.12.E.4: Use appropriate terms in conversation • 9.3.IT.4: Demonstrate positive cyber citizenry by applying industry accepted ethical practices and behaviors • 9.3.IT.12: Demonstrate knowledge of the hardware components

	associated with information systems • 9.3.ST.2: Use technology to acquire, manipulate, analyze and report data
Materials and Resources	Multi-media projector, teacher-prepared presentations and handouts, various videos, self-stick poster sheets, markers, various technology manipulatives
Notes	

Grade: 9-12 **Subject:** Exploring Computer Science	**Unit 2: Problem Solving**
Big Idea/Rationale	**Big Idea:** The problem-solving process and the usage of algorithms are explored in various contexts. **Rationale:** This unit provides students with opportunities to become "computational thinkers" by applying a variety of problem-solving techniques as they create solutions to problems that are situated in a variety of contexts. The range of contexts motivates the need for students to think abstractly and apply known algorithms where appropriate, but also create new algorithms. Analysis of various solutions and algorithms will highlight problems that are not easily solved by computer and for which there are no known solutions. This unit also focuses on the connections between mathematics and computer science. Students will be introduced to selected topics in discrete mathematics including Boolean logic, functions, graphs and the binary number system. Students are also introduced to searching and sorting algorithms and graphs.
Enduring Understanding (Mastery Objective)	• Name and explain the steps they use in solving a problem • Solve a problem by applying appropriate problem-solving techniques • Express a solution using standard design tools • Determine if a given algorithm successfully solves a stated problem • Create algorithms that meet specified objectives • Explain the connections between binary numbers and computers • Summarize the behavior of an algorithm • Compare the tradeoffs between different algorithms for solving the same problem • Explain the characteristics of problems that cannot be solved by an algorithm
Essential Questions (Instructional Objective)	• What implications does data exchange have on social interactions? • How private is the data that you create on a daily basis? • What is the difference between data used for making a case and data that informs a discovery? • What are good research questions? • What are the steps in the problem-solving process? How can these be applied to solve problems? • What is meant by the word algorithm? • How can I express a solution to a problem using standard design tools? • How can I determine if a given solution successfully solves a stated problem? • What are binary numbers? Why are they important in computer

	science? • What is the linear search algorithm? What is the binary search algorithm? Under which conditions would it be appropriate to use one over the other? • What is a sorted list? What is an unsorted list? What are sorting algorithms? How can they be compared to one another? • What is a minimal spanning tree? How can a minimal spanning tree problem be solved?
Content (Subject Matter)	*Student will know…* • Key terms – data, privacy, problem-solving, algorithm, binary, binary numbers, linear search, binary search, sorted lists, unsorted lists, minimal spanning tree, graphs *Student will be able to…* • Recognize various forms of communication as data exchange • Describe the implications of data exchange on social interactions • Consider privacy of data that they create • Explain the difference between data used for making a case and data that informs a discovery • Describe good research questions • Name and explain the steps in the problem-solving process • Solve a problem by applying the problem-solving process • Explain what the word algorithm means • Express a solution using standard design tools • Determine if a given solution successfully solves a stated problem • Count forward and backward in binary • Explain why binary numbers are important in computer science • Use binary digits to encode and decode messages • Describe the linear search algorithm • Describe the binary search algorithm • Explain conditions under which each search might be appropriate • Define sorted and unsorted lists • Describe and compare various sorting algorithms • Solve a minimal spanning tree • Draw a graph to solve a problem • Incorporate all unit objectives into the final project
Skills/Benchmarks (CCSS Standards)	• CCSS.ELA-Literacy.CCRA.R.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. • CCSS.ELA-Literacy.CCRA.R.2: Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas. • CCSS.ELA-Literacy.CCRA.W.4: Produce clear and coherent writing in which the development, organization, and style are

	appropriate to task, purpose, and audience. • CCSS.ELA-Literacy.CCRA.W.6: Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others. • CCSS.ELA-Literacy.CCRA.W.7: Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation. • CCSS.ELA-Literacy.CCRA.W.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. • CCSS.ELA-Literacy.CCRA.SL.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. • CCSS.ELA-Literacy.CCRA.SL.2: Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally. • CCSS.ELA-Literacy.CCRA.SL.4: Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience. • Reading Standards for Literacy in Science and Technical Subjects 6-12 - Grades 9-10 students: Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exception defined in the text. • CCSS.Math.Practice.MP1: Make sense of problems and persevere in solving them. • CCSS.Math.Practice.MP2: Reason abstractly and quantitatively • CCSS.Math.Practice.MP3: Construct viable arguments and critique the reasoning of others • CCSS.Math.Practice.MP4: Model with mathematics. • CCSS.Math.Content.HSF-BF.A.1a: Building functions – Write a function that describes a relationship between two quantities: Determine an explicit expression, a recursive process, or steps for calculation from a context. • 8.2.12.E.1: Demonstrate an understanding of the problem-solving capacity of computers in our world • 8.2.12.E.4: Use appropriate terms in conversation • 9.3.ST.2: Use technology to acquire, manipulate, analyze and report data
Materials and Resources	Multi-media projector, teacher-prepared presentations and handouts, various videos, self-stick poster sheets, markers, various technology manipulatives

Notes	

Grade: 9-12 **Subject:** Exploring Computer Science	**Unit 3: Web Design**
Big Idea/Rationale	**Big Idea:** Students build upon the problem-solving strategies learned earlier to design and build web pages using HTML, CSS, and JavaScript. **Rationale:** This unit prepares students to take the role of a developer by expanding their knowledge of algorithms, abstraction, and web page design and applying it to the creation of web pages and documentation for users and equipment. Students will explore issues of social responsibility in web use. They will learn to plan and code their web pages using a variety of techniques and check their sites for usability. Students learn to create user-friendly websites. Students will apply fundamental notions of Human Computer Interaction (HCI) and ergonomics.
Enduring Understanding (Mastery Objective)	• Create web pages to address specified objectives • Create web pages with a practical, personal, and/or societal purpose • Select appropriate techniques when creating web pages • Use abstraction to separate style from content in web page design and development • Describe the use of a website with appropriate documentation
Essential Questions (Instructional Objective)	• What are the basic security issues on the Internet? • How can social websites be used appropriately? • What is an HTML editor? What are the different "pieces" of an editor? • What are the basic parts of a web page known as? • How can I use paragraph tags, headings, line breaks, and horizontal lines to create a basic web page? • In what ways can I emphasize text on a web page? • What is the standard image resolution for the web? • What tools allow me to resize and/or crop an image for the web? • What are the differences between the various image formats used on today's web sites? • How can I place an image on a web page? • What is CSS? What is it used for? • How do I use CSS to create inline styles for a web page? How do I use CSS to create an internal style sheet for a web page? • How do I create an HTML page that links to a separate CSS file? • What is the purpose of separating style from structure on a web site? • What are hyperlinks? How do I place hyperlinks on a web page? • What are tables? What are tables primarily used for on a web page? How do I create tables on a web page? • What are lists? How are lists used on a web page? What are the different types of lists available for use on a web page? How do I create lists on a web page?

	• What are generic, element containers (divs and spans)? How are they used when building a web page? How do I create element containers within HTML? How do I style element containers through CSS? • How do I add a menu to a web page? • What is JavaScript? How can JavaScript be used to add interactivity to a web page? How do I link to an external JavaScript file?
Content (Subject Matter)	*Student will know…* • Key terms – HTML, HTML editor, title, body, tags, elements, empty elements, break, horizontal rule, crop, CSS, style sheet, inline, external, selector, property, value, content, presentation, hyperlink, table, list, row, column, float, various html tags, various CSS styles *Student will be able to…* • Explain basic security issues on the Internet • Identify appropriate vs. inappropriate use of social websites • Navigate an HTML editor • Create an HTML page with a title and a body • Create an HTML page with paragraph tags, headings, line breaks, and horizontal lines • Create an HTML page that includes emphasized text • Resize and crop images for the web • Identify and differentiate between the various image formats used in web sites • Create an HTML page that includes images • Create inline styles with CSS • Create a web page that uses inline styles • Create an internal style sheet with CSS • Create a web page that uses an internal style sheet • Create a web page which links to a separate CSS file • Use HTML tags and CSS styling elements to separate style from structure • Create a web page that includes hyperlinks • Use table, row, and column tagging in an HTML page • Add CSS styling to an HTML table • Use ordered and unordered list tagging in an HTML page • Add CSS styling to an HTML list • Use grid elements in CSS div placement • Add a menu to an HTML page • Create a web page that includes layout styles • Create a multi-page web site which includes a number of objectives previously discussed

	• Add JavaScript components to a web page
Skills/Benchmarks (CCSS Standards)	• CCSS.ELA-Literacy.CCRA.W.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. • CCSS.ELA-Literacy.CCRA.W.6 Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others. • CCSS.ELA-Literacy.CCRA.W.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. • CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them. • 8.1.4.A.1: Technology Operations and Concepts - Demonstrate effective input of text and data using an input device. • 8.1.4.A.5 Technology Operations and Concepts - Determine the benefits of a wide range of digital tools by using them to solve problems • 8.1.8.A.5 Technology Operations and Concepts - Select and use appropriate tools and digital resources to accomplish a variety of tasks and to solve problems. • 8.1.12.F.2 Critical Thinking, Problem Solving and Decision Making - Analyze the capabilities and limitations of current and emerging technology resources and assess their potential to address educational, career, personal, and social needs. • 8.1.12.C.1 Digital Tools and Environments - Develop an innovative solution to a complex, local or global problem or issue in collaboration with peers and experts, and present ideas for feedback in an online community. • 8.2.12.E.1: Demonstrate an understanding of the problem-solving capacity of computers in our world • 8.2.12.E.4: Use appropriate terms in conversation • 9.3.ST.2: Use technology to acquire, manipulate, analyze and report data • 9.4.12.O.(1).1 Apply the concepts, processes, guiding principles, and standards of school mathematics to solve science, engineering, and mathematics problems. • 9.4.12.O.(2).1 Develop an understanding of how science and mathematics function to provide results, answers, and algorithms for engineering activities to solve problems and issues in the real world.
Materials and Resources	Multi-media projector, teacher-prepared presentations and handouts, various videos, self-stick poster sheets, markers, various technology manipulatives
Notes	

Grade: 9-12 **Subject:** Exploring Computer Science	**Unit 4: Introduction to Programming**
Big Idea/Rationale	**Big Idea:** Students are introduced to the steps of computer program design and development through an online programming environment known as Scratch. **Rationale:** Students are introduced to some basic issues associated with program design and development. Students design algorithms and create programming solutions to a variety of computational problems using an iterative development process in Scratch. Programming problems include mathematical and logical concepts and a variety of programming constructs
Enduring Understanding (Mastery Objective)	• Use appropriate algorithms to solve a problem • Design, code, test, and execute a program that corresponds to a set of specifications • Select appropriate programming structures • Locate and correct errors in a program • Explain how a particular program functions • Justify the correctness of a program • Create programs with practical, personal, and/or societal intent
Essential Questions (Instructional Objective)	• What are the basic terms used in Scratch? • How do you begin a simple program in Scratch? • What does the "green flag" feature allow you to do in Scratch? • How do you develop a dialogue between Scratch sprites? • What are the three major ways to move sprites? • What is event-driven programming? • How do you broadcast an event in Scratch? • How can you listen for, and respond to, events that you create? • How do you change the background of a stage? • What is a variable? What is a variable used for? How do you create a variable in Scratch? How do you modify a variable in Scratch? • What is iteration? What is iteration used for? How is iteration handled in Scratch? • What is conditional logic? When is it appropriate to use conditional logic in a program? How do you use conditional logic in Scratch? • What is nested conditional logic? When is it appropriate to use nested conditional logic in a program? How do you use nested conditional logic in Scratch? • What are relational operators? How are relational operators used in conjunction with conditional logic? • What are logical operators? How are logical operators used in conjunction with conditional logic? • What are random numbers? Are computer-generated numbers ever truly random? How do you generate a random number within the

	Scratch environment? • What is a timer? What are the potential uses of a timer in programming? How is a timer created and/or used within Scratch?
Content (Subject Matter)	*Student will know…* • Key terms – program, programming, pseudocode, Scratch, sprite, script, block(s), costume, event, event-driven programming, broadcast, stage, background, variable, iteration, conditional logic, conditionals, nested conditionals, Boolean, operators, relational operators, logical operators, truth tables, random, timer *Student will be able to…* • Name the basic terms used in Scratch • Create the beginning of a simple program in Scratch • Complete a simple Scratch program • Utilize the green flag feature • Develop a dialogue between two or more Scratch sprites • Explain the three major ways to move sprites • Explain event-driven programming • Write a program that responds to user-created events from the mouse and keyboard • Broadcast events • Listen to and respond to events they create • Change the background of the stage • Develop a Scratch story project • Assess their peers to help them gauge their progress • Explain the concept of variables • Create examples of variables • Explain the concept of iteration • Create examples of iteration • Explain the concept of conditionals • Enhance a variable program with conditionals • Use conditionals with And and Or to write a grade program • Use a random number generator to write a dice program • Apply knowledge of conditionals to complete a Rock Paper Scissors program • Create a timer • Create a timing game • Incorporate all objectives in the unit into the final project
Skills/Benchmarks (CCSS Standards)	• CCSS.ELA-Literacy.CCRA.W.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. • CCSS.ELA-Literacy.CCRA.SL.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. • CCSS.ELA-Literacy.CCRA.SL.4 Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience. • CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them. • CCSS.Math.Content.HSF-BF.A.1a Building Functions - Write a function that describes a relationship between two quantities: Determine an explicit expression, a recursive process, or steps for calculation from a context. • CCSS.Math.Content.HSA-CED.A.3 Creating Equations - Create Equations that describe numbers or relationships: Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. • 8.1.4.A.1: Technology Operations and Concepts - Demonstrate effective input of text and data using an input device. • 8.1.4.A.5 Technology Operations and Concepts - Determine the benefits of a wide range of digital tools by using them to solve problems • 8.1.8.A.5 Technology Operations and Concepts - Select and use appropriate tools and digital resources to accomplish a variety of tasks and to solve problems. • 8.1.12.F.2 Critical Thinking, Problem Solving and Decision Making - Analyze the capabilities and limitations of current and emerging technology resources and assess their potential to address educational, career, personal, and social needs. • 8.1.12.C.1 Digital Tools and Environments - Develop an innovative solution to a complex, local or global problem or issue in collaboration with peers and experts, and present ideas for feedback in an online community. • 8.2.12.E.1: Demonstrate an understanding of the problem-solving capacity of computers in our world • 8.2.12.E.4: Use appropriate terms in conversation • 9.3.ST.2: Use technology to acquire, manipulate, analyze and report data • 9.4.12.O.(1).1 Apply the concepts, processes, guiding principles, and standards of school mathematics to solve science, engineering, and mathematics problems. • 9.4.12.O.(2).1 Develop an understanding of how science and mathematics function to provide results, answers, and algorithms for engineering activities to solve problems and issues in the real world.

Materials and Resources	Scratch, Multi-media projector, teacher-prepared presentations and handouts, various videos, self-stick poster sheets, markers, various technology manipulatives
Notes	

Grade: 9-12 **Subject:** Exploring Computer Science	**Unit 5: Computing and Data Analysis**
Big Idea/Rationale	**Big Idea:** Students will be prepared to collect rich data, formulate queries that will inform whatever project is chosen, and use that information to either make a case or facilitate a discovery. **Rationale:** Students explore how computing has facilitated new methods of managing and interpreting data. Students will use computers to translate, process, and visualize data in order to find patterns and test hypotheses. Students will work with a variety of large data sets that illustrate how widespread access to data and information facilitates identification of problems. Students will collect and generate their own data related to local community issues and discuss appropriate methods for data collection and aggregation of data necessary to support making a case or facilitating a discovery.
Enduring Understanding (Mastery Objective)	• Describe the features of appropriate data sets for specific problems • Apply a variety of analysis techniques to large data sets • Use computers to find patterns in data and test hypothesis about data • Compare different analysis techniques and discuss the tradeoffs among them • Justify conclusions drawn from data analysis
Essential Questions (Instructional Objective)	• What is the difference between data used to make a case and data that informs discovery? • What considerations must be made in order for a large data set to be useful? • How do various types of data (numbers, text, dates, etc.) lend themselves to processing? • What are the complexities inherent in collecting, processing, and analyzing large sets of data? • How can we draw conclusions through analysis of a data set? • What variables are needed to analyze specific data sets? • In what ways can we collect data? • What issues can arise during the data collection process? • What is aggregation (as it relates to data)? • How can you sort data? • How do you create subsets of data? • How do you read location data from a file and plot points on a map? • What is spatial analysis? How can data be analyzed using spatial analysis techniques? • What is a bar plot? How can bar plots be read and interpreted? • What is the difference between categorical and continuous data? • How can trends be identified in data sets?

	• What is a histogram? How do you read and interpret a histogram? How do you create a histogram? • What is mean? What is a median? • How do you create and query subsets of a data set? • How do you read in a file containing text as data? • How do you filter a text data set (remove punctuation, remove case, remove stop words, etc.)?
Content (Subject Matter)	*Student will know…* • Key terms – data, data analysis, big data, aggregation, header, latitude, longitude, spatial analysis, bar plot, categorical data, continuous data, trends, histogram, mean, median, minimum, maximum, query, filter *Student will be able to…* • Explain the difference between data used for making a case and data that informs discovery • Identify and discuss the considerations that must be made in order for a large data set to be useful • Consider how various types of data (numbers, text, dates, etc.) lend themselves to processing • Collaborate with others to create, manage, and maintain a large set of data • Understand the complexities of collecting, processing, and analyzing large sets of data • Identify variables needed to analyze data • Identify issues related to the data collection process • Explain aggregation of data • Translate addresses into latitude/longitude • Sort files of data • Create subsets of data • Read location data from a file and plot points on maps • Read and interpret a bar plot • Create bar plots • Differentiate between categorical and continuous data • Look for trends by analyzing various plots • Read and interpret a histogram • Create a histogram • Explain mean, median, minimum, and maximum • Create and query subsets of a data set • Analyze collected data using statistical analysis and a variety of plots • Read in a file containing text as data • Filter a text data set (remove punctuation, remove case, remove stop words, etc.)

	• Incorporate all objectives of the unit into the final project
Skills/Benchmarks (CCSS Standards)	• CCSS.ELA-Literacy.CCRA.W.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. • CCSS.ELA-Literacy.CCRA.SL.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. • CCSS.ELA-Literacy.CCRA.SL.2 [Integrate and] evaluate information presented in diverse media and formats, including visually, quantitatively, and orally. • CCSS.ELA-Literacy.CCRA.SL.3 Evaluate a [speaker's] point of view, reasoning, and use of evidence and rhetoric. • CCSS.ELA-Literacy.CCRA.SL.4 Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience. • CCSS.ELA-Literacy.CCRA.SL.5 Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations. • CCSS.ELA-Literacy.CCRA.L.6 Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when encountering an unknown term important to comprehension or expression. • CCSS.Math.Practice.MP4 Model with mathematics. • CCSS.Math.Practice.MP5 Use appropriate tools strategically. • CCSS.Math.Content.HSS-ID.A.1 Interpreting Categorical and Quantitative Data - Summarize, represent, and interpret data on a single count or measurement variable: Represent data with plots on the real number line (dot plots, histograms, and box plots). • CCSS.Math.Content.HSS-ID.A.3 Interpreting Categorical and Quantitative Data - Summarize, represent, and interpret data on a single count or measurement variable: Interpret differences in shape, center, and spread in the context of data sets, accounting for possible effects of extreme data points (outliers). • CCSS.Math.Content.HSS-ID.A.13 Interpreting Categorical and Quantitative Data - Summarize, represent, and interpret data on a single count or measurement variable: Represent data with plots on the real number line (dot plots, histograms, and box plots). • CCSS.Math.Content.HSS-CP.A.1 Conditional Probability and the Rules of Probability - Understand independence and conditional probability and use them to interpret data: Describe events as

	subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or" and "not"). • CCSS.Math.Content.HSS-IC.B.4 Making inferences and Justifying Conclusions - Make inferences and justify conclusions from sample surveys, experiments, and observational studies: Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling. • 8.1.4.A.1: Technology Operations and Concepts - Demonstrate effective input of text and data using an input device. • 8.1.4.A.5 Technology Operations and Concepts - Determine the benefits of a wide range of digital tools by using them to solve problems • 8.1.8.A.5 Technology Operations and Concepts - Select and use appropriate tools and digital resources to accomplish a variety of tasks and to solve problems. • 8.1.12.F.2 Critical Thinking, Problem Solving and Decision Making - Analyze the capabilities and limitations of current and emerging technology resources and assess their potential to address educational, career, personal, and social needs. • 8.1.12.C.1 Digital Tools and Environments - Develop an innovative solution to a complex, local or global problem or issue in collaboration with peers and experts, and present ideas for feedback in an online community. • 8.2.12.E.1: Demonstrate an understanding of the problem-solving capacity of computers in our world • 8.2.12.E.4: Use appropriate terms in conversation • 9.3.ST.2: Use technology to acquire, manipulate, analyze and report data • 9.4.12.O.(1).1 Apply the concepts, processes, guiding principles, and standards of school mathematics to solve science, engineering, and mathematics problems. • 9.4.12.O.(2).1 Develop an understanding of how science and mathematics function to provide results, answers, and algorithms for engineering activities to solve problems and issues in the real world.
Materials and Resources	Multi-media projector, teacher-prepared presentations and handouts, various videos, self-stick poster sheets, markers, various technology manipulatives, Microsoft Excel
Notes	

Grade: 9-12 **Subject:** Exploring	**Unit 6: Robotics**

Computer Science	
Big Idea/Rationale	**Big Idea:** Robotics provides a physical application of the programming and problem solving skills acquired in the previous units. **Rationale:** This unit introduces robotics as an advanced application of computer science that can be used to solve problems in a variety of settings from business to healthcare and how robotics enables innovation by automating processes that may be dangerous or otherwise problematic for humans. Students explore how to integrate hardware and software in order to solve problems. Students will see the effect of software and hardware design on the resulting product. Students will apply previously learned topics to the study of robotics.
Enduring Understanding (Mastery Objective)	• Identify the criteria that describe a robot and determine if something is a robot • Match the actions of the robot to the corresponding parts of the program • Build, code, and test a robot that solves a stated problem • Explain ways in which different hardware designs affect the function of a machine • Describe the tradeoffs among multiple ways to program a robot to achieve a goal
Essential Questions (Instructional Objective)	• What are the criteria that define a robot? • How do you determine if something is a robot based on the aforementioned criteria? • How does the design of a robot's body affect its behavior? • What are the different LEGO parts used to build a robot? • How do you build the base of a robot? • What are the different parts of the LEGO NXT brick? • In terms of robotics, what is meant by the terms input and output? • What programs are available to you directly from the NXT brick? • What are the parts of the Mindstorms NXT software? • What are the different types of icons in the common palette, and how are they used? • What are the different types of icons in the complete palette, and how are they used? • What is the difference between a software error and a hardware error? • What is the difference between a logical error and a syntax error? • How can the building blocks of the common palette be used to program the robot? • How can a sequence of game moves be expressed in simple statements? • How can you use the NXT and various output devices to program a robot to solve numerous problems?
Content	*Student will know…*

(Subject Matter)	• Key terms – robot, input, output, port, sensor, touch sensor, light sensor, sound sensor, ultrasonic sensor, motor, servo, common palette, complete palette, error, software error, hardware error, logical error, syntax error *Student will be able to…* • List and explain the criteria that define a robot • Determine if something Is a robot, using the criteria • Evaluate how the design of a robot's body affects its behavior • Distinguish between the LEGO parts for building a robot • Assemble the base of the robot • Distinguish between the parts of the NXT brick • Hook up input and output devices correctly • Use built-in NXT brick programs • Recognize the parts of the Mindstorms NXT software • Explain the different types of icons in the common palette and how to use them • Explain the different types of icons in the complete palette and how to use them • Explain the difference between software errors and hardware errors • Explain the difference between logical errors and syntax errors • Use the building blocks of the common palette to program the robot • Build robots that can execute the functions programmed through the Robot Educator Software • Program the robot using some or all of the complete palette of blocks • Use the NXT and input/output devices to design, build, and program a robot that can complete various challenges
Skills/Benchmarks (CCSS Standards)	• CCSS.ELA-Literacy.CCRA.R.2 Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas. • CCSS.ELA-Literacy.CCRA.W.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. • CCSS.ELA-Literacy.CCRA.W.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. • CCSS.ELA-Literacy.CCRA.SL.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.

	• CCSS.ELA-Literacy.CCRA.L.6 Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when encountering an unknown term important to comprehension or expression. • CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them. • CCSS.Math.Practice.MP5 Use appropriate tools strategically. • CCSS.Math.Content.HSA-CED.A.3 Creating Equations - Create Equations that describe numbers or relationships: Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. • 8.1.4.A.1: Technology Operations and Concepts - Demonstrate effective input of text and data using an input device. • 8.1.4.A.5 Technology Operations and Concepts - Determine the benefits of a wide range of digital tools by using them to solve problems • 8.1.8.A.5 Technology Operations and Concepts - Select and use appropriate tools and digital resources to accomplish a variety of tasks and to solve problems. • 8.1.12.F.2 Critical Thinking, Problem Solving and Decision Making - Analyze the capabilities and limitations of current and emerging technology resources and assess their potential to address educational, career, personal, and social needs. • 8.1.12.C.1 Digital Tools and Environments - Develop an innovative solution to a complex, local or global problem or issue in collaboration with peers and experts, and present ideas for feedback in an online community. • 8.2.12.E.1: Demonstrate an understanding of the problem-solving capacity of computers in our world • 8.2.12.E.4: Use appropriate terms in conversation • 9.3.ST.2: Use technology to acquire, manipulate, analyze and report data • 9.4.12.O.(1).1 Apply the concepts, processes, guiding principles, and standards of school mathematics to solve science, engineering, and mathematics problems. • 9.4.12.O.(2).1 Develop an understanding of how science and mathematics function to provide results, answers, and algorithms for engineering activities to solve problems and issues in the real world.
Materials and Resources	Multi-media projector, teacher-prepared presentations and handouts, various videos, self-stick poster sheets, markers, various technology manipulatives, LEGO Mindstorms NXT robotics kits (and associated

	software)
Notes	