ADVANCED PLACEMENT COMPUTER SCIENCE PRINCIPLES	
CURRICULUM/CONTENT AREA	**COURSE LENGTH**
Computer Science	*2 terms*
GRADE LEVEL	**DATE LAST REVIEWED**
9-12	2023
PREREQUISITE(s) ***if applicable***	**BOARD APPROVAL DATE**
none	9/10/2024
PRIMARY RESOURCE ***if applicable***	
College Board AP Computer Science Principles resources	

DESIRED RESULTS

COURSE DESCRIPTION AND PURPOSE

The Advanced Placement Computer Science Principles course provides students with the opportunity to develop computational thinking skills, an understanding of the real-world impact of computing, and programming literacy. The course exposes students to the breadth and relevance of computer science across many fields of study that incorporate computer science knowledge. A strong focus on creativity as it applies to the creation of computational artifacts allows a broader range of students to discover where computer science could fit in their lives, and it prepares more students for success in computer science and other related STEM fields.

WEIGHTED GRADE
Opportunity to earn industry recognized credentials:
IC3 Digital Literacy Certification
IT Specialist

BIG IDEAS *Students will understand that...*	**ESSENTIAL QUESTIONS** *Students will keep considering...*
BIG IDEA 1: CREATIVE DEVELOPMENT (CRD) When developing computing innovations, developers can use a formal, iterative design process or a less rigid process of experimentation. While using either approach, developers will encounter phases of investigating and reflecting, designing, prototyping, and testing. Additionally, collaboration is an important tool at any phase of development, because considering multiple perspectives allows for improvement of innovations.	How has working collaboratively with other students improved an overall project?
	What are some ways you can collect additional feedback on your program to use for improvements?
	What are some ways you currently plan your work before starting a project?
	What apps or programs have you stopped using because you didn't like the design of how you interacted with it?
BIG IDEA 2: DATA (DAT) Data are central to computing innovations because they communicate initial conditions to programs and represent new knowledge. Computers consume data, transform data, and produce new data, allowing users to create new information or knowledge to solve problems through the interpretation of those data. Computers store data digitally, which means that the data must be manipulated in order to be presented in a useful way to the user	How can we use 1s and 0s to represent something complex like a video of the marching band playing a song?
	How can you predict the attendance at a school event using data gathered from social media?
	When is it more appropriate to use a computer to analyze data than to complete the analysis by hand?
BIG IDEA 3: ALGORITHMS AND PROGRAMMING (AAP) Programmers integrate algorithms and abstraction to create programs for creative purposes and to solve problems. Using multiple program statements in a specified order, making decisions, and repeating the same process multiple times are the building blocks of programs. Incorporating elements of abstraction—by breaking problems down into interacting pieces, each with their own purpose—makes writing complex programs easier. Programmers need to think algorithmically and use abstraction to define and interpret processes that are used in a program.	How can we store data in a program to solve problems?
	What might happen if you completed the steps in your regular morning routine to get ready and go to school in a different order? How might the reordering affect the decisions you make each morning?
	How do video games group the different actions for a player based on what key is pressed on the keyboard or controller? How do apps group different actions together based on user interaction, such as pressing buttons?
	What types of problems can be solved more easily with a computer, and what types can be solved more easily without a computer? Why?
BIG IDEA 4: COMPUTING SYSTEMS AND NETWORKS (CSN) Computer systems and networks are used to transfer data. One of the largest and most commonly used networks is the Internet. Through a series of protocols, the Internet can be used to send and receive information and ideas throughout the world. Transferring and processing information can be slow when done on a single computer, but leveraging multiple computers to do the work at the same time can significantly	Why are long text messages sometime delivered out of order?
	When an Internet service outage occurs in a different part of your town or city, how are you still able to access the Internet?
	What are the benefits of dividing tasks among group members?
	Is there a point where adding another group member would not make completing the task faster? Why?
BIG IDEA 5: IMPACT OF COMPUTING (IOC) Computers and computing have revolutionized our lives. To use computing safely and responsibly, we need to be aware of privacy,	What app or computer software do you use most often and would have a hard time going without? How does this software solve a problem for you or benefit you?

security, and ethical issues. As programmers, we need to understand the potential impacts of our programs and be responsible for the consequences. As computer users, we need to understand any potential beneficial or harmful effects and how to protect ourselves and our privacy when using a computer.	Are innovators responsible for the harmful effects of their computing innovations, even if those effects were unintentional? Why or why not?
	What data are generated by smart phones, and what are they being used for?
COMPUTATIONAL THINKING PRACTICES *Students will be skilled at...*	**SKILLS (LEARNING TARGETS)**
Computational Solution Design *Design and evaluate computational solutions for a purpose.*	1.A Investigate the situation, context, or task.
	1.B Determine and design an appropriate method or approach to achieve the purpose
	1.C Explain how collaboration affects the development of a solution.
	1.D Evaluate solution options.
Algorithms and Program Development *Develop and implement algorithms*	2.A Represent algorithmic processes without using a programming language.
	2.B Implement and apply an algorithm.
Abstraction in Program Development *Develop programs that incorporate abstractions.*	3.A Generalize data sources through variables.
	3.B Use abstraction to manage complexity in a program.
	3.C Explain how abstraction manages complexity.
Code Analysis *Evaluate and test algorithms and programs*	4.A Explain how a code segment or program functions.
	4.B Determine the result of code segments.
	4.C Identify and correct errors in algorithms and programs, including error discovery through testing.
Computing Innovations *Investigate computing innovations.*	5.A Explain how computing systems work.
	5.B Explain how knowledge can be generated from data.
	5.C Describe the impact of a computing innovation.
	5.D Describe the impact of gathering data.
	5.E Evaluate the use of computing based on legal and ethical factors.
Responsible Computing *Contribute to an inclusive, safe, collaborative, and ethical computing culture*	6.A Collaborate in the development of solutions.
	6.B Use safe and secure methods when using computing devices.
	6.C Acknowledge the intellectual property of others.
Potential INDUSTRY-RECOGNIZED CREDENTIALS (IRCs) Opportunties associated with the course *(note- the list provides options but is not limited to the following so that students career interests can be leveraged)*	**Potential WORK BASED LEARNING (WBL) opportunities associated with the course**
IC3 Digital Literacy Certification Suite	LAUNCH project opportunities w/business & industry partners
IT Specialist Suite	
Potential DUAL CREDIT Opportunties associated with the course	
Advanced Placement	

CREATIVE DEVELOPMENT		
Collaboration is crucial when developing computing innovations, because having multiple perspectives offers opportunities to improve the design of innovations. In this big idea, students work collaboratively to design and develop programs using an iterative development process. They identify the needs of all users by gathering input from people from different backgrounds and demographics. Once the program is developed, they test it to ensure it meets these needs. Effective collaboration can often differ from group work, because it requires equal participation and voice from all members of the group. Early in the school year, it may be helpful for teachers to establish practices and norms that facilitate a collaborative environment and provide students with time to practice working together. Content in this big idea is often paired with Big Idea 3: Algorithms and Programming		
STAGE 1: Desired Unit Results *What will students understand as a result of the unit?*		**STAGE 2: Assessment Evidence** *By what criteria will performances of understanding be assessed? Through what authentic performance tasks will students demonstrate the desired unit results?*
BIG IDEAS *Students will understand that...*	**ESSENTIAL QUESTIONS** *Students will keep considering...*	**Success Criteria with Big Ideas & Skills** *The criteria for evaluating performance on standards is constant.*
"BIG IDEA 1: CREATIVE DEVELOPMENT (CRD) When developing computing innovations, developers can use a formal, iterative design process or a less rigid process of experimentation. While using either approach, developers will encounter phases of investigating and reflecting, designing, prototyping, and testing. Additionally, collaboration is an important tool at any phase of development, because considering multiple perspectives allows for improvement of innovations."	How has working collaboratively with other students improved an overall project?	Through rubrics and exemplars, students understand, goal set, and reflect on success criteria. Feedback is given through small group/ one-on-one conferring and through full class modeling.
	What are some ways you can collect additional feedback on your program to use for improvements?	Students are given prewritten program code to identify and correct errors.
	What are some ways you currently plan your work before starting a project?	AP Classroom: Personal Progress Checks, AP Question Bank Preparing for AP Exam: Students will be expected to design and implement a program of their choice for the Create performance task. While students select their own topic for this task, they are required to include certain elements, such as lists and procedures, in their program code. Students are provided with exemplars to help them consider the types of programs that can be developed while still meeting this requirement.
	What apps or programs have you stopped using because you didn't like the design of how you interacted with it?	
Topic	**Skills (Learning Targets)** ***I can...***	
1.1 Collaboration	1.C Explain how collaboration affects the development of a solution. 6.A Collaborate in the development of solutions (not assessed).	
1.2 Program Function and Purpose	1.A Investigate the situation, context, or task. 3.A Generalize data sources through variables. 4.A Explain how a code segment or program functions.	
1.3 Program Design and Development	1.B Determine and design an appropriate method or approach to achieve the purpose. 1.C Explain how collaboration affects the development of a solution. 4.A Explain how a code segment or program functions. 6.C Acknowledge the intellectual property of others	
1.4 Identifying and Correcting Errors	1.B Determine and design an appropriate method or approach to achieve the purpose. 4.C Identify and correct errors in algorithms and programs, including error discovery through testing.	

DATA

Because essentially everything we do with a computer is being broken down into some form of data, it is important for students to develop a breadth of understanding of how computers handle data and how students can use those same data to solve problems such as raising awareness for a cause, using census data to determine which state will gain seats in the House of Representatives, or using traffic and cost data to determine the ideal location for prom. In this big idea, students will gain a deep understanding of how information is stored on a computer in binary and seamlessly translated into what is seen on the screen or heard through speakers. Students will also learn how data are processed to learn something new. This big idea is often paired with Big Idea 3: Algorithms and Programming and Big Idea 5: Impact of Computing.

STAGE 1: Desired Unit Results *What will students understand as a result of the unit?*		**STAGE 2: Assessment Evidence** *By what criteria will performances of understanding be assessed? Through what authentic performance tasks will students demonstrate the desired unit results?*
BIG IDEAS *Students will understand that...*	**ESSENTIAL QUESTIONS** *Students will keep considering...*	**Success Criteria with Big Ideas & Skills** *The criteria for evaluating performance on standards is constant.*
BIG IDEA 2: DATA (DAT) Data are central to computing innovations because they communicate initial conditions to programs and represent new knowledge. Computers consume data, transform data, and produce new data, allowing users to create new information or knowledge to solve problems through the interpretation of those data. Computers store data digitally, which means that the data must be manipulated in order to be presented in a useful way to the user	How can we use 1s and 0s to represent something complex like a video of the marching band playing a song?	Through rubrics and exemplars, students understand, goal set, and reflect on success criteria. Feedback is given through small group/ one-on-one conferring and through full class modeling.
	How can you predict the attendance at a school event using data gathered from social media?	AP Classroom: Personal Progress Checks, AP Question Bank Preparing for AP Exam: On the end-of-course exam, students will be presented with the way data for text or media, such as color, are represented by a computer and will be asked to convert values from binary to decimal or vice versa. The idea that there are number systems other than the decimal system is often new to students. Connecting the foundational principles of how number systems operate to the decimal number system is likely to help students lean on their prior knowledge when asked to work with binary numbers.
	When is it more appropriate to use a computer to analyze data than to complete the analysis by hand?	
Topic	**Skills (Learning Targets)** ***I can...***	Real-world simulations: Some real-world problems and simulations involve the use of large data sets that cannot be easily analyzed by hand and require a programming solution that manipulates or combines the data with other sources to generate new knowledge and find a solution. When working with large data sets, programmers use data abstraction to write programs that can be flexible enough to handle a change in the number of data entries. Providing students with practice using data sets that are too large to manipulate by hand will motivate them to develop more general solutions and data abstractions. Because the solution is generalized, an explanation of the solution through documentation within the program may be necessary.
2.1 Binary Numbers	1.D Evaluate solution options. 2.B Implement and apply an algorithm. 3.C Explain how abstraction manages complexity.	
2.2 Data Compression	1.D Evaluate solution options.	
2.3 Extracting Information from Data	5.B Explain how knowledge can be generated from data. 5.D Describe the impact of gathering data.	
2.4 Using Programs with Data	2.B Implement and apply an algorithm. 5.B Explain how knowledge can be generated from data.	

ALGORITHMS AND PROGRAMMING

All programming languages, whether block-based or text-based, use similar programming structures and commands. Having a basic understanding of how these building blocks are combined to form algorithms and abstractions in one language makes it easier to apply these same understandings to other programming languages. This big idea focuses on determining the efficiency of algorithms, as well as writing and implementing algorithms in a program. This big idea can be paired with any of the other big ideas and taught throughout the school year

STAGE 1: Desired Unit Results *What will students understand as a result of the unit?*		**STAGE 2: Assessment Evidence** *By what criteria will performances of understanding be assessed? Through what authentic performance tasks will students demonstrate the desired unit results?*
BIG IDEAS *Students will understand that...*	**ESSENTIAL QUESTIONS** *Students will keep considering...*	**Success Criteria with Big Ideas & Skills** *The criteria for evaluating performance on standards is constant.*
BIG IDEA 3: ALGORITHMS AND PROGRAMMING (AAP) Programmers integrate algorithms and abstraction to create programs for creative purposes and to solve problems. Using multiple program statements in a specified order, making decisions, and repeating the same process multiple times are the building blocks of programs. Incorporating elements of abstraction—by breaking problems down into interacting pieces, each with their own purpose—makes writing complex programs easier. Programmers need to think algorithmically and use abstraction to define and interpret processes that are used in a	How can we store data in a program to solve problems? What might happen if you completed the steps in your regular morning routine to get ready and go to school in a different order? How might the reordering affect the decisions you make each morning? How do video games group the different actions for a player based on what key is pressed on the keyboard or controller? How do apps group different actions together based on user interaction, such as pressing buttons? What types of problems can be solved more easily with a computer, and what types can be solved more easily without a computer? Why?	Through rubrics and exemplars, students understand, goal set, and reflect on success criteria. Feedback is given through small group/ one-on-one conferring and through full class modeling. AP Classroom: Personal Progress Checks, AP Question Bank Preparing for AP Exam: On the AP Exam, students will be asked to determine the result or functionality of code. Students can practice analyzing code segments by first predicting the result of provided code and then checking their hypothesis by running the program on a computer. Because the Create performance task requires students to create their own program, they will need scaffolded practice that moves them from representing algorithmic processes through diagrams or pseudocode, to writing simple programs that perform calculations, to more complex programs that leverage abstraction. While students can collaborate on the development of the program, each student should be a contributing member of the program development. When completing the written responses, which must be completed independently, an in-depth understanding of how the code segments function will allow each student to answer the prompts on their own.

Topic	**Skills (Learning Targets)** ***I can...***
3.1 Variables and Assignments	3.A Generalize data sources through variables. 4.B Determine the result of code segments.
3.2 Data Abstraction	3.A Generalize data sources through variables. 3.B Use abstraction to manage complexity in a program. 3.C Explain how abstraction manages complexity.
3.3 Mathematical Expressions	2.A Represent algorithmic processes without using a programming language. 2.B Implement and apply an algorithm. 4.B Determine the result of code segments.
3.4 Strings	4.B Determine the result of code segments.
3.5 Boolean Expressions	2.B Implement and apply an algorithm. 4.B Determine the result of code segments.
3.6 Conditionals	2.A Represent algorithmic processes without using a programming language. 2.B Implement and apply an algorithm. 4.B Determine the result of code segments.
3.7 Nested Conditionals	2.B Implement and apply an algorithm. 4.B Determine the result of code segments
3.8 Iteration	2.A Represent algorithmic processes without using a programming language. 2.B Implement and apply an algorithm. 4.B Determine the result of code segments
3.9 Developing Algorithms	1.D Evaluate solution options. 2.A Represent algorithmic processes without using a programming language. 2.B Implement and apply an algorithm
3.10 Lists	2.B Implement and apply an algorithm. 4.B Determine the result of code segments.
3.11 Binary Search	1.A Investigate the situation, context, or task. 1.D Evaluate solution options.
3.12 Calling Procedures	3.B Use abstraction to manage complexity in a program. 4.B Determine the result of code segments.
3.13 Developing Procedures	3.B Use abstraction to manage complexity in a program. 3.C Explain how abstraction manages complexity.
3.14 Libraries	2.B Implement and apply an algorithm.
3.15 Random Values	2.B Implement and apply an algorithm. 4.B Determine the result of code segments.
3.16 Simulations	1.A Investigate the situation, context, or task. 1.D Evaluate solution options
3.17 Algorithmic Efficiency	1.D Evaluate solution options.
3.18 Undecidable Problems	1.A Investigate the situation, context, or task.

COMPUTER SYSTEMS AND NETWORKS

The Internet is a network that most students use on a regular basis to look up information, to socialize with friends, and in many cases to complete their school work. In this big idea, students will learn how computer systems and networks, primarily the Internet, work. Students will learn about how information is transmitted on the Internet and about the safeguards that have been put in place to keep this system from breaking down. In addition, students will learn the effect that dividing tasks across multiple computing devices can have on the speed at which processes can occur. This big idea is often taught in conjunction with Big Idea 5: Impact of Computing.

STAGE 1: Desired Unit Results *What will students understand as a result of the unit?*		**STAGE 2: Assessment Evidence** *By what criteria will performances of understanding be assessed? Through what authentic performance tasks will students demonstrate the desired unit results?*
BIG IDEAS *Students will understand that...*	**ESSENTIAL QUESTIONS** *Students will keep considering...*	**Success Criteria with Big Ideas & Skills** *The criteria for evaluating performance on standards is constant.*
BIG IDEA 4: COMPUTING SYSTEMS AND NETWORKS (CSN) Computer systems and networks are used to transfer data. One of the largest and most commonly used networks is the Internet. Through a series of protocols, the Internet can be used to send and receive information and ideas throughout the world. Transferring and processing information can be slow when done on a single computer, but leveraging multiple computers to do the work at the same time can significantly shorten the time it takes to complete tasks or solve problems.	Why are long text messages sometime delivered out of order? When an Internet service outage occurs in a different part of your town or city, how are you still able to access the Internet? What are the benefits of dividing tasks among group members? Is there a point where adding another group member would not make completing the task faster? Why?	Through rubrics and exemplars, students understand, goal set, and reflect on success criteria. Feedback is given through small group/ one-on-one conferring and through full class modeling. AP Classroom: Personal Progress Checks, AP Question Bank Preparing for AP Exam: On the end-of-course exam, students will be presented with scenarios for how information could be passed via the Internet along with illustrations of interconnected computers in given networks. Students will be asked to select which choice best explains how information is passed through these networks from one computing device to another or how designing systems to include redundancy helps make them fault-tolerant. To aid in understanding these diagrams, students should be encouraged to use the Marking the Text strategy. They can mark the diagrams with the information provided to ensure they have an accurate visual and can then match that visual to the explanations provided.
Topic	**Skills (Learning Targets)** ***I can...***	
4.1 The Internet	5.A Explain how computing systems work.	
4.2 Fault Tolerance	1.D Evaluate solution options. 5.A Explain how computing systems work.	
4.3 Parallel and Distributed Computing	1.D Evaluate solution options.	

IMPACT OF COMPUTING

The creation of computer programs can have extensive impacts, some unintended, on societies, economies, and cultures. In this big idea, students explore these effects, the legal and ethical concerns that come with programs, and the responsibilities of programmers. When using computing innovations and transmitting information via the Internet, students should be aware of the risk of sharing personal identifiable information about themselves, such as their age or address, and actively take steps to keep this information safe. This big idea can be integrated throughout the course and works well with the Creative Development, Data, and Computing Systems and Networks big ideas.

STAGE 1: Desired Unit Results *What will students understand as a result of the unit?*		**STAGE 2: Assessment Evidence** *By what criteria will performances of understanding be assessed? Through what authentic performance tasks will students demonstrate the desired unit results?*
BIG IDEAS *Students will understand that...*	**ESSENTIAL QUESTIONS** *Students will keep considering...*	**Success Criteria with Big Ideas & Skills** *The criteria for evaluating performance on standards is constant.*
BIG IDEA 5: IMPACT OF COMPUTING (IOC) Computers and computing have revolutionized our lives. To use computing safely and responsibly, we need to be aware of privacy, security, and ethical issues. As programmers, we need to understand the potential impacts of our programs and be responsible for the consequences. As computer users, we need to understand any potential beneficial or harmful effects and	What app or computer software do you use most often and would have a hard time going without? How does this software solve a problem for you or benefit you?	Through rubrics and exemplars, students understand, goal set, and reflect on success criteria. Feedback is given through small group/ one-on-one conferring and through full class modeling.
	Are innovators responsible for the harmful effects of their computing innovations, even if those effects were unintentional? Why or why not?	AP Classroom: Personal Progress Checks, AP Question Bank Preparing for AP Exam: Students will be asked to complete three investigations into computing innovations during the school year. Through these investigations, students will look at the data the computing innovation uses to complete its task; any data privacy, security, or storage concerns that might be associated with the innovation; and beneficial and harmful effects the computing innovation might have on society, the economy, or culture. On the end-of-course exam, students will be presented with a passage about a computing innovation and will be asked a series of questions about data and the effects of the computing innovation. While the computing innovations that need to be investigated are not specified in the curricular requirement, students will benefit from investigating a large range of computing innovations.
	What data are generated by smart phones, and what are they being used for?	

Topic	**Skills (Learning Targets)** ***I can...***
5.1 Beneficial and Harmful Effects	5.C Describe the impact of a computing innovation.
5.2 Digital Divide	5.C Describe the impact of a computing innovation.
5.3 Computing Bias	5.E Evaluate the use of computing based on legal and ethical factors.
5.4 Crowdsourcing	1.C Explain how collaboration affects the development of a solution.
5.5 Legal and Ethical Concerns	5.E Evaluate the use of computing based on legal and ethical factors.
5.6 Safe Computing	5.D Describe the impact of gathering data. 5.E Evaluate the use of computing based on legal and ethical factors.