Pascack Valley Regional High School District

Pascack Hills High School, Montvale, New Jersey
Pascack Valley High School, Hillsdale, New Jersey

Course Name: **Advanced Topics in Computer Science**

COURSE DESCRIPTION: Advanced Topics in Computer Science

Advanced Topics in Computer Science involves specialized study of theoretical and applied aspects of Computer Science. Topics will include the following:

SOFTWARE: A variety of computer programming languages will be studied, including mobile and web applications.

HARDWARE: Hardware topics will include programming of the Arduino microcontroller as well as a drone.

THEORY: Additional topics may include an analysis of the essential properties of data structures and algorithms.

CYBERSECURITY: introduce high school students to basic cybersecurity concepts and inspire interest in cybersecurity careers.

PROJECTS: A significant component of this course is student driven exploration of relevant Computer Science concepts and/or applications.
Guided readings and research will support larger individual and group projects.

All computer science courses in the Pascack Valley Regional High School District are designed to address multiple learning styles and needs, and accommodations and modifications are made for students with disabilities, multilingual students, students at risk of failure, gifted and talented students, and students with 504 plans. *Advanced Topics in Computer Science* builds on concepts learned and skills developed in *AP Computer Science A*, while also spiraling in those concepts and skills to reinforce and strengthen students' knowledge of computer science. Additionally, *Advanced Topics in Computer Science* anticipates higher-level computer science concepts and skills that will be learned in college-level computer science courses, and enrichment opportunities are provided to challenge students and engage them in rich, interesting tasks. Students are encouraged to analyze data using tools and models to make valid and reliable claims (9.4.12.IML.3), and various technologies and applications are technology are integrated throughout the curriculum.

The Pascack Valley Regional High School Computer Science Department integrates 21st century life and career skills across its courses, with the dual goal of informing students about careers and fields of study that use computer science (9.3.ST.5, 9.3.ST-ET.5 and 9.3.ST-SM.2), and helping students improve the computational thinking skills they will need to in those careers and fields of study (9.2.12.CAP.2). Computer Science courses address the *New Jersey Student Learning Standards for Career Readiness, Life Literacies and Key Skills*, with a particular emphasis on demonstrating the ability to reflect, analyze and use creative skills and ideas (9.4.12.CI.1), investigating new challenges and opportunities for personal growth, advancement and transition (9.4.12.CI.3), identifying problem-solving strategies used in the development of an innovative product or practice (9.4.12.CT.1), and explaining the potential benefits of collaborating to enhance critical thinking and problem solving (9.4.12.CT.2). Computer Science courses also address the *New Jersey Student Learning Standards for English Language Arts Companion Standards*, with a particular focus on following complex multistep procedures (RST.9-10.3/RST.11-12.3), determining the meaning of symbols, key terms, and other domain-specific words and phrases (RST.9-10.4/RST.11-12.3), and translating quantitative or technical information expressed in words into visual forms and translating information expressed visually or mathematically into words (RST.9-10.7). Similarly, the Computer Science Department seeks to support students by providing them with opportunities to use computational thinking skills in interdisciplinary contexts, in contexts that are meaningful to students, and in contexts that attend to the contributions and perspectives of historically marginalized groups. Specifically, computer science courses will look to incorporate, when appropriate, contributions and experiences of people from the LGBTQ+ community and individuals with disabilities, and references to issues of social and cultural relevance, including climate change.

Advanced Topics in Computer Science – This full-year course involves specialized study of theoretical and applied aspects of Computer Science. Topics will include the following: SOFTWARE – A variety of computer programming languages will be studied, including mobile and web applications; HARDWARE – Hardware topics will include programming of the Arduino microcontroller as well as a drone; THEORY – Additional topics may include an analysis of the essential properties of data structures and algorithms; CYBERSECURITY- basic cybersecurity concepts will be studied and PROJECTS – A significant component of this course is student driven exploration of relevant Computer Science concepts and/or applications. Guided readings and research will support larger individual and group projects.

Content/Topic:	Key Learning Items/Concepts and Pacing Guide	Observable Proficiencies and Skills:	NJSLS CS & Design Thinking Standards	Formative, Summative, Benchmark, and Alternative Assessments	Core Instructional and Supplemental Materials/ Modifications and Accommodations
Unit 1 – Python Programming **Time:** 6-8 weeks **Content Statement:** Students will be able to utilize the techniques and structures of the Python programming language to create projects that implement those concepts.	**Key learning items/concepts:** - Functions allow you to write code once that you can execute repeatedly with different inputs. (2 weeks) - Python modules allow code to be divided up into different files and reused in different programs. (2 weeks) - Topics will include the following: basic strategies for problem solving, conditional, repetition, function and other constructs that control the flow of execution of a program, and the use of high-level data types such as lists, strings and dictionaries in problem representation (2 weeks) - analyze large sets of data (2 weeks) **Content-specific modifications and accommodations** - use multiple representations and technology to support conceptual understanding - provide students with skeletons of code and/or utilize flexible grouping **Interdisciplinary/additional connections** - Engage in programming assignments that have applications in science, mathematics, or business - Consider potential programming applications for climate change - Draw on contexts from diverse groups for programming exercises	***Students will be able to:*** - Use Python to compute the results of arithmetic expressions - Use Python to define and call functions - Use Python to use logic and conditionals to change the behavior of the program based upon values within the program.	8.1.12.DA.1 8.1.12.DA.2 8.1.12.DA.5 8.1.12.AP.1 8.1.12.AP.2 8.1.12.AP.3 8.1.12.AP.4 8.1.12.AP.5 8.1.12.AP.6 8.1.12.AP.8 8.1.12.AP.9 **NJSLS SMP** MP1. Make sense of problems and persevere in solving them MP2. Construct viable arguments and critique the reasoning of others MP3. Reason abstractly and quantitatively MP4. Model with mathematics MP5. Attend to precision MP6. Use appropriate tools strategically MP7. Look for and make use of structure MP8. Look for and express regularity in repeated reasoning P1 – Analyzing the effects of computation	*Suggestion(s):* Students will be assessed regularly throughout this course, with a focus on both conceptual understanding and procedural fluency. Assessment tools may include the following: - quizzes (F) - tests (S) - performance tasks (F/S) - projects (S) - homework (F) - discussions (F) - journals (F) - Form A, B, or C benchmark (B) - alternative assessments (A) - portfolio (F, S) - online learning courses (F) - Group Learning Projects (F) - Individual Projects (S) - Oral Presentations (S)	*Suggestion(s):* Cay Horstmann. *Java Concepts.* John Wiley & Sons, Inc, 2005. (grade level); soloLearn (remediation; on grade level; advanced); PyCharm (remediation; on grade level; advanced) **Modifications and Accommodations:** **Students with special needs:** Teachers and support staff will attend to all modifications and accommodations listed in students' IEPs and 504s. Teachers will incorporate manipulatives, extra time, alternative assessments, scaffolding, spiraling, technology, and flexible grouping to support student learning. **Multilingual students:** Teachers and support staff will work to support multilingual students in their first language and in English, providing materials and/or resources

		P2 – Creating computational artifacts P3 – Using abstractions and models P4 – Analyzing problems and artifacts P5 – Communicating processes and results P6 – Working effectively in teams **NJSLS for ELA Companion Standards** RST.9-10.3 RST.9-10.4 RST.9-10.7 RST.11-12.3 RST.11-12.4 **NJSLS-CLKS** **- 21ˢᵗ Century Life and Careers** 9.4.12.CI.1 9.4.12.CI.3 9.4.12.CT.1 9.4.12.CT.2 **- Technology** 9.4.12.IML.3 *9.4.12.DC.3* *9.4.12.DC.4* *9.4.12.DC.7* *9.4.12.TL.1* **- Career Education** 9.2.12.CAP.2 9.3.ST.5 9.3.ST-ET.5 9.3.ST-SM.2		to support students' understanding. Students will be given additional time, as appropriate, and translation tools will be utilized as needed. **Students at risk of school failure:** Formative and summative data will be used to monitor student success, and students at risk of failure will receive additional supports and services, which may include parent consultation, extra help, and differentiation strategies, including small group instruction, group work, scaffolding, and spiraling. **Gifted and Talented Students:** Students who excel in their mastery of course standards will be further challenged with more complex tasks, extensions of concepts and skills, and extended problem solving and critical thinking opportunities.

Advanced Topics in Computer Science – This full-year course involves specialized study of theoretical and applied aspects of Computer Science. Topics will include the following: SOFTWARE – A variety of computer programming languages will be studied, including mobile and web applications; HARDWARE – Hardware topics will include programming of the Arduino microcontroller as well as a drone; THEORY – Additional topics may include an analysis of the essential properties of data structures and algorithms; CYBERSECURITY- basic cybersecurity concepts will be studied and PROJECTS – A significant component of this course is student driven exploration of relevant Computer Science concepts and/or applications. Guided readings and research will support larger individual and group projects.

Content/Topic:	Key Learning Items/Concepts and Pacing Guide	Observable Proficiencies and Skills:	NJSLS CS & Design Thinking Standards	Formative, Summative, Benchmark, and Alternative Assessments	Core Instructional and Supplemental Materials/ Modifications and Accommodations
Unit 2 – Web Development and Applications (e.g. HTML, CSS, JavaScript) **Time: 4** weeks **Content Statement:** Students will be able to utilize the techniques and structures of the Javascript programming language to create projects that implement those concepts.	**Key learning items/concepts:** - HTML is the base language used to power all websites. (1 week) - JavaScript is a scripting language that enables users to interact with websites. (2 weeks) - CSS is used to graphically design and layout webpages. (2 weeks) **Content-specific modifications and accommodations** - use multiple representations and technology to support conceptual understanding - provide students with skeletons of code and/or utilize flexible grouping **Interdisciplinary/additional connections** - Engage in programming assignments that have applications in science, mathematics, or business - Consider potential programming applications for climate change - Draw on contexts from diverse groups for programming	***Students will be able to:*** - Write JavaScript programs using functions, for loops, and conditional statements - Use HTML to construct a web page with paragraphs, divs, images, links, and lists - Add styles to a web page with CSS IDs and classes - Make a web page interactive with various JavaScript commands like alert, onClick, onChange, adding input features like an image canvas, button, and slider.	8.1.12.AP.1 8.1.12.AP.2 8.1.12.AP.3 8.1.12.AP.4 8.1.12.AP.5 8.1.12.AP.7 8.1.12.AP.9 **NJSLS SMP** MP1. Make sense of problems and persevere in solving them MP2. Construct viable arguments and critique the reasoning of others MP3. Reason abstractly and quantitatively MP4. Model with mathematics MP5. Attend to precision MP6. Use appropriate tools strategically MP7. Look for and make use of structure MP8. Look for and express regularity in repeated reasoning P1 – Analyzing the effects of computation P2 – Creating computational artifacts	*Suggestion(s):* Students will be assessed regularly throughout this course, with a focus on both conceptual understanding and procedural fluency. Assessment tools may include the following: - quizzes (F) - tests (S) - performance tasks (F/S) - projects (S) - homework (F) - discussions (F) - journals (F) - Form A, B, or C benchmark (B) - alternative assessments (A) - portfolio (F, S) - online learning courses (F) - Group Learning Projects (F) - Individual Projects (S) - Oral Presentations (S)	*Suggestion(s):* Cay Horstmann. *Java Concepts*. John Wiley & Sons, Inc, 2005. (grade level); soloLearn (remediation; on grade level; advanced); PyCharm (remediation; on grade level; advanced) - Google sites - Dreamweaver **Modifications and Accommodations:** **Students with special needs:** Teachers and support staff will attend to all modifications and accommodations listed in students' IEPs and 504s. Teachers will incorporate manipulatives, extra time, alternative assessments, scaffolding, spiraling, technology, and flexible grouping to support student learning. **Multilingual students:** Teachers and support staff will work to support

| exercises | | | P3 – Using abstractions and models
P4 – Analyzing problems and artifacts
P5 – Communicating processes and results
P6 – Working effectively in teams

NJSLS for ELA Companion Standards

RST.9-10.3
RST.9-10.4
RST.9-10.7
RST.11-12.3
RST.11-12.4

NJSLS-CLKS
- 21st Century Life and Careers
9.4.12.CI.1
9.4.12.CI.3
9.4.12.CT.1
9.4.12.CT.2

- Technology
9.4.12.IML.3
9.4.12.DC.3
9.4.12.DC.4
9.4.12.DC.7
9.4.12.TL.1

- Career Education
9.2.12.CAP.2
9.3.ST.5
9.3.ST-ET.5
9.3.ST-SM.2 | | multilingual students in their first language and in English, providing materials and/or resources to support students' understanding. Students will be given additional time, as appropriate, and translation tools will be utilized as needed.
Students at risk of school failure:
Formative and summative data will be used to monitor student success, and students at risk of failure will receive additional supports and services, which may include parent consultation, extra help, and differentiation strategies, including small group instruction, group work, scaffolding, and spiraling.
Gifted and Talented Students: Students who excel in their mastery of course standards will be further challenged with more complex tasks, extensions of concepts and skills, and extended problem solving and critical thinking opportunities. |

Advanced Topics in Computer Science – This full-year course involves specialized study of theoretical and applied aspects of Computer Science. Topics will include the following: SOFTWARE – A variety of computer programming languages will be studied, including mobile and web applications; HARDWARE – Hardware topics will include programming of the Arduino microcontroller as well as a drone; THEORY – Additional topics may include an analysis of the essential properties of data structures and algorithms; CYBERSECURITY- basic cybersecurity concepts will be studied and PROJECTS – A significant component of this course is student driven exploration of relevant Computer Science concepts and/or applications. Guided readings and research will support larger individual and group projects.

Content/Topic:	Key Learning Items/Concepts and Pacing Guide	Observable Proficiencies and Skills:	NJSLS CS & Design Thinking Standards	Formative, Summative, Benchmark, and Alternative Assessments	Core Instructional and Supplemental Materials/ Modifications and Accommodations
Unit 3 – Swift and Mobile Applications **Time:** 4-6 weeks **Content Statement:** Students will be able to utilize the techniques and structures of the Swift programming language to create projects that implement those concepts.	**Key learning items/concepts:** - Swift is a language that provides real-time feedback and can be incorporated into existing Objective-C code. (2-3 weeks) - The ability to use and apply core graphics, touch handling and gestures, animations and transitions, and alerts and actions can help programmers develop a more advanced, fully functioning app. (2-3 weeks) **Content-specific modifications and accommodations** - use multiple representations and technology to support conceptual understanding - provide students with skeletons of code and/or utilize flexible grouping **Interdisciplinary/additional connections** - Engage in programming assignments that have applications in science, mathematics, or business - Consider potential programming applications for climate change - Draw on contexts from diverse groups for programming exercises	***Students will be able to:*** - Utilize variable declaration, different types, and program control mechanisms. - Use classes, structs, enums, protocols, and object-oriented principles - Manipulate pixels and create filter effects (such as change contrast) - Create a basic App according to specified parameters and guidelines	8.1.12.NI.2 8.1.12.NI.3 8.1.12.AP.1 8.1.12.AP.2 8.1.12.AP.3 8.1.12.AP.4 8.1.12.AP.5 8.1.12.AP.7 8.1.12.AP.9 **NJSLS SMP** MP1. Make sense of problems and persevere in solving them MP2. Construct viable arguments and critique the reasoning of others MP3. Reason abstractly and quantitatively MP4. Model with mathematics MP5. Attend to precision MP6. Use appropriate tools strategically MP7. Look for and make use of structure MP8. Look for and express regularity in repeated reasoning P1 – Analyzing the effects of computation	*Suggestion(s):* Students will be assessed regularly throughout this course, with a focus on both conceptual understanding and procedural fluency. Assessment tools may include the following: - quizzes (F) - tests (S) - performance tasks (F/S) - projects (S) - homework (F) - discussions (F) - journals (F) - Form A, B, or C benchmark (B) - alternative assessments (A) - portfolio (F, S) - online learning courses (F) - Group Learning Projects (F)	*Suggestion(s):* Cay Horstmann. *Java Concepts*. John Wiley & Sons, Inc, 2005. (grade level); soloLearn (remediation; on grade level; advanced); PyCharm (remediation; on grade level; advanced) - XCode - iPads/iPhones **Modifications and Accommodations:** **Students with special needs:** Teachers and support staff will attend to all modifications and accommodations listed in students' IEPs and 504s. Teachers will incorporate manipulatives, extra time, alternative assessments, scaffolding, spiraling, technology, and flexible grouping to support student learning. **Multilingual students:** Teachers and support staff

| | | | P2 – Creating computational artifacts
P3 – Using abstractions and models
P4 – Analyzing problems and artifacts
P5 – Communicating processes and results
P6 – Working effectively in teams

NJSLS for ELA Companion Standards

RST.9-10.3
RST.9-10.4
RST.9-10.7
RST.11-12.3
RST.11-12.4

NJSLS-CLKS
- 21st Century Life and Careers
9.4.12.CI.1
9.4.12.CI.3
9.4.12.CT.1
9.4.12.CT.2

- Technology
9.4.12.IML.3
9.4.12.DC.3
9.4.12.DC.4
9.4.12.DC.7
9.4.12.TL.1

- Career Education
9.2.12.CAP.2
9.3.ST.5
9.3.ST-ET.5
9.3.ST-SM.2 | - Individual Projects (S)
- Oral Presentations (S) | will work to support multilingual students in their first language and in English, providing materials and/or resources to support students' understanding. Students will be given additional time, as appropriate, and translation tools will be utilized as needed.
Students at risk of school failure:
Formative and summative data will be used to monitor student success, and students at risk of failure will receive additional supports and services, which may include parent consultation, extra help, and differentiation strategies, including small group instruction, group work, scaffolding, and spiraling.
Gifted and Talented Students: Students who excel in their mastery of course standards will be further challenged with more complex tasks, extensions of concepts and skills, and extended problem solving and critical thinking opportunities. |

Advanced Topics in Computer Science – This full-year course involves specialized study of theoretical and applied aspects of Computer Science. Topics will include the following: SOFTWARE – A variety of computer programming languages will be studied, including mobile and web applications; HARDWARE – Hardware topics will include programming of the Arduino microcontroller as well as a drone; THEORY – Additional topics may include an analysis of the essential properties of data structures and algorithms; CYBERSECURITY- basic cybersecurity concepts will be studied and PROJECTS – A significant component of this course is student driven exploration of relevant Computer Science concepts and/or applications. Guided readings and research will support larger individual and group projects.

Content/Topic:	Key Learning Items/Concepts and Pacing Guide	Observable Proficiencies and Skills:	NJSLS CS & Design Thinking Standards	Formative, Summative, Benchmark, and Alternative Assessments	Core Instructional and Supplemental Materials/ Modifications and Accommodations
Unit 4 – Arduino/Drone Programming **Time: 4** weeks **Content Statement:** Students will understand the concepts and techniques involved in the programming of microcontrollers and other hardware peripherals as they relate to an Arduino.	**Key learning items/concepts:** - The Arduino environment is composed of the Arduino board, the Arduino IDE, and the Arduino-compatible shields together with their libraries. (1 week) - The C programming language is used to write code for the Arduino. (1 week) - The Arduino IDE is a user interface (accessed through its pins) for the software tools which actually compile and upload the program. (2 weeks) **Content-specific modifications and accommodations** - use multiple representations and technology to support conceptual understanding - provide students with skeletons of code and/or utilize flexible grouping **Interdisciplinary/additional connections** - Engage in programming assignments that have applications in science, mathematics, or business - Consider potential programming applications for climate change	***Students will be able to:*** - Outline the composition of the Arduino development board, and describe what it means to program the board's firmware - Read board schematics - Describe what "shields" are and specify the role of libraries in the use of shields - Compile and run a program - Name C variables, types, and common operators - Explain functions, their definition and invocation - Explain the implications of global variables - Undertake the Arduino build	8.1.12.CS.1 8.1.12.CS.2 8.1.12.CS.3 8.1.12.CS.4 8.1.12.DA.1 8.1.12.DA.4 8.1.12.AP.3 8.1.12.AP.4 8.1.12.AP.5 8.1.12.AP.7 8.2.12.NT.1 8.2.12.NT.2 **NJSLS SMP** MP1. Make sense of problems and persevere in solving them MP2. Construct viable arguments and critique the reasoning of others MP3. Reason abstractly and quantitatively MP4. Model with mathematics MP5. Attend to precision MP6. Use appropriate tools strategically MP7. Look for and make use of structure	*Suggestion(s):* Students will be assessed regularly throughout this course, with a focus on both conceptual understanding and procedural fluency. Assessment tools may include the following: - quizzes (F) - tests (S) - performance tasks (F/S) - projects (S) - homework (F) - discussions (F) - journals (F) - Form A, B, or C benchmark (B) - alternative assessments (A) - portfolio (F, S) - online learning courses (F) - Group Learning Projects (F) - Individual Projects (S) - Oral Presentations (S)	*Suggestion(s):* Cay Horstmann. *Java Concepts*. John Wiley & Sons, Inc, 2005. (grade level); soloLearn (remediation; on grade level; advanced); PyCharm (remediation; on grade level; advanced) - Arduino kits - drone **Modifications and Accommodations:** **Students with special needs:** Teachers and support staff will attend to all modifications and accommodations listed in students' IEPs and 504s. Teachers will incorporate manipulatives, extra time, alternative assessments, scaffolding, spiraling, technology, and flexible grouping to support student learning. **Multilingual students:** Teachers and support staff

	- Draw on contexts from diverse groups for programming exercises	process - Describe how to invoke functions in classes - Explain the structure of an Arduino sketch - Access the pins of the Arduino - Debug embedded software - Create interactive cross-curricular projects that demonstrate the skills and concepts taught in this section	MP8. Look for and express regularity in repeated reasoning P1 – Analyzing the effects of computation P2 – Creating computational artifacts P3 – Using abstractions and models P4 – Analyzing problems and artifacts P5 – Communicating processes and results P6 – Working effectively in teams **NJSLS for ELA Companion Standards** RST.9-10.3 RST.9-10.4 RST.9-10.7 RST.11-12.3 RST.11-12.4 **NJSLS-CLKS** **- 21st Century Life and Careers** 9.4.12.CI.1 9.4.12.CI.3 9.4.12.CT.1 9.4.12.CT.2 **- Technology** 9.4.12.IML.3 *9.4.12.DC.3* *9.4.12.DC.4* *9.4.12.DC.7* *9.4.12.TL.1*		will work to support multilingual students in their first language and in English, providing materials and/or resources to support students' understanding. Students will be given additional time, as appropriate, and translation tools will be utilized as needed. **Students at risk of school failure:** Formative and summative data will be used to monitor student success, and students at risk of failure will receive additional supports and services, which may include parent consultation, extra help, and differentiation strategies, including small group instruction, group work, scaffolding, and spiraling. **Gifted and Talented Students:** Students who excel in their mastery of course standards will be further challenged with more complex tasks, extensions of concepts and skills, and extended problem solving and critical thinking opportunities.

			- Career Education 9.2.12.CAP.2 9.3.ST.5 9.3.ST-ET.5 9.3.ST-SM.2		

Advanced Topics in Computer Science – This full-year course involves specialized study of theoretical and applied aspects of Computer Science. Topics will include the following: SOFTWARE – A variety of computer programming languages will be studied, including mobile and web applications; HARDWARE – Hardware topics will include programming of the Arduino microcontroller as well as a drone; THEORY – Additional topics may include an analysis of the essential properties of data structures and algorithms; CYBERSECURITY- basic cybersecurity concepts will be studied and PROJECTS – A significant component of this course is student driven exploration of relevant Computer Science concepts and/or applications. Guided readings and research will support larger individual and group projects.

Content/Topic:	Key Learning Items/Concepts and Pacing Guide	Observable Proficiencies and Skills:	NJSLS CS & Design Thinking Standards	Formative, Summative, Benchmark, and Alternative Assessments	Core Instructional and Supplemental Materials/ Modifications and Accommodations
Unit 5 – Additional Topics: Advanced Data Structures, Analysis of Algorithms, Game Development **Time:** 14-16 weeks **Content Statement:** Students will study additional topics in computer science that correspond to real-world or second-year courses of study.	**Key learning items/concepts:** - Sorting and searching, divide and conquer, greedy algorithms, and dynamic programming are basic algorithmic techniques used for solving computational problems (6-8 weeks) - A good algorithm usually comes together with a set of good data structures that allow the algorithm to manipulate the data efficiently (6-8 weeks) **Content-specific modifications and accommodations** - use multiple representations and technology to support conceptual understanding - provide students with skeletons of code and/or utilize flexible grouping **Interdisciplinary/additional connections** - Engage in programming assignments that have applications in science, mathematics, or business - Consider potential programming applications for climate change - Draw on contexts from diverse groups for programming exercises	*Students will be able to:* - Sort data - Break a large problem into pieces and solve them recursively - Utilize greedy algorithm - Solve computational problems - Design new algorithms - Implement solutions efficiently	8.1.12.DA.1 8.1.12.DA.2 8.1.12.DA.3 8.1.12.DA.4 8.1.12.DA.5 8.1.12.DA.6 8.1.12.AP.1 8.1.12.AP.2 8.1.12.AP.3 8.1.12.AP.4 8.1.12.AP.5 8.1.12.AP.6 8.1.12.AP.7 8.1.12.AP.8 8.1.12.AP.9 **NJSLS SMP** MP1. Make sense of problems and persevere in solving them MP2. Construct viable arguments and critique the reasoning of others MP3. Reason abstractly and quantitatively MP4. Model with mathematics MP5. Attend to precision MP6. Use appropriate	*Suggestion(s):* Students will be assessed regularly throughout this course, with a focus on both conceptual understanding and procedural fluency. Assessment tools may include the following: - quizzes (F) - tests (S) - performance tasks (F/S) - projects (S) - homework (F) - discussions (F) - journals (F) - Form A, B, or C benchmark (B) - alternative assessments (A) - portfolio (F, S) - online learning courses (F) - Group Learning Projects (F) - Individual Projects (S) - Oral Presentations (S)	*Suggestion(s):* Cay Horstmann. *Java Concepts*. John Wiley & Sons, Inc, 2005. (grade level); soloLearn (remediation; on grade level; advanced); PyCharm (remediation; on grade level; advanced) - *Algorithms and Data Structures* Textbook **Modifications and Accommodations:** **Students with special needs:** Teachers and support staff will attend to all modifications and accommodations listed in students' IEPs and 504s. Teachers will incorporate manipulatives, extra time, alternative assessments, scaffolding, spiraling, technology, and flexible grouping to support student learning. **Multilingual students:** Teachers and support staff will work to support multilingual students in their first language and in English, providing

| | | | tools strategically
MP7. Look for and make use of structure
MP8. Look for and express regularity in repeated reasoning

P1 – Analyzing the effects of computation
P2 – Creating computational artifacts
P3 – Using abstractions and models
P4 – Analyzing problems and artifacts
P5 – Communicating processes and results
P6 – Working effectively in teams

NJSLS for ELA Companion Standards

RST.9-10.3
RST.9-10.4
RST.9-10.7
RST.11-12.3
RST.11-12.4

NJSLS-CLKS
- 21st Century Life and Careers
9.4.12.CI.1
9.4.12.CI.3
9.4.12.CT.1
9.4.12.CT.2

- Technology
9.4.12.IML.3
9.4.12.DC.3
9.4.12.DC.4 | | materials and/or resources to support students' understanding. Students will be given additional time, as appropriate, and translation tools will be utilized as needed.
Students at risk of school failure:
Formative and summative data will be used to monitor student success, and students at risk of failure will receive additional supports and services, which may include parent consultation, extra help, and differentiation strategies, including small group instruction, group work, scaffolding, and spiraling.
Gifted and Talented Students:
Students who excel in their mastery of course standards will be further challenged with more complex tasks, extensions of concepts and skills, and extended problem solving and critical thinking opportunities. |

			9.4.12.DC.7 *9.4.12.TL.1* **- Career Education** 9.2.12.CAP.2 9.3.ST.5 9.3.ST-ET.5 9.3.ST-SM.2		

Advanced Topics in Computer Science – This full-year course involves specialized study of theoretical and applied aspects of Computer Science. Topics will include the following: SOFTWARE – A variety of computer programming languages will be studied, including mobile and web applications; HARDWARE – Hardware topics will include programming of the Arduino microcontroller as well as a drone; THEORY – Additional topics may include an analysis of the essential properties of data structures and algorithms; CYBERSECURITY- basic cybersecurity concepts will be studied and PROJECTS – A significant component of this course is student driven exploration of relevant Computer Science concepts and/or applications. Guided readings and research will support larger individual and group projects.

Content/Topic:	Key Learning Items/Concepts and Pacing Guide	Observable Proficiencies and Skills:	NJSLS CS & Design Thinking Standards	Formative, Summative, Benchmark, and Alternative Assessments	Core Instructional and Supplemental Materials/ Modifications and Accommodations
Unit 6 – Cybersecurity – Foundations and Threats **Time: 2-4** weeks **Content Statement:** Students will study cybersecurity concepts	**Key learning items/concepts:** - 6.0 Cybersecurity Careers, course objectives and Ethics Agreement (1 week) - 6.1 The CIA Triad and Authentication (1 week) - 6.2 Identifying Security Threats (1 week) - 6.3 Introduction to CLI (Command Line Interface) (1 week) **Content-specific modifications and accommodations** - use multiple representations and technology to support conceptual understanding - provide students with skeletons of code and/or utilize flexible grouping **Interdisciplinary/additional connections** - Engage in programming assignments that have applications in science, mathematics, or business - Consider potential programming applications for climate change	*Students will be able to:* - Define the CIA Triad and key principles of cybersecurity. • Identify authentication methods, types of attacks on authentication and best practices for mitigation. • Identify types of malware and methods of mitigation.	8.12.CS.1 8.12.CS.2, 8.1.12.NI.2, 8.1.12.NI.3, 8.1.12.NI.4, 8.1.12.IC.1, 8.1.12.IC.3, 8.2.ED.5, 9.4.12.CI.1, 9.4.12.DC.3, 9.4.12.IML.7 **NJSLS SMP** MP1. Make sense of problems and persevere in solving them MP2. Construct viable arguments and critique the reasoning of others MP3. Reason abstractly and quantitatively MP4. Model with mathematics MP5. Attend to precision MP6. Use appropriate tools strategically MP7. Look for and make use of structure MP8. Look for and	*Suggestion(s):* Students will be assessed regularly throughout this course, with a focus on both conceptual understanding and procedural fluency. Assessment tools may include the following: - quizzes (F) - tests (S) - performance tasks (F/S) - projects (S) - homework (F) - discussions (F) - journals (F) - Form A, B, or C benchmark (B) - alternative assessments (A) - portfolio (F, S) - online learning courses (F) - Group Learning Projects (F) - Individual Projects (S)	*Suggestion(s):* Cay Horstmann. *Java Concepts*. John Wiley & Sons, Inc, 2005. (grade level); soloLearn (remediation; on grade level; advanced); PyCharm (remediation; on grade level; advanced) - Garden State Cyber Curriculum - (Lab) Testing passwords, (Discussion) Matt Honan Epic Hack, (Lab) Have You Been Pwned (Lab) CyberChef tool to hash & salt with CyberChef Intro Video (Activity) Create safe password poster, (Group activity) Which Authentication – biometric products. **Modifications and Accommodations:** **Students with special needs:** Teachers and support staff will attend to all modifications and accommodations listed in students' IEPs and 504s. Teachers will incorporate manipulatives, extra time, alternative assessments, scaffolding, spiraling, technology, and flexible grouping to support student learning. **Multilingual students:** Teachers and support staff will work to support multilingual students in their first language and in English, providing

| | - Draw on contexts from diverse groups for programming exercises | | express regularity in repeated reasoning

NJSLS for ELA Companion Standards

RST.9-10.3
RST.9-10.4
RST.9-10.7
RST.11-12.3
RST.11-12.4

NJSLS-CLKS
- 21st Century Life and Careers
9.4.12.CI.1
9.4.12.CI.3
9.4.12.CT.1
9.4.12.CT.2

- Technology
9.4.12.IML.3
9.4.12.DC.3
9.4.12.DC.4
9.4.12.DC.7
9.4.12.TL.1

- Career Education
9.2.12.CAP.2
9.3.ST.5
9.3.ST-ET.5
9.3.ST-SM.2 | - Oral Presentations (S) | materials and/or resources to support students' understanding. Students will be given additional time, as appropriate, and translation tools will be utilized as needed.
Students at risk of school failure: Formative and summative data will be used to monitor student success, and students at risk of failure will receive additional supports and services, which may include parent consultation, extra help, and differentiation strategies, including small group instruction, group work, scaffolding, and spiraling.
Gifted and Talented Students: Students who excel in their mastery of course standards will be further challenged with more complex tasks, extensions of concepts and skills, and extended problem solving and critical thinking opportunities. |

Advanced Topics in Computer Science – This full-year course involves specialized study of theoretical and applied aspects of Computer Science. Topics will include the following: SOFTWARE – A variety of computer programming languages will be studied, including mobile and web applications; HARDWARE – Hardware topics will include programming of the Arduino microcontroller as well as a drone; THEORY – Additional topics may include an analysis of the essential properties of data structures and algorithms; CYBERSECURITY- basic cybersecurity concepts will be studied and PROJECTS – A significant component of this course is student driven exploration of relevant Computer Science concepts and/or applications. Guided readings and research will support larger individual and group projects.

Content/Topic:	Key learning items/concepts:	Observable Proficiencies and Skills:	NJSLS CS & Design Thinking standards/CT Practices	Benchmark Performance and Assessments	Suggested Materials
Unit 7 – Cybersecurity – The Human Factor **Time:** 2-3 weeks **Content Statement:** Students will study cybersecurity concepts	**Key learning items/concepts:** 7.1 Social Engineering (1 week) 7.2 OSINT & Phishing (1 week) **Content-specific modifications and accommodations** - use multiple representations and technology to support conceptual understanding - provide students with skeletons of code and/or utilize flexible grouping **Interdisciplinary/additional connections** - Engage in programming assignments that have applications in science, mathematics, or business - Consider potential programming applications for climate change - Draw on contexts from diverse groups for programming exercises	*Students will be able to:* -• Define social engineering techniques, phishing and tools for OSINT (Open Source Intelligence).	8.1.12.NI.2, 8.1.12.NI.3, 8.1.12.IC.1, 9.4.12.DC.6 **NJSLS SMP** MP1. Make sense of problems and persevere in solving them MP2. Construct viable arguments and critique the reasoning of others MP3. Reason abstractly and quantitatively MP4. Model with mathematics MP5. Attend to precision MP6. Use appropriate tools strategically MP7. Look for and make use of structure MP8. Look for and express regularity in repeated reasoning **NJSLS for ELA Companion Standards** RST.9-10.3	*Suggestion(s):* Students will be assessed regularly throughout this course, with a focus on both conceptual understanding and procedural fluency. Assessment tools may include the following: - quizzes (F) - tests (S) - performance tasks (F/S) - projects (S) - homework (F) - discussions (F) - journals (F) - Form A, B, or C benchmark (B) - alternative assessments (A) - portfolio (F, S) - online learning courses (F) - Group Learning Projects (F) - Individual Projects (S) - Oral Presentations (S)	*Suggestion(s):* Cay Horstmann. *Java Concepts*. John Wiley & Sons, Inc, 2005. (grade level); soloLearn (remediation; on grade level; advanced); PyCharm (remediation; on grade level; advanced) - Garden State Cyber Curriculum (Group activity) 7 Steps of an Attack – sorting, (Lab) CS Interactive: Social Engineering (Group activity) Make a Social Engineering PSA video, (Lab) Social Engineering Toolkit on Ubuntu **Modifications and Accommodations:** **Students with special needs:** Teachers and support staff will attend to all modifications and accommodations listed in students' IEPs and 504s. Teachers will incorporate manipulatives, extra time, alternative assessments, scaffolding, spiraling, technology, and flexible grouping to support student learning. **Multilingual students:** Teachers and support staff will work to support multilingual students in their first language and in English, providing materials and/or resources to support

			RST.9-10.4 RST.9-10.7 RST.11-12.3 RST.11-12.4		students' understanding. Students will be given additional time, as appropriate, and translation tools will be utilized as needed.
			NJSLS-CLKS - 21st Century Life and Careers 9.4.12.CI.1 9.4.12.CI.3 9.4.12.CT.1 9.4.12.CT.2 **- Technology** 9.4.12.IML.3 *9.4.12.DC.3* *9.4.12.DC.4* *9.4.12.DC.7* *9.4.12.TL.1* **- Career Education** 9.2.12.CAP.2 9.3.ST.5 9.3.ST-ET.5 9.3.ST-SM.2		**Students at risk of school failure:** Formative and summative data will be used to monitor student success, and students at risk of failure will receive additional supports and services, which may include parent consultation, extra help, and differentiation strategies, including small group instruction, group work, scaffolding, and spiraling. **Gifted and Talented Students:** Students who excel in their mastery of course standards will be further challenged with more complex tasks, extensions of concepts and skills, and extended problem solving and critical thinking opportunities.

Advanced Topics in Computer Science – This full-year course involves specialized study of theoretical and applied aspects of Computer Science. Topics will include the following: SOFTWARE – A variety of computer programming languages will be studied, including mobile and web applications; HARDWARE – Hardware topics will include programming of the Arduino microcontroller as well as a drone; THEORY – Additional topics may include an analysis of the essential properties of data structures and algorithms; CYBERSECURITY- basic cybersecurity concepts will be studied and PROJECTS – A significant component of this course is student driven exploration of relevant Computer Science concepts and/or applications. Guided readings and research will support larger individual and group projects.

Content/Topic:	Key Learning Items/Concepts and Pacing Guide	Observable Proficiencies and Skills:	NJSLS CS & Design Thinking Standards	Formative, Summative, Benchmark, and Alternative Assessments	Core Instructional and Supplemental Materials/ Modifications and Accommodations
Unit 8– Artificial Intelligence **Time:** 1-2 weeks **Content Statement:** Students will study emerging trends in AI	**Key learning items/concepts:** Emerging trends in Artificial Intelligence and its ethical implications including AI bias (1-2 weeks) **Content-specific modifications and accommodations** - use multiple representations and technology to support conceptual understanding - provide students with skeletons of code and/or utilize flexible grouping **Interdisciplinary/additional connections** - Engage in programming assignments that have applications in science, mathematics, or business - Consider potential programming applications for climate change - Draw on contexts from diverse groups for programming exercises	*Students will be able to:* Study various trends in AI and their implications	8.2.12.EC.1 8.2.12.EC.2 8.2.12.EC.3 8.2.12.ETW.1 8.1.12.IC.1 8.1.12.IC.3 **NJSLS SMP** MP1. Make sense of problems and persevere in solving them MP2. Construct viable arguments and critique the reasoning of others MP3. Reason abstractly and quantitatively MP4. Model with mathematics MP5. Attend to precision MP6. Use appropriate tools strategically MP7. Look for and make use of structure MP8. Look for and express regularity in repeated reasoning **NJSLS for ELA**	*Suggestion(s):* Students will be assessed regularly throughout this course, with a focus on both conceptual understanding and procedural fluency. Assessment tools may include the following: - quizzes (F) - tests (S) - performance tasks (F/S) - projects (S) - homework (F) - discussions (F) - journals (F) - Form A, B, or C benchmark (B) - alternative assessments (A) - portfolio (F, S) - online learning courses (F) - Group Learning Projects (F) - Individual Projects (S) - Oral Presentations (S)	*Suggestion(s):* Cay Horstmann. *Java Concepts*. John Wiley & Sons, Inc, 2005. (grade level); soloLearn (remediation; on grade level; advanced); PyCharm (remediation; on grade level; advanced) - *Algorithms and Data Structures* Textbook **Modifications and Accommodations:** **Students with special needs:** Teachers and support staff will attend to all modifications and accommodations listed in students' IEPs and 504s. Teachers will incorporate manipulatives, extra time, alternative assessments, scaffolding, spiraling, technology, and flexible grouping to support student learning. **Multilingual students:** Teachers and support staff will work to support multilingual students in their first language and in English, providing materials and/or resources to support students' understanding. Students will be given additional time, as appropriate, and translation tools will be utilized as needed. **Students at risk of school failure:** Formative and summative data will be used to monitor student success, and students at risk of failure will receive additional supports and services, which

			Companion Standards		may include parent consultation, extra help, and differentiation strategies, including small group instruction, group work, scaffolding, and spiraling.
			RST.9-10.3		**Gifted and Talented Students:** Students who excel in their mastery of course standards will be further challenged with more complex tasks, extensions of concepts and skills, and extended problem solving and critical thinking opportunities.
			RST.9-10.4		
			RST.9-10.7		
			RST.11-12.3		
			RST.11-12.4		
			NJSLS-CLKS **- 21st Century Life and Careers**		
			9.4.12.CI.1		
			9.4.12.CI.3		
			9.4.12.CT.1		
			9.4.12.CT.2		
			- Technology		
			9.4.12.IML.3		
			9.4.12.DC.3		
			9.4.12.DC.4		
			9.4.12.DC.7		
			9.4.12.TL.1		
			- Career Education		
			9.2.12.CAP.2		
			9.3.ST.5		
			9.3.ST-ET.5		
			9.3.ST-SM.2		