Computer Science

Content Area: **Technology**
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Essential Questions

- How can computing and the use of computational tools foster creative expression?
- How can computing extend traditional forms of human expression and experience?
- How can computational models and stimulations help generate new understanding and knowledge?
- How are programs developed to help people, organizations, or society solve problems?
- How are programs used for creative expression, to satisfy personal curiosity, or to create new knowledge?
- how do computer programs implement algorithms?
- How does abstraction make the development of computer programs Computer Programming Python possible?
- How do people develop and test computer programs?
- Which mathematical and logical concepts are fundamental to computer programming?
- What is the difference between hardware and software?
- How do we use both hardware and software to process data?
- Why do i need to know how to use a database?
- Why is a spreadsheet such an important technology tool?
- How do I create, format, and edit meaningful information in a spreadsheet?
- How do technologies affect everyday activities and career options?
- Are human jobs being taken over by technology?
- How have jobs developed over time?

Big Ideas

- The study of human–computer interaction can improve the design of devices and extend the abilities of humans.
- Software and hardware determine a computing system's capability to store and process information. The design or selection of a computing system involves multiple considerations and potential tradeoffs.
- Troubleshooting a problem is more effective when knowledge of the specific device along with a systematic process is used to identify the source of a problem.
- Protocols, packets, and addressing are the key components for reliable delivery of information across networks.
- Advancements in computing technology can change individuals' behaviors. Society is faced with trade-offs due to the increasing globalization and automation that computing brings.
- Data is represented in many formats. Software tools translate the low-level representation of bits into a form understandable by individuals. Data is organized and accessible based on the application used to store it.
- The purpose of cleaning data is to remove errors and make it easier for computers to process.
- Computer models can be used to simulate events, examine theories and inferences, or make predictions.

- Individuals design algorithms that are reusable in many situations. Algorithms that are readable are easier to follow, test, and debug.
- Programmers create variables to store data values of different types and perform appropriate operations on their values.
- Control structures are selected and combined in programs to solve more complex problems.
- Programs use procedures to organize code and hide implementation details. Procedures can be repurposed in new programs. Defining parameters for procedures can generalize behavior and increase reusability.
- Individuals design and test solutions to identify problems taking into consideration the diverse needs of the users and the community.
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Enduring Understandings

- 8.1.8.CS.1: Recommend improvements to computing devices in order to improve the ways users interact with the devices.
- 8.1.8.CS.3: Justify design decisions and explain potential system tradeoffs.
- 8.1.8.CS.4: Systematically apply troubleshooting strategies to identify and resolve hardware and software problems in computing systems.
- 8.1.8.NI.1: Model how information is broken down into smaller pieces, transmitted as addressed packets through multiple devices over networks and the Internet, and reassembled at the destination.
- 8.1.8.NI.2: Model the role of protocols in transmitting data across networks and the Internet and how they enable secure and errorless communication.
- 8.1.8.IC.1: Compare the tradeoffs associated with computing technologies that affect individual's everyday activities and career options.
- 8.1.8.DA.2: Explain the difference between how the computer stores data as bits and how the data is displayed.
- 8.1.8.DA.3: Identify the appropriate tool to access data based on its file format.
- 8.1.8.DA.4: Transform data to remove errors and improve the accuracy of the data for analysis.
- 8.1.8.DA.5: Test, analyze .and refine computational models.
- 8.1.8.AP.2: Create clearly named variables that represent different data types and perform operations on their values.
- 8.1.8.AP.3: Design and iteratively develop programs that combine control structures, including nested loops and compound conditionals.
- 8.1.8.AP.4: Decompose problems and sub-problems into parts to facilitate the design, implementation, and review of programs.

- 8.1.8.AP.5: Create procedures with parameters to organize code and make it easier to reuse.
- 8.1.8.AP.6: Refine a solution that meets users' needs by incorporating feedback from team members and users.
- 8.1.8.AP.7: Design programs, incorporating existing code, media, and libraries, and give attribution.
- 8.1.8.AP.8: Systematically test and refine programs using a range of test cases and users.
- 8.1.8.AP.9: Document programs in order to make them easier to follow, test, and debug.

Career Readiness, Life Literacies and Key Skills Integration

Performance Expectations

- 9.2.8.CAP.10: Evaluate how careers have evolved regionally, nationally, and globally.
- 9.4.8.CI.1: Assess data gathered on varying perspectives on causes of climate change (e.g., crosscultural, gender-specific, generational), and determine how the data can best be used to design multiple potential solutions (e.g., RI.7.9, 6.SP.B.5, 7.1.NH.IPERS.6, 8.2.8.ETW.4).
- 9.4.8.CI.3: Examine challenges that may exist in the adoption of new ideas (e.g., 2.1.8.SSH, 6.1.8.CivicsPD.2).
- 9.4.8.CI.4: Explore the role of creativity and innovation in career pathways and industries.
- 9.4.8.CT.1: Evaluate diverse solutions proposed by a variety of individuals, organizations, and/or agencies to a local or global problem, such as climate change, and use critical thinking skills to predict which one(s) are likely to be effective (e.g., MS-ETS1-2).
- 9.4.8.CT.2: Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MS-ETS1-4, 6.1.8.CivicsDP.1).
- 9.4.8.GCA.1: Model how to navigate cultural differences with sensitivity and respect (e.g., 1.5.8.C1a).
- 9.4.8.GCA.2: Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal.
- 9.4.8.IML.3: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping (e.g., 6.SP.B.4, 7.SP.B.8b).
- 9.4.8.IML.7: Use information from a variety of sources, contexts, disciplines, and cultures for a specific purpose (e.g., 1.2.8.C2a, 1.4.8.CR2a, 2.1.8.CHSS/IV.8.AI.1, W.5.8, 6.1.8.GeoSV.3.a, 6.1.8.CivicsDP.4.b, 7.1.NH. IPRET.8).
- 9.4.8.IML.8: Apply deliberate and thoughtful search strategies to access high-quality information on climate change (e.g., 1.1.8.C1b).
- 9.4.8.IML.12: Use relevant tools to produce, publish, and deliver information supported with evidence for an authentic audience.
- 9.4.8.IML.13: Identify the impact of the creator on the content, production, and delivery of information (e.g., 8.2.8.ED.1).
- 9.4.8.TL.1: Construct a spreadsheet in order to analyze multiple data sets, identify relationships, and facilitate data-based decision-making.
- 9.4.8.TL.2: Gather data and digitally represent information to communicate a real-world problem (e.g., MS-ESS3-4, 6.1.8.EconET.1, 6.1.8.CivicsPR.4).
- 9.4.8.TL.3: Select appropriate tools to organize and present information digitally.
- 9.4.8.TL.4: Synthesize and publish information about a local or global issue or event (e.g., MSLS4-5, 6.1.8.CivicsPI.3).
- 9.4.8.TL.6: Collaborate to develop and publish work that provides perspectives on a real-world

problem.

Practices

- Act as a responsible and contributing community member and employee.
- Consider the environmental, social and economic impacts of decisions.
- Demonstrate creativity and innovation
- Utilize critical thinking to make sense of problems and persevere in solving them
- Model integrity, ethical leadership and effective management.
- Plan education and career paths aligned to personal goals
- Use technology to enhance productivity, increase collaboration and communicate effectively.
- Work productively in teams while using cultural/global competence

Activities and Assessments

- Videos: https://www.youtube.com/user/CodeOrg
  - Anybody Can Learn (60 sec.)
  - Bill Gates explains IF & IF/ELSE statements (44 sec.)
  - Mark Zuckerburg teaches REPEAT LOOPS (36 sec.)
  - Chris Bosh explains FUNCTIONS (60 sec.)
- Code Studio Course 2 (20 hrs): https://studio.course.org
- Research and present ways computers are used that have had an impact across the range of human activity and within different careers where they are used.
- *(Extended Exploration)* Code Studio Course 2 Unplugged Activities: https://studio.course.org
- *(Extended Exploration)* Code Studio Course 3 (20 hrs): https://studio.course.org
- *(Extended Exploration)* Code Studio Course 4 (20 hrs): https://studio.course.org
- *(Extended Exploration)* Code Studio Infinity Play Lab: https://studio.course.org
- *(Extended Exploration)* Code Studio Flappy Code: https://studio.course.org
- *(Extended Exploration)* Code Studio Play Lab: https://studio.course.org
- *(Extended Exploration)* Code Studio Artist: https://studio.course.org

Additional Resources

- Hidden figures: 7 Black programmers you should know: https://www.infoworld.com/article/3606070/hidden-figures-7-black-programmers-you-should-know.html#:~:text=Katherine%20Johnson%2C%20Dorothy%20Vaughan%2C%20and,and%20mathematics%20positions%20at%20NASA. **(Amistad Law)**
- Black Programmers and Technologists Who Inspire Us:

https://www.codecademy.com/resources/blog/black-programmers-and-technologists-who-inspire-us/ **(Amistad Law)**

- Move to Include, the multi-platform public media initiative designed to promote inclusion for people with disabilities: https://ny.pbslearningmedia.org/collection/move-to-include/ **(Disabilities Awareness)**
- Hot Shots & Hot Jobs: Software Engineers Create Solutions through Code: https://ny.pbslearningmedia.org/resource/stem-career-coding-technology/hot-shots-hot-jobs-software-engineers-create-solutions-through-code/
- Equity in Computer Science Education: https://youtu.be/PmW6K6ufTpY **(Diversity, Equity, and Inclusion)**
- How to Make a Video Game: https://ny.pbslearningmedia.org/resource/2143a241-f8d9-4a54-a4a5-b9634797bd28/make-a-video-game/
- Newsela - Teens help MIT teach lending algorithms not to be racist **(Diversity, Equity & Inclusion)**
- More public schools get with the program with computer science classes **(Diversity, Equity & Inclusion)**
- Video: Teen Voices: Oversharing and Your Digital Footprint: https://www.commonsense.org/education/digital-citizenship/lesson/social-media-and-digital-footprints-our-responsibilities
- Will 3D Printing Change the World?: https://ny.pbslearningmedia.org/resource/b9194612-d6e7-4307-b08c-9c2857956713/will-3d-printing-change-the-world/
- Programming Pride: 10 LGBTQI+ Pioneers of Computer Science: https://newrelic.com/blog/nerd-life/10-lgbt-computer-science-pioneers **(LGBTQ+)**
- How can we reduce the carbon footprint of global computing?: https://news.mit.edu/2022/how-can-we-reduce-carbon-footprint-global-computing-0428 **(Climate Change)**
- Classroom Innovations: Redefining Holocaust Education With Technology: https://echoesandreflections.org/connect/?postname=Classroom-Innovations:-Redefining-Holocaust-Education-with-Technology **(Holocaust Law)**
- The 'virtual' future of Holocaust education is already here: https://www.timesofisrael.com/the-virtual-future-of-holocaust-education-is-already-here/ **(Holocaust Law)**