AP Computer Science A
Grades 10-12 (PLTW)
Curriculum

This curricula and accompanying instructional materials have been developed to align with the NJSLS and in accordance with the NJ Department of Education's guidelines to include: Curriculum designed to meet grade level expectations, integrated accommodations and modifications for students with IEPs, 504s, ELLs, and gifted and talented students, assessments including benchmarks, formative, summative, and alternative assessments, a list of core instructional and supplemental materials, pacing guide, interdisciplinary connections, integration of 21st century skills, integration of technology, and integration of 21st Century Life and Career standards.

About the Standards

In 1996, the New Jersey State Board of Education adopted the state's first set of academic standards called the Core Curriculum Content Standards. The standards described what students should know and be able to do upon completion of a thirteen-year public school education. Over the last twenty years, New Jersey's academic standards have laid the foundation for local district curricula that is used by teachers in their daily lesson plans.

Revised every five years, the standards provide local school districts with clear and specific benchmarks for student achievement in nine content areas. Developed and reviewed by panels of teachers, administrators, parents, students, and representatives from higher education, business, and the community, the standards are influenced by national standards, research-based practice, and student needs. The standards define a "Thorough and Efficient Education" as guaranteed in 1875 by the New Jersey Constitution. Currently the standards are designed to prepare our students for college and careers by emphasizing high-level skills needed for tomorrow's world.

The New Jersey Student Learning Standards include Preschool Teaching and Learning Standards, as well as nine K-12 standards for the following content areas: **21st Century Life and Careers, Comprehensive Health and Physical Education, English Language Arts, Mathematics, Science, Social Studies, Technology, Visual and Performing Arts, World Languages**

Lower Cape May Regional School District 9-12 Grade AP Computer Science A Curriculum	
Content Area: Computer Science	
Course Title: AP Computer Science A	**Grade level: 9-12**
Unit 1: Introducing Java	**44 days**
Unit 2: Android Development	**41 days**
Unit 3: Games and Algorithms	**39 days**
Unit 4: The LibGDX Game Development Framework	**24 days**
Date Created: 11/16/21	**Board Approved: 2021**

Lower Cape May Regional School District 9-12 Grade AP Computer Science A Curriculum Unit 1 Overview
Content Area: Computer Science
Unit Title: Introducing Java
Target Course/Grade Level: 9-12 Grade
Unit 1: Introducing Java Unit one provides a primer in the basics of the Java programming language and object oriented programming (OOP). Students create classes, instantiate them, add instance data and access that data. They use conditionals, iteration, arithmetic and logical operators, arrays and iterators, first in BlueJ to ensure code correctness, and then in AndroidTM Studio to incorporate their own code into fully functional apps. The material provided also includes extra practice on all these Java topics and more.

Interdisciplinary Connections:
- Life Literacies and Key Skills (Critical Thinking and Problem Solving)

21st Century Themes, Skills, and Standards:

• 9.4.12.DC.3: Evaluate the social and economic implications of privacy in the context of safety, law, or ethics (e.g., 6.3.12.HistoryCA.1).
9.4.12.DC.4: Explain the privacy concerns related to the collection of data (e.g., cookies) and generation of data through automated processes that may not be evident to users (e.g., 8.1.12.NI.3).
9.4.12.DC.5: Debate laws and regulations that impact the development and use of software.

9.4.12.DC.1: Explain the beneficial and harmful effects that intellectual property laws can have on the creation and sharing of content (e.g., 6.1.12.CivicsPR.16.a).
9.4.12.DC.2: Compare and contrast international differences in copyright laws and ethics
9.2.12.CAP.2: Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs.
9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth.
9.2.12.CAP.4: Evaluate different careers and develop various plans (e.g., costs of public, private, training schools) and timetables for achieving them, including educational/training requirements, costs, loans, and debt repayment.
9.2.12.CAP.5: Assess and modify a personal plan to support current interests and postsecondary plans.
9.2.12.CAP.6: Identify transferable skills in career choices and design alternative career plans based on those skills.
9.2.12.CAP.7: Use online resources to examine licensing, certification, and credentialing requirements at the local, state, and national levels to maintain compliance with industry requirements in areas of career interest.
9.2.12.CAP.8: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors.
9.2.12.CAP.9: Locate information on working papers, what is required to obtain them, and who must sign them.

Learning Targets

CPI #	Cumulative Progress Indicators (CPI) for Unit
8.1.12.AP.1	Design algorithms to solve computational problems using a combination of original and existing algorithms.
8.1.12.AP.2	Create generalized computational solutions using collections instead of repeatedly using simple variables
8.1.12.AP.3	Select and combine control structures for a specific application based upon performance and readability, and identify trade-offs to justify the choice.

8.1.12.AP.4	Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue
8.1.12.AP.5	Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.
8.1.12.AP.6	Create artifacts by using procedures within a program, combinations of data and procedures, or independent but interrelated programs.
8.1.12.AP.7	Collaboratively design and develop programs and artifacts for broad audiences by incorporating feedback from users.
8.1.12.AP.8	Evaluate and refine computational artifacts to make them more usable and accessible
8.1.12.AP.9	Collaboratively document and present design decisions in the development of complex programs.
8.1.12.CS.1	Describe ways in which integrated systems hide underlying implementation details to simplify user experiences.
8.1.12.CS.2	Model interactions between application software, system software, and hardware.
8.1.12.CS.3	Compare the functions of application software, system software, and hardware.
8.1.12.CS.4	Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors.

Unit Enduring Questions:	Unit Enduring Understandings:
● **What is Java?** ● **How do we manipulate java?**	• **Android Development** • **Making Objects** • **MagPie**

Unit Objectives: *Students will know….* ● **How to manipulate data**	Unit Objectives: *Students will be able to…...* ● **Store data** ● **Create an android project**

Lower Cape May Regional School District 9-12 Grade AP Computer Science A Unit 2 Overview
Content Area: Computer Science
Unit Title: Android Development
Target Course/Grade Level: 9-12 Grade
Students will use a Backend As A Service (BaaS) to implement persistent data within their app, allowing a user to access their data from any AndroidTM device. At the end of the unit, students create a new app, applying what they have learned throughout the unit.
Interdisciplinary Connections: ● Life Literacies and Key Skills (Creativity and Innovation):
21st Century Themes, Skills, and Standards: 9.4.12.DC.3: Evaluate the social and economic implications of privacy in the context of safety, law, or ethics (e.g., 6.3.12.HistoryCA.1). 9.4.12.DC.4: Explain the privacy concerns related to the collection of data (e.g., cookies) and generation of data through automated processes that may not be evident to users (e.g., 8.1.12.NI.3). 9.4.12.DC.5: Debate laws and regulations that impact the development and use of software.
Learning Targets

CPI #	Cumulative Progress Indicators (CPI) for Unit
8.1.12.NI.1	Evaluate the scalability and reliability of networks, by describing the relationship between routers, switches, servers, topology, and addressing

8.1.12.NI.2	Evaluate security measures to address various common security threats.
8.1.12.NI.3	Explain how the needs of users and the sensitivity of data determine the level of security implemented.
8.1.12.NI.4	Explain how decisions on methods to protect data are influenced by whether the data is at rest, in transit, or in use.
8.1.12.IC.1	Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices.
8.1.12.IC.2	Test and refine computational artifacts to reduce bias and equity deficits.
8.1.12.IC.3	Predict the potential impacts and implications of emerging technologies on larger social, economic, and political structures, using evidence from credible sources
8.1.12.CS.1	Describe ways in which integrated systems hide underlying implementation details to simplify user experiences.
8.1.12.CS.2	Model interactions between application software, system software, and hardware.
8.1.12.CS.3	Compare the functions of application software, system software, and hardware
8.1.12.CS.4	Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors.

Unit Enduring Questions: ● **What is App Navigation?** ● **What is Data Persistence?**	**Unit Enduring Understandings:** ● **Server Vulnerabilities** ● **Server Exploits** ● **The Ecommerce Site**
Unit Objectives: *Students will know….* ● **How to use the College App** ● **Prototyping** ● **App navigation**	**Unit Objectives:** *Students will be able to…...* ● **Understand the OOP paradigm** ● **Remove a database** ● **List and detail**

Lower Cape May Regional School District 9-12 Grade AP Computer Science A
Unit 3 Overview

Content Area: Computer Science

Unit Title: Advanced Android

Target Course/Grade Level: 9-12 Grade

Unit 3: Advanced AndroidTM Features The goal of Unit Three is for students to reach a level of understanding of Google's AndroidTM libraries that allow them to create apps that use a broad range of mobile features such as Global Positioning Systems (GPS) and web access. The major project in this unit is a social networking app that utilizes the Google Cloud Platform to store data. Students begin by learning about the Google Cloud Datastore service and using client and server code to read and write to a cloud database. Students then learn to access the GPS features of their mobile devices and move on to reading Quick Response (QR) codes and accessing the web. The unit culminates in a problem in which students create a geo-cache style app using the techniques they developed in the social networking app projects

Interdisciplinary Connections:

Career Readiness Life Literacies and Key Skills (Digital Citizenship)
Career Readiness Life Literacies and Key Skills (Global and Cultural Awareness)
Social Studies
Ethics

21st Century Themes, Skills, and Standards:
9.4.12.IML.1: Compare search browsers and recognize features that allow for filtering of information.
•9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources (e.g., NJSLSA.W8, Social Studies Practice: Gathering and Evaluating Sources.
9.4.12.DC.3: Evaluate the social and economic implications of privacy in the context of safety, law, or ethics (e.g., 6.3.12.HistoryCA.1).
9.4.12.DC.4: Explain the privacy concerns related to the collection of data (e.g., cookies) and generation of data through automated processes that may not be evident to users (e.g., 8.1.12.NI.3).
9.4.12.DC.5: Debate laws and regulations that impact the development and use of software.

Learning Targets

CPI #	Cumulative Progress Indicators (CPI) for Unit
8.1.12.DA.1	Create interactive data visualizations using software tools to help others better understand real world phenomena, including climate change.

8.1.12.DA.2	Describe the trade-offs in how and where data is organized and stored.
8.1.12.DA.3	Translate between decimal numbers and binary numbers
8.1.12.DA.4	Explain the relationship between binary numbers and the storage and use of data in a computing device
8.1.12.DA.5	Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.
8.1.12.DA.6	Create and refine computational models to better represent the relationships among different elements of data collected from a phenomenon or process.

Unit Enduring Questions:	**Unit Enduring Understandings:**
● **What is location awareness?** ● **How can we list trips?** ● **How can we store and retrieve data?**	• **Algorithms** • **Search algorithms** • **Social media networking** • **Public vs. Private trips**
Unit Objectives: *Students will know….* ● **How to crowd source** ● **How to cloud source** ● **About user authentication** ● **About location awareness**	**Unit Objectives:** *Students will be able to…...* • **Use java to authenticate web frameworks** • **Understand APIs** • **Understand OOP**

Lower Cape May Regional School District 9-12 Grade AP Computer Science A Unit 4 Overview
Content Area: Computer Science
Unit Title: LibGDX Game Development Framework
Target Course/Grade Level: 9-12 Grade
The goal of Unit 4 is to give students an opportunity to practice and refine their understanding of Java techniques in the context of game development. LibGDX is a popular open source game development

framework that is constantly growing due to the contributions of its active community members. An important part of this lesson is teaching students to access resources to help themselves utilize all the tools that are available to them. Students learn to incorporate media assets, and work with graphics and touch events. Students access and manipulate data in 2-D data structures, and interpret code created using the MVC pattern before making significant modifications of their own. Finally, students create a unique app that incorporates elements like geolocation, communication with a database, and utilization of the camera, speakers, and microphone. The choice of app theme and topic are left to the student, though they should target a specific audience, and benefit their community in some way. Students need to find a "client" with whom they communicate regularly about the progress of the project. This could be the manager of a GitHub repository, a community leader, or a local business owner. Students might also choose to develop a full-fledged game at this point in the course with their fellow students as the clients.

Interdisciplinary Connections:

Career Readiness Life Literacies and Key Skills (Digital Citizenship)
Career Readiness Life Literacies and Key Skills (Global and Cultural Awareness)

21st Century Themes, Skills, and Standards:
- 9.4.12.CI.1: Use appropriate communication technologies to collaborate with individuals with diverse perspectives about a local and/or global climate change issue and deliberate about possible solutions (e.g., W.4.6, 3.MD.B.3,7.1.NM.IPERS.6).
- 9.4.12.CT.3: Describe how digital tools and technology may be used to solve problems.

Learning Targets

CPI #	Cumulative Progress Indicators (CPI) for Unit
8.2.12.EC.1	Analyze controversial technological issues and determine the degree to which individuals, businesses, and governments have an ethical role in decisions that are made.
8.2.12.EC.2	Assess the positive and negative impacts of emerging technologies on developing countries and evaluate how individuals, non-profit organizations, and governments have responded.
8.2.12.EC.3	Synthesize data, analyze trends, and draw conclusions regarding the effect of a technology on the individual, culture, society, and environment and share this information with the appropriate audience.
8.2.12.EC.4	Research historical tensions between environmental and economic considerations as driven by human needs and wants in the development of a technological product and present the competing viewpoints.

8.2.12.ETW.1	Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation, and maintenance of a chosen product.

Unit Enduring Questions: ● **What is LibGDX?** ● **Why is this important for creating games?**	**Unit Enduring Understandings:** ● **LibGDX setup** ● **Code overview**
Unit Objectives: *Students will know….* ● **About game improvement**	**Unit Objectives:** *Students will be able to…...* ● **Identify erratic movement** ● **Do game improvement** ● **Create walls, characters, etc.**

Lower Cape May Regional School District Computer Science Curriculum Evidence of Learning
Specific Formative Assessments Utilized in Daily Lessons: ● List examples of specific formative assessments to be utilized daily to gauge student comprehension and drive instruction here. Link here for ideas. More ideas and here. ● If you utilization Kahoot, Socrative, quizlet or other online assessment platforms list those here as well.
Summative Assessment Utilized throughout Units: ● QBA's ● Benchmarks
Modifications for ELL's, Special Education, 504, and Gifted and Talented Students: ● Teacher tutoring ● Peer tutoring ● Cooperative Learning Groups ● Modified Assignments ● Differentiated Instruction ● Response to Intervention (www.help4teachers.com) ● Follow all IEP and 504 modifications

Teacher Notes:
- As required by the NJ Department of Education, teachers in all content areas will integrate the 21st Century Life and Careers Standards. As the NJDOE indicates, "Providing New Jersey students with the life and career skills needed to function optimally within this dynamic context is a critical focus and organizing principle of K-12 public education. New Jersey has both an obligation to prepare its young people to thrive in this environment, and a vested economic interest in grooming an engaged citizenry made up of productive members of a global workforce that rewards innovation, creativity, and adaptation to change." The links below indicate the CPIs for grade ranges and need to be addressed throughout the units of study:
  Life and Career Standards
- As indicated in the NJSLS, standards and interdisciplinary connections will be integrated throughout content area curriculum.

College Board Performance Task (12 days)- at the end of unit 3
- Throughout the course, students have the flexibility to write programs that reflect their interests (e.g., their desire to solve a problem, program a game, or produce digital art appealing to a specific audience). This allows students to engage in the study of computer science from a creative perspective. During these 12 days, students apply all they have learned to select an interest, develop a program, document the program, and submit to the College Board for scoring if they are seeking advanced placement standing. No new content is introduced during this time. Students provide evidence of their knowledge regarding important programming concepts, such as developing algorithms and using abstractions. Students are required to submit an individual program but are able to collaborate on the development of their program. This performance task focuses on students developing computer programs and describing significant aspects of the program that allow it to run as intended.

Vocabulary:
- In-text vocabulary should be incorporated into every unit. Word journals, vocabulary walls, and/or various other activities should be utilized by the instructor to teach vocabulary.

The Research Process:
- The research process must be integrated within each course curriculum. Student will be provided with opportunities to investigate issues from thematic units of study. As the NJSLS indicate, students will develop proficiency with MLA or APA format as applicable.
- Link Research resources here.

Technology:
- Students must engage in technology applications integrated throughout the curriculum. Applicable technology utilized in this curricula are included below:
- Microcontrollers, physical computing systems, input devices, etc.

Resources: ● Ancillary resources and materials used to deliver instruction are included below: Project Lead the Way curriculum and activities as available through personal accounts

Differentiation Strategies
Differentiation strategies can require varied amounts of preparation time. High-prep strategies often require a teacher to both create multiple pathways to process information/demonstrate learning and to assign students to those pathways. Hence, more ongoing monitoring and assessment is often required. In contrast, low-prep strategies might require a teacher to strategically create process and product choices for students, but students are allowed to choose which option to pursue given their learning profile or readiness level. Also, a low-prep strategy might be focused on a discrete skill (such as vocabulary words), so there are fewer details to consider. Most teachers find that integration of one to two new low-prep strategies and one high-prep strategy each quarter is a reasonable goal.

Low Prep Strategies	
Varied journal prompts, spelling or vocabulary lists	Students are given a choice of different journal prompts, spelling lists or vocabulary lists depending on level of proficiency/assessment results.
Anchor activities	Anchor activities provide meaningful options for students when they are not actively engaged in classroom activities (e.g., when they finish early, are waiting for further directions, are stumped, first enter class, or when the teacher is working with other students). Anchors should be directly related to the current learning goals.
Choices of books	Different textbooks or novels (often at different levels) that students are allowed to choose from for content study or for literature circles.
Choices of review activities	Different review or extension activities are made available to students during a specific section of the class (such as at the beginning or end of the period).
Homework options	Students are provided with choices about the assignments they complete as homework. Or, students are directed to specific homework based on student needs.

Student-teacher goal setting	The teacher and student work together to develop individual learning goals for the student.
Flexible grouping	Students might be instructed as a whole group, in small groups of various permutations (homogeneous or heterogeneous by skill or interest), in pairs or individual. Any small groups or pairs change over time based on assessment data.
Varied computer programs	The computer is used as an additional center in the classroom, and students are directed to specific websites or software that allows them to work on skills at their level.
Multiple Intelligence or Learning Style options	Students select activities or are assigned an activity that is designed for learning a specific area of content through their strong intelligence (verbal-linguistic, interpersonal, musical, etc.)
Varying scaffolding of same organizer	Provide graphic organizers that require students to complete various amounts of information. Some will be more filled out (by the teacher) than others.
Think-Pair-Share by readiness, interest, and/or learning profile	Students are placed in predetermined pairs, asked to think about a question for a specific amount of time, then are asked to share their answers first with their partner and then with the whole group.
Mini workshops to re-teach or extend skills	A short, specific lesson with a student or group of students that focuses on one area of interest or reinforcement of a specific skill.
Orbitals	Students conduct independent investigations generally lasting 3-6 weeks. The investigations "orbit" or revolve around some facet of the curriculum.
Games to practice mastery of information and skill	Use games as a way to review and reinforce concepts. Include questions and tasks that are on a variety of cognitive levels.
Multiple levels of questions	Teachers vary the sorts of questions posed to different students based on their ability to handle them. Varying questions is an excellent way to build the confidence (and motivation) of students who are reluctant to contribute to class discourse. Note: Most teachers would probably admit that without even thinking about it they tend to address particular types of questions to particular students. In some cases, such tendencies may need to be corrected. (For example, a teacher may be unknowingly addressing all of the more challenging questions to one student, thereby inhibiting other students' learning and fostering class resentment of that student.)

High Prep Strategies	
Cubing	Designed to help students think about a topic or idea from many different angles or perspectives. The tasks are placed on the six sides of a cube and use commands that help support thinking (justify, describe, evaluate, connect, etc.). The students complete the task on the side that ends face up, either independently or in homogenous groups.
Tiered assignment/ product	The content and objective are the same, but the process and/or the products that students must create to demonstrate mastery are varied according to the students' readiness level.
Independent studies	Students choose a topic of interest that they are curious about and wants to discover new information on. Research is done from questions developed by the student and/or teacher. The researcher produces a product to share learning with classmates.
4MAT	Teachers plan instruction for each of four learning preferences over the course of several days on a given topic. Some lessons focus on mastery, some on understanding, some on personal involvement, and some on synthesis. Each learner has a chance to approach the topic through preferred modes and to strengthen weaker areas
Jigsaw	Students are grouped based on their reading proficiency and each group is given an appropriate text on a specific aspect of a topic (the economic, political and social impact of the Civil War, for example). Students later get into heterogeneous groups to share their findings with their peers, who have read about different areas of study from source texts on their own reading levels. The jigsaw technique allows you to tackle the same subject with all of your students while discreetly providing them the different tools they need to get there.
Multiple texts	The teacher obtains or creates a variety of texts at different reading levels to assign strategically to students.
Alternative assessments	After completing a learning experience via the same content or process, the student may have a choice of products to show what has been learned. This differentiation creates possibilities for students who excel in different modalities over others (verbal versus visual).
Modified Assessments	Assessments can be modified in a variety of ways – for example by formatting the document differently (e.g. more space between questions) or by using different types of questions (matching vs.

	open ended) or by asking only the truly essential questions.
Learning contracts or Personal Agendas	A contract is a negotiated agreement between teacher and student that may have a mix of requirements and choice based on skills and understandings considered important by the teacher. A personal agenda could be quite similar, as it would list the tasks the teacher wants each student to accomplish in a given day/lesson/unit. Both Learning contracts and personal agendas will likely vary between students within a classroom.
Compacting	This strategy begins with a student assessment to determine level of knowledge or skill already attained (i.e. pretest). Students who demonstrate proficiency before the unit even begins are given the opportunity to work at a higher level (either independently or in a group).
Literature circles	Flexible grouping of students who engage in different studies of a piece of literature. Groups can be heterogeneous and homogeneous.
Learning Centers	A station (or simply a collection of materials) that students might use independently to explore topics or practice skills. Centers allow individual or groups of students to work at their own pace. Students are constantly reassessed to determine which centers are appropriate for students at a particular time, and to plan activities at those centers to build the most pressing skills.
Tic-Tac-Toe Choice Board (sometimes called "Think-Tac-Toe"	The tic-tac-toe choice board is a strategy that enables students to choose multiple tasks to practice a skill, or demonstrate and extend understanding of a process or concept. From the board, students choose (or teacher assigns) three adjacent or diagonal. To design a tic-tac-toe board: - Identify the outcomes and instructional focus - Design 9 different tasks - Use assessment data to determine student levels - Arrange the tasks on a tic-tac-toe board either randomly, in rows according to level of difficulty, or you may want to select one critical task to place in the center of the board for all students to complete.

Curriculum development Resources/Instructional Materials:

- Projectleadtheway.com

Board of Education Approved Text(s)

- Project Lead the Way online materials