## 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** Born On: September, 2018 Previous Revision: August, 2022 Current Revision: August, 2023 Board Approval: 8/28/23

## **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 experiences of people from the LGBTQ+ community and individuals with disabilities, and references to issues of social and cultural relevance, including climate change.

	nputer Science – This full-year course involves				
	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.				
Science concepts and/or a	pprications. Guided readings and research wit	· · ·	fici viduai and group projects.	Formative, Summative,	Core Instructional and
	Key Learning Items/Concepts and	Observable	NJSLS CS & Design	Benchmark, and	Supplemental Materials/
Content/Topic:	Pacing Guide	Proficiencies	Thinking Standards	Alternative	Modifications and
		and Skills:		Assessments	Accommodations
Unit 1 – Python	Key learning items/concepts:	Students will	8.1.12.DA.1	Suggestion(s):	Suggestion(s):
Programming	- Functions allow you to write code once	be able to:	8.1.12.DA.2	Students will be assessed	Cay Horstmann. Java
	that you can execute repeatedly with	- Use Python	8.1.12.DA.5	regularly throughout this	Concepts. John Wiley &
Time: 6-8 weeks	different inputs. (2 weeks)	to compute	8.1.12.AP.1	course, with a focus on	Sons, Inc, 2005. (grade
	- Python modules allow code to be divided	the results of	8.1.12.AP.2	both conceptual	level); soloLearn
<b>Content Statement:</b>	up into different files and reused in	arithmetic	8.1.12.AP.3	understanding and	(remediation; on grade
Students will be able to	different programs. (2 weeks)	expressions	8.1.12.AP.4	procedural fluency.	level; advanced);
utilize the techniques	- Topics will include the following: basic	- Use Python	8.1.12.AP.5	Assessment tools may	PyCharm (remediation; on
and structures of the	strategies for problem solving, conditional,	to define and	8.1.12.AP.6	include the following:	grade level; advanced)
Python programming	repetition, function and other constructs	call functions	8.1.12.AP.8	- quizzes (F)	35 100 1
language to create	that control the flow of execution of a	- Use Python	8.1.12.AP.9	- tests (S)	Modifications and
projects that implement	program, and the use of high-level data	to use logic	NICL C CMP	- performance tasks	Accommodations:
those concepts.	types such as lists, strings and dictionaries	and	NJSLS SMP	(F/S)	Students with special
	in problem representation (2 weeks)	conditionals	MD1 M 1 C 11	- projects (S) - homework (F)	needs: Teachers and
	- analyze large sets of data (2 weeks)	to change the behavior of	MP1. Make sense of problems	- discussions (F)	support staff will attend to all modifications and
	Content-specific modifications and	the program	and persevere in solving them MP2. Construct viable	- journals (F)	accommodations listed in
	accommodations	based upon	arguments and critique the	- Form A, B, or C	students' IEPs and 504s.
	- use multiple representations and	values within	reasoning of others	benchmark (B)	Teachers will incorporate
	technology to support conceptual	the program.	MP3. Reason abstractly and	- alternative assessments	manipulatives, extra time,
	understanding	the program.	quantitatively	(A)	alternative assessments,
	- provide students with skeletons of code		MP4. Model with mathematics	- portfolio (F, S)	scaffolding, spiraling,
	and/or utilize flexible grouping		MP5. Attend to precision	- online learning courses	technology, and flexible
	and of diffice from the grouping		MP6. Use appropriate tools	(F)	grouping to support
	Interdisciplinary/additional connections		strategically	- Group Learning	student learning.
	- Engage in programming assignments that		MP7. Look for and make use of	Projects (F)	Multilingual students:
	have applications in science, mathematics,		structure	- Individual Projects (S)	Teachers and support staff
	or business		MP8. Look for and express	- Oral Presentations (S)	will work to support
	- Consider potential programming		regularity in repeated reasoning		multilingual students in
	applications for climate change				their first language and in
	- Draw on contexts from diverse groups		P1 – Analyzing the effects of		English, providing
	for programming exercises		computation		materials and/or resources

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

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	oplications. Guided readings and research			1	1
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	Key learning items/concepts:	Students will be able		Suggestion(s):	Suggestion(s):
Development and	- HTML is the base language	to:	8.1.12.AP.1	Students will be	Cay Horstmann. Java
Applications (e.g.	used to power all websites. (1	- Write JavaScript	8.1.12.AP.2	assessed regularly	Concepts. John Wiley &
HTML, CSS, JavaScript)	week)	programs using	8.1.12.AP.3	throughout this course,	Sons, Inc, 2005. (grade
	- JavaScript is a scripting	functions, for loops,	8.1.12.AP.4	with a focus on both	level); soloLearn
Time: 4 weeks	language that enables users to	and conditional	8.1.12.AP.5	conceptual	(remediation; on grade
	interact with websites. (2 weeks)	statements	8.1.12.AP.7	understanding and	level; advanced);
<b>Content Statement:</b>	- CSS is used to graphically	- Use HTML to	8.1.12.AP.9	procedural fluency.	PyCharm (remediation; on
Students will be able to	design and layout webpages. (2	construct a web page		Assessment tools may	grade level; advanced)
utilize the techniques and	weeks)	with paragraphs, divs,	NJSLS SMP	include the following:	
structures of the		images, links, and lists		- quizzes (F)	- Google sites
Javascript programming	Content-specific modifications	- Add styles to a web	MP1. Make sense of problems	- tests (S)	- Dreamweaver
language to create	and accommodations	page with CSS IDs	and persevere in solving them	- performance tasks	3.5 1.6
projects that implement	- use multiple representations and	and classes	MP2. Construct viable	(F/S)	Modifications and
those concepts.	technology to support conceptual	- Make a web page	arguments and critique the	- projects (S)	Accommodations:
	understanding - provide students with skeletons	interactive with various JavaScript	reasoning of others MP3. Reason abstractly and	- homework (F) - discussions (F)	Students with special needs: Teachers and
	of code and/or utilize flexible	commands like alert,	quantitatively	- journals (F)	support staff will attend to
	grouping	onClick, onChange,	MP4. Model with mathematics	- Journals (F) - Form A, B, or C	all modifications and
	grouping	adding input features	MP5. Attend to precision	benchmark (B)	accommodations listed in
	Interdisciplinary/additional	like an image canvas,	MP6. Use appropriate tools	- alternative	students' IEPs and 504s.
	connections	button, and slider.	strategically	assessments	Teachers will incorporate
	- Engage in programming	oution, and snaci.	MP7. Look for and make use of	(A)	manipulatives, extra time,
	assignments that have		structure	- portfolio (F, S)	alternative assessments,
	applications in science,		MP8. Look for and express	- online learning	scaffolding, spiraling,
	mathematics, or business		regularity in repeated reasoning	courses (F)	technology, and flexible
	- Consider potential			- Group Learning	grouping to support
	programming applications for		P1 – Analyzing the effects of	Projects (F)	student learning.
	climate change		computation	- Individual Projects (S)	Multilingual students:
	- Draw on contexts from diverse		P2 – Creating computational	- Oral Presentations (S)	Teachers and support staff
	groups for programming		artifacts		will work to support

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exercises	P3 – Using abstractions and	multilingual students in
	models	their first language and in
	P4 – Analyzing problems and	English, providing
	artifacts	materials and/or resources
	P5 – Communicating processes	to support students'
	and results	understanding. Students
	P6 – Working effectively in	will be given additional
	teams	time, as appropriate, and
		translation tools will be
	NJSLS for ELA Companion	utilized as needed.
	Standards	Students at risk of
		school failure:
	RST.9-10.3	Formative and summative
	RST.9-10.4	data will be used to
	RST.9-10.7	monitor student success,
	RST.11-12.3	and students at risk of
	RST.11-12.4	failure will receive
	1011111211	additional supports and
	NJSLS-CLKS	services, which may
	- 21st Century Life and	include parent
	Careers	consultation, extra help,
	9.4.12.CI.1	and differentiation
	9.4.12.CI.3	strategies, including small
	9.4.12.CT.1	group instruction, group
	9.4.12.CT.1 9.4.12.CT.2	work, scaffolding, and
	9.4.12.C1.2	spiraling.
	- Technology	Gifted and Talented
	9.4.12.IML.3	Students: Students who
	9.4.12.DC.3	excel in their mastery of
	9.4.12.DC.4	course standards will be
	9.4.12.DC.7	further challenged with
	9.4.12.TL.1	more complex tasks,
		extensions of concepts
	- Career Education	and skills, and extended
	9.2.12.CAP.2	problem solving and
	9.3.ST.5	critical thinking
	9.3.ST-ET.5	opportunities.
	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 – programming of the Ardu CYBERSECURITY- basis	- A variety of computer programming langu ino microcontroller as well as a drone; THE ic cybersecurity concepts will be studied and pplications. Guided readings and research w	ages will be studied, ORY – Additional to I PROJECTS – A sig	including mobile and web application opics may include an analysis of the emificant component of this course is s	ns; HARDWARE – Ha ssential properties of d	ardware topics will include ata structures and algorithms;
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	Key learning items/concepts:	Students will be	8.1.12.NI.2	Suggestion(s):	Suggestion(s):
Mobile Applications	- Swift is a language that provides real-	able to:	8.1.12.NI.3	Students will be	Cay Horstmann. Java
	time feedback and can be incorporated	- Utilize variable	8.1.12.AP.1	assessed regularly	Concepts. John Wiley &
Time: 4-6 weeks	into existing Objective-C code. (2-3	declaration,	8.1.12.AP.2	throughout this	Sons, Inc, 2005. (grade
	weeks)	different types,	8.1.12.AP.3	course, with a	level); soloLearn
<b>Content Statement:</b>	- The ability to use and apply core	and program	8.1.12.AP.4	focus on both	(remediation; on grade
Students will be able to	graphics, touch handling and gestures,	control	8.1.12.AP.5	conceptual	level; advanced); PyCharm
utilize the techniques	animations and transitions, and alerts	mechanisms.	8.1.12.AP.7	understanding and	(remediation; on grade
and structures of the	and actions can help programmers	- Use classes,	8.1.12.AP.9	procedural fluency.	level; advanced)
Swift programming	develop a more advanced, fully	structs, enums,		Assessment tools	
language to create	functioning app. (2-3 weeks)	protocols, and	NJSLS SMP	may include the	- XCode
projects that implement		object-oriented		following:	- iPads/iPhones
those concepts.	Content-specific modifications and	principles	MP1. Make sense of problems	- quizzes (F)	25 100 1
	accommodations	- Manipulate	and persevere in solving them	- tests (S)	Modifications and
	- use multiple representations and	pixels and create	MP2. Construct viable arguments	- performance	Accommodations:
	technology to support conceptual	filter effects	and critique the reasoning of	tasks (F/S)	Students with special
	understanding	(such as change	others	- projects (S)	needs: Teachers and
	- provide students with skeletons of	contrast)	MP3. Reason abstractly and	- homework (F)	support staff will attend to
	code and/or utilize flexible grouping	- Create a basic	quantitatively	- discussions (F)	all modifications and
	Internal and all the seconds at 1242 and 1	App according to	MP4. Model with mathematics	- journals (F)	accommodations listed in
	Interdisciplinary/additional connections	specified	MP5. Attend to precision	- Form A, B, or C	students' IEPs and 504s.
		parameters and	MP6. Use appropriate tools	benchmark (B)	Teachers will incorporate
	- Engage in programming assignments	guidelines	strategically	- alternative	manipulatives, extra time,
	that have applications in science,		MP7. Look for and make use of	assessments	alternative assessments,
	mathematics, or business - Consider potential programming		structure	(A) - portfolio (F, S)	scaffolding, spiraling, technology, and flexible
	applications for climate change		MP8. Look for and express	- portiono (F, S) - online learning	
	- Draw on contexts from diverse groups		regularity in repeated reasoning	courses (F)	grouping to support student learning.
	for programming exercises		P1 – Analyzing the effects of	- Group Learning	Multilingual students:
	for programming exercises		1	Projects (F)	Teachers and support staff
			computation	1 Tojecis (F)	reachers and support staff

Course: Advanced Topics in Computer Science

<b>PVRHSD</b>	CURRICUL	JIM MAP

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

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

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- 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	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
	skills and concepts	_	at risk of failure will receive
			services, which may include parent consultation, extra
		RST.9-10.4	strategies, including small group instruction, group
		NJSLS-CLKS - 21st Century Life and	Students: Students who excel in their mastery of course standards will be
		Careers 9.4.12.CI.1 9.4.12.CI.3 9.4.12.CT.1 9.4.12.CT.2	further challenged with more complex tasks, extensions of concepts and skills, and extended problem solving and critical thinking opportunities.
		- Technology 9.4.12.IML.3 9.4.12.DC.3 9.4.12.DC.4	оррогишись.
		9.4.12.DC.7 9.4.12.TL.1	

Course: Advanced Topics in Computer Science PVRHSD CURRICULUM MAP Grade Level: 11 – 12

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

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

tools strategically materials and/or resources to MP7. Look for and make support students' understanding. Students will be use of structure given additional time, as MP8. Look for and appropriate, and translation express regularity in tools will be utilized as needed. repeated reasoning Students at risk of school P1 – Analyzing the effects failure: Formative and summative data of computation P2 – Creating will be used to monitor student computational artifacts success, and students at risk of P3 – Using abstractions failure will receive additional supports and services, which and models P4 – Analyzing problems may include parent and artifacts consultation, extra help, and differentiation strategies, P5 – Communicating processes and results including small group P6 – Working effectively instruction, group work, scaffolding, and spiraling. in teams **Gifted and Talented Students:** Students who excel in their NJSLS for ELA **Companion Standards** mastery of course standards will be further challenged with more complex tasks, extensions RST.9-10.3 RST.9-10.4 of concepts and skills, and extended problem solving and RST.9-10.7 critical thinking opportunities. 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

PVRHSD CURRICULUM MAP

Grade Level: 11 – 12

Course: Advanced Topics in Computer Science

Course: Advanced Topics in Computer Science	PVRHSD CURRICULUM MAP	Grade Level: 11 – 12
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	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

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

- Draw on contexts from diverse	express regularity in	- Oral Presentations	materials and/or resources to support
groups for programming exercises	repeated reasoning	(S)	students' understanding. Students will be
			given additional time, as appropriate, and
	NJSLS for ELA		translation tools will be utilized as
	Companion		needed.
	Standards		Students at risk of school failure:
			Formative and summative data will be
	RST.9-10.3		used to monitor student success, and
	RST.9-10.4		students at risk of failure will receive
	RST.9-10.7		additional supports and services, which
	RST.11-12.3		may include parent consultation, extra
	RST.11-12.4		help, and differentiation strategies,
			including small group instruction, group
	NJSLS-CLKS		work, scaffolding, and spiraling.
	- 21st Century Life		Gifted and Talented Students: Students
	and Careers		who excel in their mastery of course
	9.4.12.CI.1		standards will be further challenged with
	9.4.12.CI.3		more complex tasks, extensions of
	9.4.12.CT.1		concepts and skills, and extended
	9.4.12.CT.2		problem solving and critical thinking opportunities.
	- Technology		11
	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		

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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 –	Key learning items/concepts:	Students will be able to:	8.1.12.NI.2, 8.1.12.NI.3,	Suggestion(s): Students will be assessed	Suggestion(s): Cay Horstmann. Java Concepts. John		
The Human Factor	7.1 Social Engineering (1 week) 7.2 OSINT & Phishing (1 week)	-• Define social	8.1.12.IV.1.5, 8.1.12.IC.1, 9.4.12.DC.6	regularly throughout this course, with a focus on both	Wiley & Sons, Inc, 2005. (grade level); soloLearn (remediation; on grade level;		
Time: 2-3 weeks  Content	Content-specific modifications and accommodations	engineering techniques, phishing and	NJSLS SMP	conceptual understanding and procedural fluency. Assessment tools may	advanced); PyCharm (remediation; on grade level; advanced)		
Statement: Students will study	- use multiple representations and	tools for	MP1. Make sense of	include the following:	- Garden State Cyber Curriculum		
cybersecurity concepts	technology to support conceptual understanding - provide students with skeletons of code and/or utilize flexible grouping  Interdisciplinary/additional connections - Engage in programming	OSINT (Open Source Intelligence).	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	- quizzes (F) - tests (S) - performance tasks (F/S) - projects (S) - homework (F) - discussions (F) - journals (F) - Form A, B, or C benchmark (B)	(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		
	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		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	- alternative assessments (A) - portfolio (F, S) - online learning courses (F) - Group Learning Projects (F) - Individual Projects (S) - Oral Presentations (S)	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		

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					driven exploration of relevant Computer		
Science concepts and/or applications. Guided readings and research will support larger individual and group projects.							
Camtant/Tania	Key Learning Items/Concepts	Observable Proficiencies	NJSLS CS & Design	Formative, Summative,	Core Instructional and Supplemental		
Content/Topic:	and Pacing Guide	and Skills:	Thinking Standards	Benchmark, and	Materials/ Modifications and		
Unit 8– Artificial	Variations it amelian anter	Students will	8.2.12.EC.1	Alternative Assessments	Accommodations		
	Key learning items/concepts:		8.2.12.EC.1 8.2.12.EC.2	Suggestion(s): Students will be assessed	Suggestion(s):		
Intelligence	Ein-a to do in AntiGoi-1	be able to:	8.2.12.EC.2 8.2.12.EC.3		Cay Horstmann. Java Concepts. John		
T1 21	Emerging trends in Artificial	Study		regularly throughout this	Wiley & Sons, Inc, 2005. (grade level);		
Time: 1-2 weeks	Intelligence and its ethical	various	8.2.12.ETW.1	course, with a focus on both	soloLearn (remediation; on grade level;		
	implications including AI bias (1-2	trends in AI	8.1.12.IC.1	conceptual understanding	advanced); PyCharm (remediation; on		
Content	weeks)	and their	8.1.12.IC.3	and procedural fluency.	grade level; advanced)		
Statement:	C	implications	NICL C CMD	Assessment tools may	41		
Students will study	Content-specific modifications		NJSLS SMP	include the following:	- Algorithms and Data Structures		
emerging trends in	and accommodations		) (D1 ) (1 ) (1	- quizzes (F)	Textbook		
AI	- use multiple representations and		MP1. Make sense of	- tests (S)	B# 1:00 /* 1 / 1 / 1 / 1		
	technology to support conceptual		problems and	- performance tasks (F/S)	Modifications and Accommodations:		
	understanding		persevere in solving	- projects (S)	Students with special needs: Teachers		
	- provide students with skeletons		them	- homework (F)	and support staff will attend to all		
	of code and/or utilize flexible		MP2. Construct viable	- discussions (F)	modifications and accommodations listed		
	grouping		arguments and critique	- journals (F)	in students' IEPs and 504s. Teachers will		
			the reasoning of others	- Form A, B, or C	incorporate manipulatives, extra time,		
	Interdisciplinary/additional		MP3. Reason	benchmark (B)	alternative assessments, scaffolding,		
	connections		abstractly and	- alternative assessments	spiraling, technology, and flexible		
	- Engage in programming		quantitatively	(A)	grouping to support student learning.		
	assignments that have applications		MP4. Model with	- portfolio (F, S)	Multilingual students: Teachers and		
	in science, mathematics, or		mathematics	- online learning courses (F)	support staff will work to support		
	business		MP5. Attend to	- Group Learning Projects	multilingual students in their first language		
	- Consider potential programming		precision	(F)	and in English, providing materials and/or		
	applications for climate change		MP6. Use appropriate	- Individual Projects (S)	resources to support students'		
	- Draw on contexts from diverse		tools strategically	- Oral Presentations (S)	understanding. Students will be given		
	groups for programming exercises		MP7. Look for and		additional time, as appropriate, and		
			make use of structure		translation tools will be utilized as needed.		
			MP8. Look for and		Students at risk of school failure:		
			express regularity in		Formative and summative data will be		
			repeated reasoning		used to monitor student success, and		
					students at risk of failure will receive		
			NJSLS for ELA		additional supports and services, which		

Companion	may include parent consultation, extra
Standards	help, and differentiation strategies,
	including small group instruction, group
RST.9-10.3	work, scaffolding, and spiraling.
RST.9-10.4	<b>Gifted and Talented Students:</b> Students
RST.9-10.7	who excel in their mastery of course
RST.11-12.3	standards will be further challenged with
RST.11-12.4	more complex tasks, extensions of
	concepts and skills, and extended problem
NJSLS-CLKS	solving and critical thinking opportunities.
- 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	