

Computer Science Fundamentals

Computer Science · Answer Key · 18 Questions

1. Which of the following sorting algorithms has an average-case time complexity of $O(n \log n)$?

- A) Bubble Sort
- B) Insertion Sort
- C) Merge Sort**
- D) Selection Sort

2. In terms of computability theory, what does the Halting Problem state?

- A) It is impossible to create a program that can predict if any given program will finish or run forever.**
- B) All problems can be solved by a Turing machine.
- C) There exists a universal Turing machine that can simulate any other Turing machine.
- D) The set of all decidable languages is countably infinite.

3. What is the primary function of a compiler?

- A) To execute machine code directly.
- B) To translate source code written in a high-level language into machine code.**
- C) To manage memory allocation for programs.
- D) To provide a graphical user interface for software development.

4. Which data structure follows the Last-In, First-Out (LIFO) principle?

- A) Queue
- B) Linked List
- C) Stack**
- D) Tree

5. What is the purpose of Big O notation in algorithm analysis?

- A) To precisely measure the execution time of an algorithm in seconds.
- B) To describe the upper bound of an algorithm's time or space complexity.**
- C) To determine the memory usage of a data structure.
- D) To provide a definitive ranking of all known algorithms.

6. In object-oriented programming, what is polymorphism?

- A) The ability to inherit properties from multiple parent classes.
- B) The process of encapsulating data and methods within a class.
- C) The ability of an object to take on many forms, typically through method overriding or overloading.**
- D) The creation of new classes based on existing ones.

7. Which of these is a fundamental principle of relational database design?

- A) Data duplication is encouraged for faster retrieval.
- B) Tables should be designed to minimize redundancy and improve data integrity.**
- C) All data should be stored in a single, large table.
- D) Relationships between tables are defined using implicit links.

8. What is the significance of the Church-Turing thesis?

- A) It proves that all computational problems are solvable.
- B) It suggests that any function that can be computed by an algorithm can be computed by a Turing machine.**
- C) It defines the limits of artificial intelligence.
- D) It states that only specific programming languages can achieve universal computation.

9. What does the term 'binary search' refer to?

- A) A search algorithm that examines every other element in a list.
- B) A search algorithm that requires the data to be sorted and divides the search interval in half at each step.**
- C) A search algorithm used exclusively for binary files.
- D) A search algorithm with a worst-case time complexity of $O(n)$.

10. In computer architecture, what is the role of the Arithmetic Logic Unit (ALU)?

- A) To fetch instructions from memory.
- B) To perform arithmetic and logical operations on data.**
- C) To manage the flow of data between the CPU and peripherals.
- D) To store the results of computations.

11. What is a hash table?

- A) A data structure that stores elements in a sorted order.
- B) A data structure that uses a hash function to map keys to indices in an array.**
- C) A linear data structure where elements are accessed sequentially.
- D) A tree-like structure used for hierarchical data storage.

12. Which of the following is a characteristic of a dynamically typed programming language?

- A) Variable types are checked at compile time.
- B) Variable types are checked at runtime.**
- C) All variables must be explicitly declared with a type.
- D) Type errors are always caught before program execution.

13. What is the primary goal of cryptographic hashing?

- A) To encrypt messages for secure communication.
- B) To generate a unique, fixed-size fingerprint (hash) of data that is difficult to reverse.**
- C) To compress large files for efficient storage.
- D) To provide a method for random number generation.

14. What is a Turing machine?

- A) A physical computer with specific processing capabilities.
- B) A theoretical model of computation that manipulates symbols on a tape according to a table of rules.**
- C) A type of algorithm used for sorting data.
- D) A database management system.

15. In the context of operating systems, what is a deadlock?

- A) A situation where a process terminates unexpectedly.
- B) A state where two or more processes are unable to proceed because each is waiting for the other to release a resource.**
- C) A condition where the system runs out of memory.
- D) A failure in the network connection.

16. What is a 'stack overflow' error?

- A) An error that occurs when a program attempts to write more data to a buffer than it can hold.
- B) An error that occurs when a recursive function calls itself too many times, exceeding the allocated stack memory.**
- C) An error indicating that a network connection has failed.
- D) An error related to insufficient disk space.

17. Which of the following is a fundamental principle of NoSQL databases?

- A) Strict adherence to the ACID properties.
- B) Enforcement of rigid, predefined schemas.
- C) Flexibility in data models and often distributed architecture.**
- D) Use of SQL as the primary query language.

18. What is the Traveling Salesperson Problem (TSP)?

- A) A problem of finding the shortest path between two specific points in a network.
- B) A problem of finding the shortest possible route that visits a set of cities exactly once and returns to the origin city.**
- C) A problem of optimizing resource allocation in a manufacturing process.
- D) A problem related to scheduling tasks with dependencies.