

# Level 3A: 9-10

## Computing Systems

- 3A-CS-01** Explain how abstractions hide the underlying implementation details of computing systems embedded in everyday objects. [P.4.1](#)
- 3A-CS-02** Compare levels of abstraction and interactions between application software, system software, and hardware layers. [P.4.1](#)
- 3A-CS-03** Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors. [P.6.2](#)

## Networks and the Internet

- 3A-NI-04** Evaluate the scalability and reliability of networks, by describing the relationship between routers, switches, servers, topology, and addressing. [P.4.1](#)
- 3A-NI-05** Give examples to illustrate how sensitive data can be affected by malware and other attacks. [P.7.2](#)
- 3A-NI-06** Recommend security measures to address various scenarios based on factors such as efficiency, feasibility, and ethical impacts [P.3.3](#)
- 3A-NI-07** Compare various security measures, considering tradeoffs between the usability and security of a computing system. [6.3](#)
- 3A-NI-08** Explain tradeoffs when selecting and implementing cybersecurity recommendations. [P.7.2](#)

## Data and Analysis

- 3A-DA-09** Translate between different bit representations of real-world phenomena, such as characters, numbers, and images. [P.4.1](#)
- 3A-DA-10** Evaluate the tradeoffs in how data elements are organized and where data is stored. [P3.3](#)
- 3A-DA-11** Create interactive data visualizations using software tools to help others better understand real-world phenomena. [P.4.4](#)
- 3A-DA-12** Create computational models that represent the relationships among different elements of data collected from a phenomenon or process. [P.4.4](#)

## Algorithms and Programming

- 3A-AP-13** Create prototypes that use algorithms to solve computational problems by leveraging prior student knowledge and personal interests. [P.5.2](#)

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- 3A-AP-14** Use lists to simplify solutions, generalizing computational problems instead of repeatedly using simple variables. [P.4.1](#)
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- 3A-AP-15** Justify the selection of specific control structures when tradeoffs involve implementation, readability, and program performance, and explain the benefits and drawbacks of choices made. [P.5.2](#)
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- 3A-AP-16** Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue by using events to initiate instructions. [P.5.2](#)
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- 3A-AP-17** Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects. [P.3.2](#)
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- 3A-AP-18** Create artifacts by using procedures within a program, combinations of data and procedures, or independent but interrelated programs. [P.5.2](#)
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- 3A-AP-19** Systematically design and develop programs for broad audiences by incorporating feedback from users [P.5.1](#)
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- 3A-AP-20** Evaluate licenses that limit or restrict use of computational artifacts when using resources such as libraries. [P.7.3](#)
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- 3A-AP-21** Evaluate and refine computational artifacts to make them more usable and accessible. [P.6.3](#)
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- 3A-AP-22** Design and develop computational artifacts working in team roles using collaborative tools. [P.2.4](#)
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- 3A-AP-23** Document – esign decisions using text, graphics, presentations, and/or demonstrations in the development of complex programs. [P.7.2](#)
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## Impacts of Computing

- 3A-IC-24** Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices. [P.1.2](#)
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- 3A-IC-25** Test and refine computational artifacts to reduce bias and equity deficits. [P.1.2](#)
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- 3A-IC-26** Demonstrate ways a given algorithm applies to problems across disciplines. [P.3.1](#)
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- 3A-IC-27** Use tools and methods for collaboration on a project to increase connectivity of people in different cultures and career fields. [P.2.4](#)
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- 3A-IC-28** Explain the beneficial and harmful effects that intellectual property laws can have on innovation. [P.7.3](#)

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**3A-IC-29** Explain the privacy concerns related to the collection and generation of data through automated processes that may not be evident to users. P.7.2

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**3A-IC-30** Evaluate the social and economic implications of privacy in the context of safety, law, or ethics. P.7.3