Computer Science: The Discipline

The discipline of computer science was born in the early 1940s with the confluence of algorithm theory, mathematical logic, and the invention of the stored-program electronic computer. Examples are the works of Alan Turing and Kurt Godel in the 1930s about algorithms and their realizations as machines or rule-systems, the algorithms created by Ada Lovelace sixty years earlier, the analog computers built by Vannevar Bush in the 1920s, and the electronic computers built by Howard Aiken and Konrad Zuse in the 1930s. The writings of John von Neumann demonstrate considerable intellectual depth to the emerging discipline by the late 1940s. By the early 1960s, there was a sufficient body of knowledge to merit the first academic departments and degree programs. This discipline is also called computer science and engineering, computing, and informatics.

The body of knowledge of computing is frequently described as the systematic study of algorithmic processes that describe and transform information: their theory, analysis, design, efficiency, implementation, and application. The fundamental question underlying all of computing is: “What can be (efficiently) automated?”

Every practitioner of the discipline must be skilled in four basic areas: algorithmic thinking, representation, programming, and design. Algorithmic thinking is an interpretation of the world in which a person understands and formulates actions in terms of step-by-step procedures that give unambiguous results when carried out by anyone (or by a suitable machine). It resembles standard scientific thinking, which seeks to invent standard ways of observing that allow anyone to see and reproduce physical effects. Algorithmic thinking emphasizes the standard procedure and scientific thinking. Representation addresses the way in which data are stored so that the questions one will ask about them can be answered efficiently.

Programming enables people to take algorithmic thinking and representations and embody them in software that will cause a machine to perform in a prescribed way. This skill includes working knowledge of different programming languages (each having its own strengths and limitations), program development tools (which aid testing, debugging, modularity, and compatibility), and operating systems (which control the internal operations of computers). Finally, design connects the other three skills to the concerns of people, through the medium of systems that serve them. Design includes many practical considerations such as engineering tradeoffs, meeting time and cost constraints, and meeting safety and reliability requirements.

Denning, P. J. "Computer Science: The Discipline in Encyclopaedia of Computer Science, Ralston, A., and Hemmendinger." *George Mason University, Fairfax VA* (2000).

Comprehension MCQ (7 Pts): *Circle the correct answer.*

1- What were the key factors that contributed to the birth of computer science?

a) Mathematical logic and algorithm theory | c) The works of Alan Turing and Kurt Godel | d) Vannevar Bush's analog computers

2- What is the systematic study of algorithmic processes in computing called?

a) Algorithmic thinking | b) Computer science and engineering | d) Informatics

3- Which skill in computer science involves embodying algorithmic thinking in software?

a) Algorithmic thinking | b) Representation | c) Programming

4- What does representation address in computing?

a) The invention of new algorithms | b) The way data is stored efficiently | c) The design of computer systems

5- Which area of computer science connects algorithmic thinking, representation, and programming to people's concerns?

a) Algorithmic thinking | b) Representation | c) Design

6- What is the main emphasis of algorithmic thinking?

a) Standard procedures | b) Scientific thinking | c) Unambiguous results

7- What is the fundamental question underlying all of computing?

a) How can algorithms be created? | b) What can be efficiently automated? | c) How can data be stored efficiently?

Vocabulary (5 Pts): *Complete the table by matching the underlined words in the text with their meaning.*

Word	Meaning
Automate	To run or operate something, such as a factory or a system, by using machines and computers instead of people.
Logic	A particular way of thinking, especially one that is reasonable and based on good judgment.
Data	Information that has been translated into a form that is efficient for movement or processing.

Programming	Providing (a computer or other machine) with coded instructions for the automatic performance of a particular task.
Algorithms	A process or set of rules to be followed in calculations or other problem-solving operations, especially by a computer.
Skilled	Having or showing the knowledge, ability, or training to perform a certain activity or task well.

Grammar MCQ (8 Pts): *Circle the correct answer.*

1- Mary and Peter _____ new algorithms for computer science.

a) invents b) invented c) inventing

2- The scientist developed advanced _____ for analyzing data.

a) methods b) methodes c) method

3- Python is one of the _____ programming languages.

a) easier b) easiest c) easierest

4- The team of researchers _____ the efficiency of the algorithm.

a) analyzes b) will analyze c) analyzing

5- The new software incorporates various _____ for data encryption.

a) techniques b) techniquees c) technis

6- The latest version of the software is _____ than the previous one.

a) most reliable b) reliabler c) more reliable

7- The new programming language is _____ for handling large datasets.

a) efficiency b) efficient c) efficienctly

8- The scientist _____ groundbreaking theories in the field of computer science.

a) propose b) proposed c) proposing