Review Questions

1. What is computer science?

2. What two subjects does computer science combine the foundations of?

    a. math and engineering

    b. math and physics

    c. physics and engineering

    d. math and chemistry

3. What can execute an algorithm?

4. What enables the ENIAC (one of the first digital computers, invented in 1945) to be able to compute anything that can run on modern computers?

    a. Both the ENIAC and modern computers have memory.

    b. Both the ENIAC and modern computers share the same hardware.

    c. Both the ENIAC and modern computers are considered Turing-complete.

    d. Both the ENIAC and modern computers run the same software.

5. What invention was credited as the first calculator?

    a. punch cards

    b. abacus

    c. Difference Machine

    d. ENIAC

6. What term is considered an algorithm that can be run on a computer?

    a. artificial intelligence

    b. algorithm

    c. computer program

    d. programming language

7. Why is computer science often not considered a science?

    a. Computer science does not study natural objects.

    b. Computer science emphasizes the discovery of natural phenomena.

    c. Computer science is spreadsheet-based.

d. Computer science focuses on computational structures.

8. What is the definition of data science?

   a. a subfield of computer science that emphasizes the social aspects of computation

   b. an interdisciplinary field studying information technologies and systems as they relate to people, organizations, and societies

   c. a subfield of computer science that emphasizes how problems can be solved with computers as well as the practices and processes that can help people design more effective software solutions

   d. an interdisciplinary field that applies computing toward managing data and extracting information from data

9. What term is used to describe a subfield of computer science that emphasizes how a computational problem can be defined in mathematical terms and whether that mathematical problem can be efficiently solved with a computer?

   a. computational science

   b. theoretical computer science

   c. information science

   d. data science

10. What subfield of computer science relates information technology to people and society?

    a. computational science

    b. theoretical computer science

    c. information science

    d. data science

11. How does computational science contribute new methods to the study of the sciences?

12. How do information science and computer science compare?

13. What does it mean to say that the various areas of computer science are synergistic?

14. What term is defined as an approach that emphasizes people rather than technologies in the design of computer solutions?

a. human-centered computing

b. neural network

c. social determination of technology

d. technological fix

15. A software application takes an image as an input and analyzes it. This is an example of what? a.   illustrative processing

b. image recognition

c. image generation

d. analytical modeling

16. What are adversarial attacks and why is it important to study them?

17. What is the relationship between artificial intelligence, image recognition, and neural networks?

18. How do neural networks recognize objects in images?

Conceptual Questions

1. Give two definitions of computer science. How do they compare?

2. Explain the concept of theoretical computer science.

3. What is body-syntonic reasoning and how has it affected education?

4. In terms of data science, what is a spreadsheet and why can it be said that by using spreadsheets, people are programming without realizing it?

5. How do discovery and invention differ and how are these involved in computer science?

6. Describe in your own words the difference between data (as in data science) and information (as in information science). How does computer science shape both fields?

7. Give a real-life example that refutes social determination of technology. Your example does not need to involve computing, but it should involve some technology designed by humans.

8. Artificial intelligence approaches are typically used to solve problems that requires specific kinds of "intelligence." Describe a real-life computational problem or application that does notneed artificial intelligence.

9. Image recognition systems that can detect objects in images enable self-driving cars and many large-scale manufacturing or agricultural operations. Give another example where image recognition could be used as part of a larger system to automate decisions at scale.

Practice Exercises

1. Research where the term debuggingoriginated from and why it refers to finding problems in our programs today.

2. Research some examples of computational models and how they are a part of everyday life.

3. Research how computational models relate to mathematics.

4. Research some examples of how artificial intelligence is used across multiple industries. Summarize at least two different industries and how AI is currently being used.

5. Research ethical issues related to artificial intelligence and provide an example of how artificial intelligence can be misused for unethical and even criminal ways.

Problem Set A

1. Research examples of how modeling and simulations have led to new inventions and discoveries.

2. Research and provide a summary of the difference between artificial intelligence and machine learning.

Problem Set B

1. Research how artificial intelligence and machine learning can improve the accuracy of computational models and lead to cutting-edge technology inventions in the future. Provide a specific example of how AI and ML have been used in this way so far.

2. Research and provide a summary of how machine learning is a subset of artificial intelligence and plays a key role in artificial intelligence systems.

Thought Provokers

1. Corporate social responsibility is the idea that businesses have a responsibility to society, including the areas of environmental responsibility, ethical responsibility, philanthropic responsibility, and economic responsibility. Given the contentious history of computer science and computer technologies, what can businesses (or businesspeople) that wish to employ a "disruptive" computer technology do to ensure corporate social responsibility?

2. Computer technologies like the Internet have changed everyone's lives, regardless of whether they use the Internet directly or not. Yet, with computer technologies, the future is rarely certain. How can a business stay relevant and profitable in the face of new technologies while ensuring corporate social responsibility? In what ways does ensuring corporate social responsibility create economic value and more diverse kinds of value?

3. Give a real-life public policy problem involving a computer technology or dataset and use it to illustrate differences between the fields of data science, information science, and computer science.

4. Mathematics is one of three perspectives that computer scientists use to design, analyze, and evaluate computational structures, systems, and processes. However, mathematics is often regarded as an abstract or "pure" field of study that is not involved in social or political concerns. How might computer science's ability to automate and represent problems in mathematical terms have social or political consequences?

5. The future of society will be shaped by the philosophy of computer science and people's purposes, motivations, and political values. Give another philosophy that might influence or affect how computer scientists go about creating solutions.

6. If your organization is interested in artificial intelligence technology to enhance operations, what could you do to ensure the system is designed and implemented in a safe, socially responsible, and just manner?

Labs

1. Explore the Parable of the Polygons (https://openstax.org/r/76polygons). How does computer science contribute to the simulation? What does the simulation suggest is needed in the world? What are the limitations of the simulation as a model of the much more complicated real world?

2. Explore the Anatomy of an AI System (https://openstax.org/r/76AIanatomy) that breaks down the "human, labor, data and planetary resources" behind an Amazon Echo device. What parts surprised you? Based on your understanding of computer science, what parts are emphasized in the public conscience? What parts are downplayed or minimized? Then, select one surprising aspect and investigate it further.

3. Explore DALL-E (https://openstax.org/r/76DALL-E), a very large neural network created by OpenAI "that creates images from text captions for a wide range of concepts expressible in natural language." If the neural network is learning from English language images and captions on the Internet, what are some of the social

risks of this system? How might it encode problematic ideas about marginalized people in society?