

Advanced High School Computer Science

Computer Science · Answer Key · 25 Questions

1. In Big O notation, what is the worst-case time complexity of the Quicksort algorithm?

- A) $O(n \log n)$
- B) $O(n)$
- C) $O(n^2)$**
- D) $O(\log n)$

2. Which logic gate implements the Boolean function $F = A \text{ XOR } B$?

- A) The output is 1 if and only if A and B are both 0
- B) The output is 1 if and only if A and B are both 1
- C) The output is 1 if A and B are different**
- D) The output is 0 if A and B are different

3. What is the primary purpose of a translation lookaside buffer (TLB) in a CPU?

- A) To cache frequently accessed main memory addresses
- B) To store the results of complex floating-point calculations
- C) To cache virtual-to-physical address translations**
- D) To provide a high-speed interface for peripheral devices

4. In a binary max-heap, where is the largest element always located?

- A) At the last leaf node
- B) At the root node**
- C) In the middle of the array
- D) At the deepest level of the tree

5. Which of the following sorting algorithms is considered 'stable'?

- A) Heapsort
- B) Quicksort
- C) Merge Sort**
- D) Selection Sort

6. What is the result of the two's complement representation of -5 using 8 bits?

- A) 11111011**
- B) 00000101
- C) 10000101
- D) 11111010

7. Which networking protocol is connectionless and does not guarantee packet delivery?

- A) TCP
- B) UDP**
- C) HTTP
- D) FTP

8. In the context of database management, what does ACID stand for?

- A) Atomicity, Consistency, Isolation, Durability**
- B) Array, Class, Integrity, Database
- C) Access, Control, Index, Data
- D) Algorithm, Computation, Input, Design

9. What is the theoretical maximum throughput of a 10Gbps Ethernet connection in bits per second?

- A) 1,000,000,000 bps
- B) 10,000,000,000 bps**
- C) 100,000,000 bps
- D) 10,240,000,000 bps

10. Which architectural style separates the application logic from the presentation layer and the data source?

- A) Microservices
- B) Monolithic
- C) MVC (Model-View-Controller)**
- D) Serverless

11. Which data structure uses the 'First-In-First-Out' (FIFO) principle?

- A) Stack
- B) Queue**
- C) Linked List
- D) Hash Table

12. In Python, what is the result of the expression `5 // 2`?

- A) 2.5
- B) 2**
- C) 3
- D) 2.0

13. What does a parity bit added to a byte of data serve to detect?

A) Data corruption or transmission errors

- B) Encryption failure
- C) Memory overflow
- D) Address bus conflicts

14. Which of these is a non-deterministic polynomial-time hard (NP-hard) problem?

A) Searching an array

B) The Traveling Salesperson Problem

- C) Bubble sort
- D) Binary tree traversal

15. Which layer of the OSI model is responsible for routing and logical addressing?

A) Data Link Layer

B) Transport Layer

C) Network Layer

D) Physical Layer

16. What is the main function of the program counter (PC) in a CPU?

A) To store the result of the last arithmetic operation

B) To hold the address of the next instruction to be executed

- C) To track the number of active processes
- D) To manage the input/output interrupts

17. Which programming paradigm uses pure functions and avoids shared state or mutable data?

A) Object-Oriented Programming

B) Procedural Programming

C) Functional Programming

D) Imperative Programming

18. What is the primary function of a hashing algorithm like SHA-256?

A) To compress large files into smaller sizes

B) To create a fixed-size unique signature for input data

- C) To encrypt data so it can be decrypted with a key
- D) To identify the author of a piece of software

19. In a graph, what is the term for a path that visits every vertex exactly once?

A) Eulerian path

B) Hamiltonian path

- C) Bipartite path
- D) Spanning tree

20. What is the time complexity of searching for an element in a balanced binary search tree with n nodes?

- A) $O(n)$
- B) $O(1)$
- C) $O(n \log n)$
- D) $O(\log n)$**

21. Which CSS property is used to change the text color of an element?

- A) text-style
- B) font-color
- C) color**
- D) background-color

22. Which of these describes a 'race condition' in multithreaded programming?

- A) Two threads competing for CPU time
- B) System behavior depending on the sequence or timing of uncontrollable events**
- C) A thread waiting indefinitely for a resource held by another
- D) A thread attempting to access memory outside its allocation

23. In discrete mathematics, what is the result of $A \text{ AND } (\text{NOT } A)$ for any proposition A?

- A) 1 (True)
- B) 0 (False)**
- C) A
- D) NOT A

24. Which storage device uses non-volatile memory and has no moving parts?

- A) Hard Disk Drive (HDD)
- B) Solid State Drive (SSD)**
- C) Magnetic Tape
- D) Optical Disc

25. What is the purpose of the 'break' statement in a loop?

- A) To skip the current iteration and move to the next
- B) To terminate the execution of the loop entirely**
- C) To pause the loop until a key is pressed
- D) To restart the loop from the beginning