

Grades 9-12 Advanced

COMPUTING SYSTEMS CS

D. Devices CS.D

- a Evaluate the function of various devices to formulate a human interaction solution. CS.D.9-12.A.A
 - b Integrate multifunctional computing devices to solve a problem. CS.D.9-12.A.B
 - c Identify the functionality of various categories of hardware components and the communication between them and use that information to build a system virtually or physically for a specific task. CS.D.9-12.A.C
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HS. Hardware and Software CS.HS

- a Categorize types of operating systems and how they will be used. CS.HS.9-12.A.A
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T. Troubleshooting CS.T

- a Evaluate and revise a systematic process to identify the source of a problem and the steps to correct it within individual and connected devices. CS.T.9-12.A.A
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NETWORKS AND THE INTERNET NI

N. Networking NI.N

- a Construct a networking devices map solution for a realworld scenario to establish communication between distant devices. NI.N.9-12.A.A
 - b Develop a solution to a real-world scenario using networking protocols to establish network communication. NI.N.9-12.A.B
 - c Improve scalability and reliability of networks to describe the relationships and effects of how the different types of networks work together. NI.N.9-12.A.C
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C. Cybersecurity NI.C

- a Identify cybersecurity ethics and law. NI.C.9-12.A.A
- b Implement a devised solution to counter a security threat. NI.C.9-12.A.B
- c Compare and contrast various threat actors, such as nation-states, cyber terrorist groups, organized crime or hacktivists. NI.C.9-12.A.C
- d Explore and utilize examples of encryption methods (e.g., Vigenère, Bacon's cipher and Enigma). NI.C.9-12.A.D

IOT. Internet of Things (IoT) NI.IOT

- a Design and implement an IoT life cycle scenario that encompasses data gathering, transmission, reception and data analysis to demonstrate how the IoT operates and apply these skills to design products that model the process. NI.IOT.9-12.A.A

DATA AND ANALYSIS DA**DCS. Data Collection and Storage** DA.DCS

- a Create multidimensional data collections that can be utilized through various methods to solve complex data problems. DA.DCS.9-12.A.A
- b Investigate data storage and collection tools to analyze tradeoffs and limitations. DA.DCS.9-12.A.B

VC. Visualization and Communication DA.VC

- a Create visualization or multisensory artifacts to communicate insights and knowledge gained from complex data analysis that answers real-world questions. DA.VC.9-12.A.A

IM. Inference and Modeling DA.IM

- a Create a model that simulates a complex system and uses extracted data to hypothesize, test and refine the model to discover connections or trends. DA.IM.9-12.A.A

**ALGORITHMIC THINKING
AND PROGRAMMING** ATP**A. Algorithms** ATP.A

- a Define and explain Iterative and recursive algorithms to understand how and when to apply them. ATP.A.9-12.A.A
- b Use iteration to effectively solve problems. ATP.A.9-12.A.B
- c Use recursion to effectively solve problems. ATP.A.9-12.A.C
- d Define and explain sorting and searching algorithms to understand how and when to apply them. ATP.A.9-12.A.D
- e Use sorting and searching to analyze and organize data. ATP.A.9-12.A.E
- f Compare and contrast classical, cluster and quantum computing algorithms. ATP.A.9-12.A.F

VDR. Variables and Data Representation ATP.VDR

- a Utilize different data storage structures to store larger and more complex data than variables can contain. ATP.VDR.9-12.A.A
- b Identify the appropriate data structures or variables to use to design a solution to a complex problem. ATP.VDR.9-12.A.B

CS. Control Structures ATP.CS

- a Write programs that use library methods and control structures and methods to solve a problem. ATP.CS.9-12.A.A
 - b Refactor a program to be smaller and more efficient. ATP.CS.9-12.A.B
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M. Modularity ATP.M

- a Construct solutions to problems using student-created components (e.g., procedures, modules, objects). ATP.M.9-12.A.A
 - b Design or redesign a solution to a large-scale computational problem by identifying generalizable patterns. ATP.M.9-12.A.B
 - c Create programming solutions by reusing existing code (e.g., libraries, Application Programming Interface (APIs), code repositories). ATP.M.9-12.A.C
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PD. Program Development ATP.PD

- a Fully implement the most appropriate software methodology to complete a team programming project. ATP.PD.9-12.A.A
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**ARTIFICIAL
INTELLIGENCE** AI**P. Perception** AI.P

- a Describe some of the technical difficulties in making computer perception systems function well for diverse groups. AI.P.9-12.A.A
 - b Illustrate the abstraction hierarchy for speech understanding, from waveforms to sentences, showing how knowledge at each level is used to resolve ambiguities in the levels below. AI.P.9-12.A.B
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RR. Representation & Reasoning AI.RR

- a Write code to create an algorithmic search. AI.RR.9-12.A.A
 - b Illustrate breadth-first, depth-first and best-first search algorithms to grow a search tree. AI.RR.9-12.A.B
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ML. Machine Learning AI.ML

- a Evaluate a dataset used to train a real AI system by considering the size of the dataset, the way that the data were acquired and labeled, the storage required and the estimated time to produce the dataset. AI.ML.9-12.A.A
 - b Using a data visualization tool, investigate imbalances in training data in terms of gender, age, ethnicity or other demographic variables that could result in a biased model. AI.ML.9-12.A.B
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NI. Natural Interaction AI.NI

- a Identify and debate the issues of AI and consciousness. AI.NI.9-12.A.A
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SI. Societal Impacts AI.SI

- a Design an AI system to address social issues or explain how AI could be used to address a social issue. AI.SI.9-12.A.A

IMPACTS OF COMPUTING **IC**

Cu. Culture **IC.CU**

- a Evaluate an alternative solution where a current tool does not exist due to limited resources. **IC.CU.9-12.A.A**
- b Analyze the global impact of the distribution of computing resources in terms of equity, access and influence. **IC.CU.9-12.A.B**
- c Design a study of the potential impacts of classical computers, clustered computing and quantum computing in different fields. **IC.CU.9-12.A.C**
- d Evaluate and explore how research and commercial entities are using clustered and quantum computing as alternative solutions due to limitations of classical computers. **IC.CU.9-12.A.D**

SLE. Safety, Law and Ethics **IC.SLE**

- b Evaluate and explore how research and commercial entities use intellectual property laws including copyright, trademarks, and patents to identify practical, business and ethical impacts. **IC.SLE.9-12.A.B**
- a Create a scenario to demonstrate typical tradeoffs between usability and security and recommend security measures based on these or other tradeoffs. **IC.SLE.9-12.A.A**