

1. What is the time complexity of finding the maximum element in an unsorted array of size n ?
- a) $O(1)$
 - b) $O(n)$
 - c) $O(\log n)$
 - d) $O(n^2)$

Answer: b

2. Which of the following is the correct way to declare a 2D array in C++?
- a) `int arr[10, 20];`
 - b) `int arr[10][20];`
 - c) `int arr[10][20] = {0};`
 - d) Both b and c

Answer: d

Linked List

3. Which of the following operations is faster in a singly linked list than in an array?
- a) Random access
 - b) Deleting a node
 - c) Searching for an element
 - d) Accessing the middle element

Answer: b

4. What is the best way to reverse a singly linked list?
- a) Recursion
 - b) Using an auxiliary array
 - c) Iterative in-place reversal
 - d) None of the above

Answer: c

Stacks

5. Which of the following applications is not typically associated with stacks?
- a) Parentheses checking
 - b) Function call tracking
 - c) Infix-to-postfix conversion
 - d) Shortest path in a graph
- Answer:** d
6. What is the time complexity of the "pop" operation in a stack implemented using a linked list?
- a) $O(1)$
 - b) $O(n)$

c) $O(\log_{10} n) O(\log n) O(\log n)$

d) $O(n^2) O(n^2) O(n^2)$

Answer: a

Queues

7. What type of queue allows elements to be added or removed from either end?

- a) Simple Queue
- b) Priority Queue
- c) Deque
- d) Circular Queue

Answer: c

8. What is the maximum number of elements that can be stored in a circular queue of size m ?

- a) $m - 1$
- b) m
- c) $m + 1$
- d) $m/2$

Answer: a

Binary Trees

9. In a binary tree, if the total number of nodes is m , what is the maximum possible height of the tree?

- a) m
- b) $\log_2 m$
- c) $m - 1$
- d) 2^{m-1}

Answer: c

10. Which traversal technique visits the root of a binary tree before its children?

- a) In-order
- b) Pre-order
- c) Post-order
- d) Level-order

Answer: b

Binary Search Tree

11. What is the time complexity of searching for an element in a balanced binary search tree?

- a) $O(\log_{10} n) O(\log n) O(\log n)$

- b) $O(n)O(n)O(n)$
- c) $O(n^2)O(n^2)O(n^2)$
- d) $O(1)O(1)O(1)$

Answer: a

12. Which of the following is true about a Binary Search Tree (BST)?

- a) Left child nodes are greater than the parent node
- b) Right child nodes are smaller than the parent node
- c) Nodes in the left subtree are smaller than the parent node
- d) It does not follow any specific order

Answer: c

Heaps

13. What is the time complexity of extracting the maximum element from a max-heap?

- a) $O(1)O(1)O(1)$
- b) $O(\log n)O(\log n)O(\log n)$
- c) $O(n)O(n)O(n)$
- d) $O(n^2)O(n^2)O(n^2)$

Answer: b

14. Which of the following applications is best solved using heaps?

- a) Binary Search
- b) Sorting large datasets
- c) Priority scheduling
- d) Traversing trees

Answer: c

Hashing

15. What is the time complexity of searching for an element in a hash table (assuming no collisions)?

- a) $O(1)O(1)O(1)$
- b) $O(n)O(n)O(n)$
- c) $O(\log n)O(\log n)O(\log n)$
- d) $O(n \log n)O(n \log n)O(n \log n)$

Answer: a

16. Which of the following is not a collision resolution technique?

- a) Chaining
- b) Linear Probing
- c) Quadratic Probing
- d) Recursion

Answer: d

Recursion

17. **What is the base case in recursion?**

- a) The point where the function begins to execute
- b) The point where recursive calls stop
- c) The last recursive call
- d) The point where recursion is optimized

Answer: b

18. **Which of the following problems is typically solved using recursion?**

- a) Sorting
- b) Fibonacci sequence
- c) Tower of Hanoi
- d) Both b and c

Answer: d

Sorting Algorithms

19. **Which sorting algorithm has the best time complexity for already sorted data?**

- a) Merge Sort
- b) Quick Sort
- c) Bubble Sort
- d) Insertion Sort

Answer: d

20. **Which sorting algorithm works by repeatedly partitioning the array into smaller subarrays?**

- a) Merge Sort
- b) Quick Sort
- c) Heap Sort
- d) Selection Sort

Answer: b

Let me know if you'd like more MCQs or require additional topics to be covered!

40

You said:

30 more

ChatGPT

Here are **30 additional important MCQs** on Data Structures and Algorithms:

Arrays (5 MCQs)

1. **What is the minimum number of swaps required to sort an array of size n ?**

- a) $O(1)$
- b) $O(n)$
- c) Depends on the sorting algorithm
- d) $O(n^2)$

Answer: c

2. **Which of the following is the correct way to initialize an array in C++?**

- a) `int arr[5] = {1, 2, 3};`
- b) `int arr[5] = {1, 2, 3, 4, 5, 6};`
- c) `int arr[5] = {};`
- d) All of the above

Answer: a

3. **Which operation has a constant time complexity in a static array?**

- a) Search
- b) Insert at the beginning
- c) Access by index
- d) Delete at the end

Answer: c

4. **What happens if we access an index outside the bounds of an array in C++?**

- a) Returns -1
- b) Triggers a runtime error
- c) Undefined behavior
- d) Automatically resizes the array

Answer: c

5. **What is the space complexity of an array with n elements?**

- a) $O(1)$
- b) $O(\log n)$
- c) $O(n)$
- d) $O(n^2)$

Answer: c

Linked List (5 MCQs)

6. Which linked list allows traversing in both directions?

- a) Singly linked list
- b) Circular linked list
- c) Doubly linked list
- d) None of the above

Answer: c

7. What is the time complexity of finding the middle element in a singly linked list?

- a) $O(1)O(1)O(1)$
- b) $O(n)O(n)O(n)$
- c) $O(\log n)O(\log n)O(\log n)$
- d) $O(n^2)O(n^2)O(n^2)$

Answer: b

8. Which of the following is a disadvantage of a singly linked list over an array?

- a) Random access is not possible
- b) Fixed size
- c) Inefficient memory usage
- d) Complexity of traversal

Answer: a

9. In a circular linked list, where does the last node point?

- a) Null
- b) The head node
- c) A random node
- d) The node before it

Answer: b

10. What is the space complexity of inserting a node into a linked list?

- a) $O(1)O(1)O(1)$
- b) $O(n)O(n)O(n)$
- c) $O(n^2)O(n^2)O(n^2)$
- d) $O(\log n)O(\log n)O(\log n)$

Answer: a

Stacks (5 MCQs)

11. Which of the following applications uses a stack?

- a) Depth-First Search
- b) Breadth-First Search
- c) Shortest Path Algorithm
- d) None of the above

Answer: a

12. Which operation is not performed by a stack?

- a) Push

- b) Pop
- c) Enqueue
- d) Peek

Answer: c

13. What is the result of attempting to pop an element from an empty stack?

- a) Underflow
- b) Overflow
- c) Undefined behavior
- d) Returns -1

Answer: a

14. What data structure is used for the undo operation in text editors?

- a) Queue
- b) Linked list
- c) Stack
- d) Hash table

Answer: c

15. What is the space complexity of a stack implemented using an array?

- a) $O(1)$ $O(1)$ $O(1)$
- b) $O(n)$ $O(n)$ $O(n)$
- c) $O(\log n)$ $O(\log n)$ $O(\log n)$
- d) $O(n^2)$ $O(n^2)$ $O(n^2)$

Answer: b

Queues (5 MCQs)

16. Which data structure is used for implementing breadth-first search (BFS)?

- a) Stack
- b) Queue
- c) Priority Queue
- d) Linked List

Answer: b

17. What type of queue is used in a printer spooler?

- a) Circular Queue
- b) Simple Queue
- c) Priority Queue
- d) Deque

Answer: b

18. Which of the following does a circular queue overcome?

- a) Inefficient memory usage
- b) Overflow
- c) Underflow
- d) Both a and b

Answer: a

19. What is the time complexity of enqueue operation in a queue implemented using an array?

- a) $O(1)O(1)O(1)$
- b) $O(n)O(n)O(n)$
- c) $O(\log n)O(\log n)O(\log n)$
- d) $O(n^2)O(n^2)O(n^2)$

Answer: a

20. Which of the following is a type of queue?

- a) Simple Queue
- b) Priority Queue
- c) Circular Queue
- d) All of the above

Answer: d

Binary Trees (5 MCQs)

21. What is the minimum height of a binary tree with n nodes?

- a) $\log_2(n+1) \lceil \log_2(n+1) \rceil$
- b) $n-1$
- c) $\log_2(n) \lceil \log_2(n) \rceil$
- d) $n/2$

Answer: a

22. Which traversal is also known as depth-first traversal?

- a) Level-order traversal
- b) Pre-order traversal
- c) Post-order traversal
- d) In-order traversal

Answer: b

23. What is the degree of a node in a binary tree?

- a) Number of children
- b) Number of parents
- c) Number of siblings
- d) Number of leaves

Answer: a

24. What is a full binary tree?

- a) Every node has exactly two children
- b) All leaf nodes are at the same level
- c) All nodes except leaves have two children
- d) Both b and c

Answer: d

25. Which data structure is used for implementing level-order traversal of a binary tree?

- a) Stack
- b) Queue

c) Priority Queue

d) Linked List

Answer: b

Binary Search Trees (5 MCQs)

1. **What is the in-order traversal of the binary search tree used for?**

a) Sorting

b) Searching

c) Reversing

d) None of the above

Answer: a

2. **What happens when you insert a duplicate key in a binary search tree?**

a) It is added as a new node

b) It replaces the existing key

c) It is ignored

d) Undefined behavior

Answer: c

3. **Which condition must be satisfied for a binary tree to be a binary search tree?**

a) Root node is larger than its children

b) Left child is smaller, and right child is larger than the parent node

c) Nodes at the same level are equal

d) None of the above

Answer: b

4. **What is the time complexity of deleting a node in a binary search tree?**

a) $O(1)$ $O(1)$ $O(1)$

b) $O(\log n)$ $O(\log n)$ $O(\log n)$

c) $O(n)$ $O(n)$ $O(n)$

d) Both b and c depending on the balance of the tree

Answer: d

5. **What is the maximum number of leaf nodes in a binary search tree of height h ?**

a) $2^h - 1$

b) 2^h

c) $2^h - 1$

d) h

Answer: b

6. **Searching Algorithms**

7. **What is the time complexity of linear search in the worst case?**

8. a) $O(1)$ $O(1)$ $O(1)$

9. b) $O(n)$ $O(n)$ $O(n)$

10. c) $O(\log n)$ $O(\log n)$ $O(\log n)$

11. d) $O(n^2)$ $O(n^2)$ $O(n^2)$

12. **Answer: b**

13. What is the time complexity of binary search in the average case?

- 14. a) $O(1)O(1)O(1)$
- 15. b) $O(n)O(n)O(n)$
- 16. c) $O(\log n)O(\log n)O(\log n)$
- 17. d) $O(n^2)O(n^2)O(n^2)$

18. Answer: c

19. Which of the following is true for binary search?

- 20. a) Works on sorted arrays only
- 21. b) Can work on unsorted arrays
- 22. c) Requires $O(n)O(n)O(n)$ space
- 23. d) Has $O(n^2)O(n^2)O(n^2)$ complexity

24. Answer: a

25. What is the best case time complexity of binary search?

- 26. a) $O(1)O(1)O(1)$
- 27. b) $O(n)O(n)O(n)$
- 28. c) $O(\log n)O(\log n)O(\log n)$
- 29. d) $O(n^2)O(n^2)O(n^2)$

30. Answer: a

31. What is the disadvantage of linear search?

- a) Does not work with unsorted arrays
- b) High space complexity
- c) Low efficiency for large datasets
- d) Only works on integers

Answer: c

Sorting Algorithms

32. Which sorting algorithm has the best time complexity for sorted or nearly sorted data?

- a) Bubble Sort
- b) Quick Sort
- c) Merge Sort
- d) Insertion Sort

Answer: d

33. What is the worst-case time complexity of Quick Sort?

- a) $O(\log n)O(\log n)O(\log n)$
- b) $O(n)O(n)O(n)$
- c) $O(n^2)O(n^2)O(n^2)$
- d) $O(n \log n)O(n \log n)O(n \log n)$

Answer: c

34. What is the space complexity of Merge Sort?

- a) $O(1)O(1)O(1)$
- b) $O(n)O(n)O(n)$
- c) $O(\log n)O(\log n)O(\log n)$
- d) $O(n^2)O(n^2)O(n^2)$

Answer: b

35. Which sorting algorithm is best suited for a large dataset where memory usage is a concern?

- a) Quick Sort
- b) Merge Sort
- c) Heap Sort
- d) Bubble Sort

Answer: c

36. Which of the following is not a comparison-based sorting algorithm?

- a) Quick Sort
- b) Radix Sort
- c) Merge Sort
- d) Heap Sort

Answer: b

Space-Time Complexities

37. What is the time complexity of Bubble Sort in the best case?

- a) $O(n)O(n)O(n)$
- b) $O(n \log n)O(n \log n)O(n \log n)$
- c) $O(n^2)O(n^2)O(n^2)$
- d) $O(1)O(1)O(1)$

Answer: a

38. What is the space complexity of Quick Sort?

- a) $O(1)O(1)O(1)$
- b) $O(n)O(n)O(n)$
- c) $O(\log n)O(\log n)O(\log n)$ (for recursion)
- d) $O(n^2)O(n^2)O(n^2)$

Answer: c

39. Which of the following algorithms uses a divide-and-conquer strategy?

- a) Quick Sort
- b) Merge Sort
- c) Binary Search
- d) All of the above

Answer: d

40. Which sorting algorithm guarantees $O(n \log n)O(n \log n)O(n \log n)$ time complexity in all cases?

- a) Quick Sort
- b) Merge Sort
- c) Heap Sort
- d) Both b and c

Answer: d

41. What is the time complexity of searching for a value in a hash table in the best case?

- a) $O(1)O(1)O(1)$
- b) $O(n)O(n)O(n)$
- c) $O(\log n)O(\log n)O(\log n)$
- d) $O(n^2)O(n^2)O(n^2)$

Answer: a

Applications and Characteristics

42. Which sorting algorithm is considered "stable"?

- a) Quick Sort
- b) Merge Sort
- c) Heap Sort
- d) None of the above

Answer: b

43. Which sorting algorithm has the lowest overhead for small datasets?

- a) Quick Sort
- b) Merge Sort
- c) Insertion Sort
- d) Heap Sort

Answer: c

44. Which data structure is primarily used in Heap Sort?

- a) Array
- b) Linked List
- c) Binary Heap
- d) Hash Table

Answer: c

45. What is the time complexity of Radix Sort?

- a) $O(n \log n)$ $O(n \log n)$ $O(n \log n)$
- b) $O(n^2)$ $O(n^2)$ $O(n^2)$
- c) $O(d \cdot (n+k))$ $O(d \cdot (n+k))$ $O(d \cdot (n+k))$, where d is the number of digits and k is the range
- d) $O(n)$ $O(n)$ $O(n)$

Answer: c

46. Which algorithm uses a partitioning technique?

- a) Quick Sort
- b) Merge Sort
- c) Heap Sort
- d) Bubble Sort

Answer: a

Advanced Concepts

47. What is the average-case time complexity of Quick Sort?

- a) $O(1)$ $O(1)$ $O(1)$
- b) $O(n)$ $O(n)$ $O(n)$
- c) $O(n \log n)$ $O(n \log n)$ $O(n \log n)$
- d) $O(n^2)$ $O(n^2)$ $O(n^2)$

Answer: c

48. Which algorithm is the most efficient for searching in a sorted array?

- a) Linear Search
- b) Binary Search

- c) Jump Search
- d) Interpolation Search

Answer: b

49. What is the time complexity of Heap Sort in the best case?

- a) $O(1)O(1)O(1)$
- b) $O(n)O(n)O(n)$
- c) $O(\log n)O(\log n)O(\log n)$
- d) $O(n \log n)O(n \log n)O(n \log n)$

Answer: d

50. Which sorting algorithm uses "pivots" during execution?

- a) Merge Sort
- b) Quick Sort
- c) Radix Sort
- d) Bubble Sort

Answer: b

51. What is the key characteristic of a stable sorting algorithm?

- a) Sorting in $O(n)O(n)O(n)$ time
- b) Preserves the relative order of equal elements
- c) Uses $O(1)O(1)O(1)$ additional memory
- d) Requires sorted input

Answer: b

Miscellaneous

52. What is the worst-case time complexity of Radix Sort?

- a) $O(n \log n)O(n \log n)O(n \log n)$
- b) $O(n^2)O(n^2)O(n^2)$
- c) $O(d \cdot (n+k))O(d \cdot (n+k))O(d \cdot (n+k))$
- d) $O(n)O(n)O(n)$

Answer: c

53. What is the average case time complexity of Linear Search?

- a) $O(1)O(1)O(1)$
- b) $O(n/2)O(n/2)O(n/2) \approx O(n)O(n)O(n)$
- c) $O(\log n)O(\log n)O(\log n)$
- d) $O(n^2)O(n^2)O(n^2)$

Answer: b

54. What is the minimum time complexity of sorting an array of size n using a comparison-based algorithm?

- a) $O(1)O(1)O(1)$
- b) $O(n)O(n)O(n)$
- c) $O(n \log n)O(n \log n)O(n \log n)$
- d) $O(n^2)O(n^2)O(n^2)$

Answer: c

55. Which algorithm is best for sorting data that fits entirely in memory?

- a) External Merge Sort

- b) Quick Sort
- c) Bubble Sort
- d) Radix Sort

Answer: b

56. What is the auxiliary space complexity of Merge Sort?

- a) $O(1)O(1)O(1)$
- b) $O(n)O(n)O(n)$
- c) $O(\log n)O(\log n)O(\log n)$
- d) $O(n^2)O(n^2)O(n^2)$

Answer: b

57. General Concepts

58. Which of the following is not an OOP concept?

- 59. a) Abstraction
- 60. b) Encapsulation
- 61. c) Polymorphism
- 62. d) Iteration

63. Answer: d

64. What does encapsulation mean in OOP?

- 65. a) Hiding data and exposing functionality
- 66. b) Combining two classes into one
- 67. c) Passing messages between objects
- 68. d) Creating multiple objects from one class

69. Answer: a

70. Which of the following is an example of polymorphism?

- 71. a) Function overloading
- 72. b) Method overriding
- 73. c) Operator overloading
- 74. d) All of the above

75. Answer: d

76. Which OOP concept refers to the process of defining a new class from an existing class?

- 77. a) Inheritance
- 78. b) Polymorphism
- 79. c) Encapsulation
- 80. d) Abstraction

81. Answer: a

82. What is the primary purpose of abstraction in OOP?

- 83. a) To improve performance
- 84. b) To hide unnecessary details
- 85. c) To enable inheritance
- 86. d) To define multiple classes

87. Answer: b

Abstraction

88. Which of the following best describes abstraction?

- a) Hiding implementation details and showing essential features
- b) Protecting data from unauthorized access
- c) Reusing code
- d) Organizing code in modules

Answer: a

89. How is abstraction achieved in OOP?

- a) Using classes and objects
- b) Using access specifiers
- c) Using abstract classes and interfaces
- d) Using inheritance

Answer: c

90. Which of the following is true about abstract classes?

- a) They cannot be instantiated
- b) They can have both abstract and concrete methods
- c) They are used for achieving abstraction
- d) All of the above

Answer: d

91. What keyword is used in Java to declare an abstract class?

- a) abstract
- b) interface
- c) virtual
- d) static

Answer: a

92. What is the difference between an abstract class and an interface?

- a) Interfaces allow multiple inheritance, abstract classes do not
- b) Abstract classes can have constructors, interfaces cannot
- c) Abstract classes can have non-abstract methods, interfaces cannot (prior to Java 8)
- d) All of the above

Answer: d

Encapsulation

93. What is used to implement encapsulation in OOP?

- a) Public methods and private variables
- b) Static methods
- c) Interfaces
- d) None of the above

Answer: a

94. Which access specifier in Java provides the highest level of encapsulation?

- a) Public
- b) Protected

- c) Private
- d) Default

Answer: c

95. Which of the following is not an advantage of encapsulation?

- a) Better control over data
- b) Supports code modularity
- c) Allows multiple inheritance
- d) Improves maintainability

Answer: c

96. What is a benefit of encapsulation?

- a) Enhances security
- b) Reduces code complexity
- c) Both a and b
- d) None of the above

Answer: c

97. Which of the following best explains data hiding in OOP?

- a) Wrapping of data into methods
- b) Making variables private and accessing them through public methods
- c) Hiding method implementation
- d) Defining abstract classes

Answer: b

Inheritance

98. What is the main advantage of inheritance?

- a) Memory efficiency
- b) Code reuse
- c) Faster execution
- d) Improved security

Answer: b

99. Which type of inheritance is not supported in Java?

- a) Single inheritance
- b) Multilevel inheritance
- c) Multiple inheritance using classes
- d) Hierarchical inheritance

Answer: c

100. What is the relationship between a superclass and a subclass?

- a) Has-a
- b) Is-a
- c) Uses-a
- d) None of the above

Answer: b

101. Which keyword is used to access a superclass's constructor in Java?

- a) super
- b) this
- c) base

d) parent

Answer: a

102. **Which of the following is not a type of inheritance?**

- a) Multilevel inheritance
- b) Hierarchical inheritance
- c) Hybrid inheritance
- d) Virtual inheritance

Answer: d

Polymorphism

103. **What are the two types of polymorphism?**

- a) Method overloading and method overriding
- b) Single and multiple
- c) Static and dynamic
- d) Abstract and concrete

Answer: a

104. **Which of the following is an example of runtime polymorphism?**

- a) Method overloading
- b) Method overriding
- c) Operator overloading
- d) All of the above

Answer: b

105. **What is the advantage of polymorphism in OOP?**

- a) Code flexibility
- b) Code reusability
- c) Improved performance
- d) Both a and b

Answer: d

106. **What is method overriding?**

- a) Defining a method in a subclass with the same name and signature as in the superclass
- b) Writing multiple methods with the same name but different parameters
- c) Using operators for different data types
- d) None of the above

Answer: a

107. **Which of the following cannot be achieved using polymorphism?**

- a) Extending code functionality
- b) Runtime decision making
- c) Multiple inheritance using classes
- d) None of the above

Answer: c

Association, Aggregation, and Composition

108. **What is the relationship type in composition?**

- a) Is-a
- b) Has-a

- c) Uses-a
- d) None of the above

Answer: b

109. Which of the following is true about composition?

- a) The composed object cannot exist independently of the parent object
- b) It is a weaker form of association
- c) It does not involve object creation
- d) None of the above

Answer: a

110. What is aggregation in OOP?

- a) A type of inheritance
- b) A type of association where the child object can exist independently
- c) A type of association where objects are tightly coupled
- d) None of the above

Answer: b

111. Which is an example of aggregation?

- a) A car and its engine
- b) A library and its books
- c) A human and their heart
- d) None of the above

Answer: b

112. Which type of association is the strongest in OOP?

- a) Aggregation
- b) Composition
- c) Dependency
- d) Inheritance

Answer: b

HTML5 and CSS

113. Which HTML5 element is used to define navigation links?

- a) <nav>
- b) <header>
- c) <footer>
- d) <aside>

Answer: a

114. Which attribute is used in HTML5 to specify an image's alternate text?

- a) alt
- b) src
- c) title
- d) href

Answer: a

115. What is the purpose of the <canvas> element in HTML5?

- a) To draw graphics dynamically via JavaScript
- b) To embed videos
- c) To create forms
- d) To insert audio

Answer: a

116. What is the CSS property used to change the background color of an element?

- a) background-color
- b) color
- c) background
- d) bgcolor

Answer: a

117. Which HTML5 element is used to play audio files?

- a) <audio>
- b) <sound>
- c) <music>
- d) <play>

Answer: a

118. What does the z-index property in CSS control?

- a) The font size of text
- b) The stacking order of elements
- c) The position of elements
- d) The visibility of elements

Answer: b

119. Which of the following is NOT a valid CSS selector?

- a) .classname
- b) #idname
- c) @media
- d) :hover

Answer: c

120. What is the difference between <section> and <div> in HTML5?

- a) <section> is semantic, <div> is not
- b) <div> is used for forms, <section> is not
- c) <section> is used for headings only
- d) Both are identical

Answer: a

121. Which CSS framework is widely used for responsive web design?

- a) Bootstrap
- b) Materialize
- c) Tailwind CSS
- d) All of the above

Answer: d

122. How do you apply a CSS rule to elements with the class name "example"?

- a) example {}
- b) #example {}
- c) .example {}
- d) @example {}

Answer: c

JavaScript

123. **What is the correct syntax to output "Hello World" in JavaScript?**

- a) `print("Hello World");`
- b) `console.log("Hello World");`
- c) `echo("Hello World");`
- d) `alertBox("Hello World");`

Answer: b

124. **Which keyword is used to declare a variable in JavaScript?**

- a) `var`
- b) `let`
- c) `const`
- d) All of the above

Answer: d

125. **What is the result of `typeof null` in JavaScript?**

- a) `undefined`
- b) `null`
- c) `object`
- d) `string`

Answer: c

126. **Which method is used to remove whitespace from both ends of a string?**

- a) `slice()`
- b) `trim()`
- c) `substring()`
- d) `replace()`

Answer: b

127. **What is the purpose of the `addEventListener` method in JavaScript?**

- a) To create new events
- b) To attach an event handler to an element
- c) To remove an event handler from an element
- d) To manipulate the DOM

Answer: b

128. **What does `===` mean in JavaScript?**

- a) Strict equality (type and value)
- b) Loose equality (value only)
- c) Assignment operator
- d) None of the above

Answer: a

129. **What is the default value of an uninitialized variable in JavaScript?**

- a) `0`
- b) `null`
- c) `undefined`
- d) `false`

Answer: c

130. **How do you create an object in JavaScript?**

- a) `let obj = {};`
- b) `let obj = [];`
- c) `let obj = Object();`
- d) `let obj = Object[];`

Answer: a

131. **What is the purpose of the `JSON.stringify()` method?**

- a) To parse JSON strings into objects
- b) To convert objects into JSON strings
- c) To sort JSON objects
- d) To filter JSON data

Answer: b

132. **Which function is used to schedule a callback after a specified delay?**

- a) `setInterval()`
- b) `setTimeout()`
- c) `delay()`
- d) `schedule()`

Answer: b

HTTP/HTTPS and REST APIs

133. **Which HTTP method is used to retrieve data from a server?**

- a) GET
- b) POST
- c) PUT
- d) DELETE

Answer: a

134. **What does HTTPS ensure?**

- a) Secure communication over the network
- b) Faster data transfer
- c) IP address masking
- d) None of the above

Answer: a

135. **Which status code represents "Resource not found"?**

- a) 200
- b) 404
- c) 500
- d) 401

Answer: b

136. **What is the main advantage of using REST APIs?**

- a) Platform independence
- b) Statelessness
- c) Scalability
- d) All of the above

Answer: d

137. **Which HTTP method is idempotent?**

- a) GET
- b) DELETE
- c) PUT
- d) All of the above

Answer: d

Cookies

138. **What is the purpose of cookies in web development?**

- a) Storing client-side data
- b) Enhancing server security
- c) Enabling server communication
- d) None of the above

Answer: a

139. **What is the default expiration of a session cookie?**

- a) 1 hour
- b) Until the browser is closed
- c) 1 day
- d) 1 week

Answer: b

140. **Which attribute is used to secure cookies over HTTPS?**

- a) Secure
- b) HttpOnly
- c) Domain
- d) Expires

Answer: a

141. **Which attribute prevents JavaScript from accessing cookies?**

- a) Secure
- b) HttpOnly
- c) Path
- d) SameSite

Answer: b

142. **What is the maximum size of a cookie?**

- a) 1 KB
- b) 4 KB
- c) 8 KB
- d) 16 KB

Answer: b

Version Control (Git)

143. **What is the purpose of Git?**

- a) To track changes in source code
- b) To deploy applications

- c) To secure code
- d) None of the above

Answer: a

144. What is the command to create a new Git repository?

- a) git start
- b) git init
- c) git create
- d) git new

Answer: b

145. What does the command git clone do?

- a) Creates a copy of a remote repository
- b) Merges two branches
- c) Deletes a repository
- d) None of the above

Answer: a

146. What is the purpose of a .gitignore file?

- a) To list files to ignore in the repository
- b) To delete ignored files
- c) To track all files
- d) None of the above

Answer: a

147. Which command is used to view the commit history in Git?

- a) git status
- b) git log
- c) git diff
- d) git history

Answer: b

Software Development Lifecycle (SDLC)

148. Which is the first phase of the SDLC?

- a) Requirement Analysis
- b) Design
- c) Testing
- d) Coding

Answer: a

149. What is the main objective of the requirement analysis phase?

- a) Writing code for the software
- b) Gathering and analyzing user needs
- c) Testing the software
- d) Deploying the product

Answer: b

150. Which phase involves creating wireframes and prototypes?

- a) Deployment
- b) Product Design
- c) Coding
- d) Maintenance

Answer: b

151. Which SDLC phase focuses on writing the actual source code?

- a) Requirement Analysis
- b) Testing
- c) Coding
- d) Deployment

Answer: c

152. What is the purpose of the testing phase in SDLC?

- a) To identify and fix defects
- b) To gather user requirements
- c) To deploy the software
- d) To create documentation

Answer: a

153. What happens during the deployment phase?

- a) The product is released to the production environment
- b) Bugs are identified and fixed
- c) Requirements are gathered
- d) Software modules are integrated

Answer: a

154. Which SDLC model is best suited for projects with unclear requirements?

- a) Waterfall Model
- b) Agile Model
- c) V-Model
- d) Spiral Model

Answer: b

155. What is the primary focus of the post-production maintenance phase?

- a) Adding new features
- b) Fixing bugs and updating software
- c) Testing the software
- d) Rewriting the source code

Answer: b

156. Which SDLC model emphasizes a sequential flow?

- a) Agile Model
- b) Spiral Model
- c) Waterfall Model
- d) Iterative Model

Answer: c

157. Which phase ensures that software meets user expectations through testing by end-users?

- a) Unit Testing
- b) UAT (User Acceptance Testing)
- c) Integration Testing
- d) Regression Testing

Answer: b

Software Testing Concepts

158. Which type of testing focuses on testing the internal logic of the code?

- a) Black Box Testing
- b) White Box Testing
- c) Integration Testing
- d) UAT

Answer: b

159. Which testing type validates individual components or modules?

- a) Integration Testing
- b) Unit Testing
- c) Regression Testing
- d) System Testing

Answer: b

160. What does black box testing focus on?

- a) Internal implementation of the system
- b) Output based on input, ignoring internal details
- c) Test automation scripts
- d) System deployment

Answer: b

161. What is the purpose of regression testing?

- a) To test new features
- b) To ensure recent changes haven't broken existing functionality
- c) To validate user acceptance
- d) To test individual units of code

Answer: b

162. What is integration testing?

- a) Testing the complete application
- b) Testing interactions between different modules
- c) Testing user interfaces
- d) Testing system performance

Answer: b

163. Which testing type simulates real-world usage conditions?

- a) System Testing
- b) Load Testing
- c) UAT (User Acceptance Testing)
- d) Stress Testing

Answer: c

164. Which type of testing is performed without executing the code?

- a) Static Testing
- b) Dynamic Testing
- c) White Box Testing
- d) Black Box Testing

Answer: a

165. **What does smoke testing validate?**

- a) Critical functionality of the software
- b) Detailed internal logic of the system
- c) Security vulnerabilities
- d) Database schema

Answer: a

166. **Which type of testing checks system performance under heavy loads?**

- a) Load Testing
- b) Regression Testing
- c) Unit Testing
- d) Black Box Testing

Answer: a

167. **In agile methodologies, testing is typically done:**

- a) After coding is complete
- b) During each iteration
- c) Only in the deployment phase
- d) At the end of the project

Answer: b

Design Patterns

168. **What is a design pattern?**

- a) A reusable solution to a common problem in software design
- b) A coding guideline
- c) A database schema
- d) None of the above

Answer: a

169. **Which design pattern involves creating an interface to encapsulate a group of individual factories?**

- a) Singleton
- b) Abstract Factory
- c) Builder
- d) Prototype

Answer: b

170. **What is the purpose of the Singleton design pattern?**

- a) To ensure a class has only one instance and provide global access to it
- b) To create families of related objects
- c) To decouple dependencies
- d) To iterate over a collection

Answer: a

171. **Which design pattern provides a simplified interface to a complex subsystem?**

- a) Adapter
- b) Facade
- c) Proxy

d) Composite

Answer: b

172. **Which design pattern is used to dynamically add behavior to objects?**

- a) Strategy
- b) Decorator
- c) Observer
- d) Factory

Answer: b

173. **What is the purpose of the Observer design pattern?**

- a) To define a one-to-many dependency between objects
- b) To create objects dynamically
- c) To encapsulate algorithms
- d) To share common resources

Answer: a

174. **Which pattern allows classes with incompatible interfaces to work together?**

- a) Adapter
- b) Strategy
- c) Proxy
- d) Singleton

Answer: a

175. **What is the primary purpose of the Builder design pattern?**

- a) To create complex objects step by step
- b) To provide an interface for creating families of related objects
- c) To ensure only one instance exists
- d) To decouple abstraction and implementation

Answer: a

176. **Which design pattern separates object construction from its representation?**

- a) Builder
- b) Prototype
- c) Factory Method
- d) Command

Answer: a

177. **Which pattern ensures loose coupling by inverting control of object creation?**

- a) Dependency Injection
- b) Singleton
- c) Prototype
- d) Strategy

Answer: a

SOLID Principles

178. **What does the 'S' in SOLID stand for?**

- a) Single Responsibility Principle
- b) Singleton Principle
- c) System Design Principle

d) Software Usability Principle

Answer: a

179. **Which SOLID principle ensures that classes should be open for extension but closed for modification?**

- a) Open/Closed Principle
- b) Liskov Substitution Principle
- c) Dependency Inversion Principle
- d) Interface Segregation Principle

Answer: a

180. **What is the main idea behind the Liskov Substitution Principle?**

- a) Subtypes must be replaceable by their base types
- b) Classes should have one reason to change
- c) Interfaces should be small and specific
- d) Dependencies should be abstracted

Answer: a

181. **Which principle suggests that no client should be forced to depend on methods it doesn't use?**

- a) Interface Segregation Principle
- b) Single Responsibility Principle
- c) Dependency Inversion Principle
- d) Open/Closed Principle

Answer: a

182. **What does the Dependency Inversion Principle emphasize?**

- a) High-level modules should not depend on low-level modules
- b) Classes should have only one responsibility
- c) Objects should be replaceable by their subtypes
- d) Interfaces should be segregated

Answer: a

Basic Database Concepts

183. **What does RDBMS stand for?**

- a) Relational Data Batch Management System
- b) Relational Database Management System
- c) Regional Database Management Software
- d) Random Data Management System

Answer: b

184. **Which component is the primary language used to interact with RDBMS?**

- a) HTML
- b) SQL
- c) XML
- d) JSON

Answer: b

185. **What does the term 'schema' represent in a database?**

- a) A collection of related tables
- b) A blueprint or structure of a database
- c) A set of permissions for a user

d) A specific row in a table

Answer: b

186. Which of the following is a non-relational database?

- a) MySQL
- b) MongoDB
- c) PostgreSQL
- d) Oracle DB

Answer: b

187. What is the main advantage of a relational database?

- a) Scalability
- b) Structured data storage using tables
- c) Complex query writing
- d) In-memory data processing

Answer: b

ER Diagram

188. What does an entity in an ER diagram represent?

- a) A row in a table
- b) A real-world object or concept
- c) A database query
- d) A relationship between two tables

Answer: b

189. In an ER diagram, a diamond shape represents:

- a) Entity
- b) Attribute
- c) Relationship
- d) Primary Key

Answer: c

190. A weak entity in an ER diagram must be associated with:

- a) A relationship with a strong entity
- b) A primary key
- c) An independent attribute
- d) A self-relationship

Answer: a

191. What does a multi-valued attribute look like in an ER diagram?

- a) A rectangle
- b) A double oval
- c) A diamond
- d) A triangle

Answer: b

192. What is the purpose of a primary key in an ER model?

- a) To define relationships between entities
- b) To uniquely identify each entity instance
- c) To represent multi-valued attributes
- d) To define derived attributes

Answer: b

Transactions and ACID Properties

193. **What does the 'A' in ACID properties stand for?**

- a) Abstraction
- b) Atomicity
- c) Authentication
- d) Alignment

Answer: b

194. **Which ACID property ensures that a transaction will leave the database in a consistent state?**

- a) Isolation
- b) Durability
- c) Consistency
- d) Atomicity

Answer: c

195. **The Durability property of a transaction ensures:**

- a) Transactions occur without interference
- b) Changes are permanent even after a failure
- c) Transactions are divided into sub-transactions
- d) The database remains consistent

Answer: b

196. **What does the Isolation property in transactions ensure?**

- a) Transactions can only read committed data
- b) Transactions remain independent of each other
- c) All changes are logged
- d) Data remains unchanged during a transaction

Answer: b

197. **A rollback operation is used to:**

- a) Save a transaction permanently
- b) Undo changes made during a transaction
- c) Retrieve data from backup
- d) Lock the database

Answer: b

Keys

198. **Which key is used to uniquely identify a row in a table?**

- a) Foreign Key
- b) Candidate Key
- c) Primary Key
- d) Composite Key

Answer: c

199. **Which key is used to establish relationships between two tables?**

- a) Primary Key
- b) Foreign Key

- c) Alternate Key
- d) Candidate Key

Answer: b

200. **A candidate key can:**

- a) Always be selected as a primary key
- b) Never be a foreign key
- c) Be any attribute that uniquely identifies a record
- d) Always contain a composite attribute

Answer: c

201. **What is an alternate key?**

- a) A backup of the primary key
- b) A key that can be used as a primary key but is not selected
- c) A secondary foreign key
- d) None of the above

Answer: b

202. **Which of the following can be a composite key?**

- a) A single attribute
- b) A combination of multiple attributes
- c) A primary key used across two tables
- d) A derived attribute

Answer: b

Indexes

203. **What is the main purpose of an index in a database?**

- a) To ensure unique entries
- b) To speed up query processing
- c) To establish relationships between tables
- d) To normalize data

Answer: b

204. **Which of the following is NOT a type of database index?**

- a) Clustered Index
- b) Non-clustered Index
- c) Transactional Index
- d) Full-text Index

Answer: c

205. **Clustered indexes are:**

- a) Stored in a separate file
- b) Physically arranged in the order of indexed data
- c) Logical indexes used for filtering
- d) Used only for primary keys

Answer: b

206. **Which index allows searching within text fields?**

- a) Non-clustered Index
- b) Clustered Index

- c) Full-text Index
- d) Composite Index

Answer: c

207. **Which SQL command is used to create an index?**

- a) CREATE TABLE
- b) CREATE INDEX
- c) CREATE VIEW
- d) CREATE KEY

Answer: b

Normalization

208. **What is the main goal of normalization in databases?**

- a) To reduce redundancy
- b) To speed up query execution
- c) To denormalize data
- d) To increase indexing

Answer: a

209. **Which normal form removes partial dependencies?**

- a) 1NF
- b) 2NF
- c) 3NF
- d) BCNF

Answer: b

210. **A table in 1NF:**

- a) Has no repeating groups
- b) Has no transitive dependencies
- c) Has no partial dependencies
- d) Has a single primary key

Answer: a

211. **What is a transitive dependency?**

- a) A dependency involving non-key attributes
- b) A dependency between a key and a non-key attribute
- c) A dependency that violates 2NF
- d) A dependency that violates 3NF

Answer: d

212. **Boyce-Codd Normal Form (BCNF) is a stricter version of:**

- a) 1NF
- b) 2NF
- c) 3NF
- d) 4NF

Answer: c

Joins

213. Which join returns only the matching rows between two tables?

- a) Inner Join
- b) Left Join
- c) Right Join
- d) Full Outer Join

Answer: a

214. Which SQL command is used to combine rows from multiple tables based on a related column?

- a) UNION
- b) JOIN
- c) MERGE
- d) INTERSECT

Answer: b

215. A Left Join includes:

- a) Only matching rows from both tables
- b) All rows from the left table and matching rows from the right
- c) All rows from the right table
- d) Only rows from the right table

Answer: b

216. What is the result of a cross join?

- a) Cartesian product of both tables
- b) Matching rows only
- c) All rows from the left table
- d) Rows that satisfy a specific condition

Answer: a

217. Which join includes all rows from both tables, filling unmatched columns with NULL?

- a) Inner Join
- b) Full Outer Join
- c) Cross Join
- d) Right Join

Answer: b

Cross-Site Scripting (XSS)

218. What is the main goal of a Cross-Site Scripting (XSS) attack?

- a) To crash the server
- b) To inject malicious scripts into a web page viewed by users
- c) To gain access to system files
- d) To overload the web server

Answer: b

219. Which type of XSS occurs when malicious code is directly injected into a web application's database?

- a) Stored XSS
- b) Reflected XSS

- c) DOM-based XSS
- d) Persistent XSS

Answer: a

220. What does DOM-based XSS exploit?

- a) Server-side vulnerabilities
- b) Browser-side vulnerabilities
- c) JavaScript code manipulation in the client
- d) Database queries

Answer: c

221. Which of the following is a common way to prevent XSS attacks?

- a) Use strong passwords
- b) Validate and sanitize user inputs
- c) Block all incoming HTTP requests
- d) Disable cookies

Answer: b

222. How can Content Security Policy (CSP) help in mitigating XSS attacks?

- a) By encrypting user data
- b) By restricting the sources from which scripts can be loaded
- c) By limiting database access
- d) By preventing brute force attacks

Answer: b

Cross-Site Request Forgery (CSRF)

223. What is a Cross-Site Request Forgery (CSRF) attack?

- a) Forcing a user to execute unwanted actions on a web application
- b) Injecting malicious scripts into a database
- c) Overloading a server with requests
- d) Guessing passwords through brute force

Answer: a

224. Which of the following is an effective way to prevent CSRF attacks?

- a) Use of CSRF tokens in forms
- b) Hashing sensitive data
- c) Encrypting session cookies
- d) Disabling JavaScript

Answer: a

225. In a CSRF attack, what does the attacker rely on?

- a) Browser's trust in a user's authenticated session
- b) Server vulnerabilities
- c) Database injection flaws
- d) DDoS mechanisms

Answer: a

226. What is the role of the SameSite cookie attribute in preventing CSRF attacks?

- a) It restricts cookies from being sent with cross-site requests
- b) It encrypts cookies in storage
- c) It ensures secure database transactions

d) It blocks unauthorized IP addresses

Answer: a

227. **Why are GET requests more vulnerable to CSRF attacks than POST requests?**

- a) GET requests do not allow CSRF tokens
- b) GET requests are cached by browsers
- c) GET requests have predictable URLs that can be exploited
- d) GET requests are slower to process

Answer: c

Injection Attacks

228. **Which of the following is a common target of SQL injection attacks?**

- a) Web application server logs
- b) Database queries
- c) Static HTML pages
- d) Browser cache

Answer: b

229. **What does an attacker achieve through a successful SQL injection attack?**

- a) Steal, manipulate, or delete database information
- b) Modify JavaScript code on a webpage
- c) Flood the server with requests
- d) Access admin credentials via cookies

Answer: a

230. **Which technique is commonly used to prevent SQL injection attacks?**

- a) Hashing passwords
- b) Using parameterized queries or prepared statements
- c) Disabling cookies in the browser
- d) Encrypting all database columns

Answer: b

231. **What does the term "blind SQL injection" refer to?**

- a) An injection where no data is returned to the attacker
- b) An injection without using SQL commands
- c) An injection that manipulates server logs
- d) An injection that only targets stored procedures

Answer: a

232. **Which of the following is NOT an example of an injection attack?**

- a) SQL injection
- b) XML injection
- c) Command injection
- d) Brute force attack

Answer: d

Distributed Denial-of-Service (DDoS)

233. **What is the goal of a DDoS attack?**

- a) To steal sensitive information from the server
- b) To overwhelm a server or network with traffic
- c) To manipulate database queries
- d) To redirect users to phishing websites

Answer: b

234. **Which of the following is a common symptom of a DDoS attack?**

- a) Sudden loss of database integrity
- b) Slow website performance or complete unavailability
- c) Unauthorized database access
- d) Cross-site scripting vulnerability

Answer: b

235. **What is a botnet in the context of a DDoS attack?**

- a) A tool used to detect vulnerabilities
- b) A network of compromised devices controlled by an attacker
- c) A firewall that blocks malicious traffic
- d) A legitimate cloud-based load balancer

Answer: b

236. **Which layer of the OSI model is targeted by volumetric DDoS attacks?**

- a) Application Layer
- b) Transport Layer
- c) Network Layer
- d) Data Link Layer

Answer: c

237. **What is one effective way to mitigate a DDoS attack?**

- a) Using CAPTCHA challenges
- b) Deploying a content delivery network (CDN)
- c) Encrypting all traffic
- d) Disabling unused ports

Answer: b

Brute Force Attacks

238. **What is a brute force attack?**

- a) Sending multiple requests to overwhelm a server
- b) Systematically guessing passwords or encryption keys
- c) Injecting malicious SQL into database queries
- d) Modifying cookies to impersonate users

Answer: b

239. **Which of the following can help mitigate brute force attacks?**

- a) Rate limiting and account lockout policies
- b) Using plain text passwords
- c) Disabling firewalls

d) Increasing cookie expiration times

Answer: a

240. **What is the main drawback of a brute force attack for the attacker?**

- a) It is easily automated
- b) It can take a long time to succeed
- c) It requires high computational power
- d) Both b and c

Answer: d

241. **What is a dictionary attack?**

- a) A type of brute force attack using common passwords from a list
- b) An injection attack targeting SQL databases
- c) A DDoS attack using multiple botnets
- d) An attack on encrypted cookies

Answer: a

242. **What security measure makes brute force attacks nearly impossible?**

- a) Using a strong password policy and multi-factor authentication (MFA)
- b) Avoiding the use of HTTPS
- c) Increasing session timeouts
- d) Storing passwords in plain text

Answer: a

Tree Traversal Strategies: Breadth and Depth First Search

243. **What is the order of visiting nodes in a Breadth-First Search (BFS)?**

- a) Pre-order
- b) Level by level
- c) Post-order
- d) Depth-wise

Answer: b

244. **Which data structure is used to implement BFS?**

- a) Stack
- b) Queue
- c) Priority Queue
- d) Linked List

Answer: b

245. **In Depth-First Search (DFS), the order of traversal is:**

- a) Level by level
- b) Left-right root
- c) Root-left-right or root-right-left
- d) Top to bottom

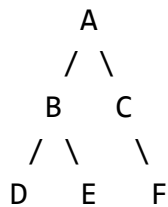
Answer: c

246. **Which data structure is most suitable for implementing DFS?**

- a) Queue
- b) Stack
- c) Priority Queue
- d) Array

Answer: b

Given the tree:



247. **What is the BFS traversal order?**

- a) A, B, C, D, E, F
- b) A, C, B, F, E, D
- c) D, E, B, F, C, A
- d) A, F, E, D, C, B

Answer: a

Digital Signatures and Public-Private Key Encryption

248. **What is the primary use of a digital signature?**

- a) Encrypting the data
- b) Authenticating the sender and ensuring message integrity
- c) Generating random keys for encryption
- d) Sending encrypted files

Answer: b

249. **Which algorithm is commonly used in digital signatures?**

- a) AES
- b) SHA + RSA
- c) DES
- d) Diffie-Hellman

Answer: b

250. **Symmetric key encryption uses:**

- a) One key for encryption and another for decryption
- b) The same key for both encryption and decryption
- c) Public keys only
- d) Multiple random keys

Answer: b

251. **Asymmetric encryption relies on:**

- a) A single shared key
- b) A pair of public and private keys
- c) Random hash generation
- d) Encrypted sessions only

Answer: b

252. **Which of the following is an example of asymmetric encryption?**

- a) AES
- b) RSA
- c) DES
- d) Blowfish

Answer: b

OWASP Top 10 Web Security Risks

253. **What does the OWASP Top 10 focus on?**

- a) Common database operations
- b) Secure coding practices for web applications
- c) Network security vulnerabilities
- d) Hardware attacks

Answer: b

254. **Which risk ranks high in OWASP for exposing sensitive user information?**

- a) Injection attacks
- b) Sensitive Data Exposure
- c) DDoS attacks
- d) Brute force attacks

Answer: b

255. **Cross-Site Scripting (XSS) is categorized under which OWASP risk?**

- a) Injection attacks
- b) Broken Access Control
- c) Security Misconfiguration
- d) Insecure Direct Object Reference

Answer: a

256. **Which OWASP risk is associated with insufficiently protected APIs?**

- a) Security Misconfiguration
- b) Insecure Design
- c) Broken Access Control
- d) Vulnerable and Outdated Components

Answer: c

257. **What is the main mitigation for SQL injection attacks?**

- a) Parameterized queries
- b) Database encryption
- c) Strong passwords
- d) Frequent backups

Answer: a

Database Questions (DDL, DML, TCL, Functions, Views, Triggers, Cursors)

258. **Which of the following is a DDL command?**

- a) SELECT
- b) DELETE
- c) CREATE
- d) INSERT

Answer: c

259. **Which SQL command is used to rollback a transaction?**

- a) ROLLBACK
- b) COMMIT
- c) SAVEPOINT

d) DELETE

Answer: a

260. **A trigger in a database is:**

- a) A special stored procedure executed automatically on specific events
- b) A view for monitoring data changes
- c) A command to lock rows in a table
- d) A method for creating a backup

Answer: a

261. **What is the purpose of normalization in SQL?**

- a) Reducing query execution time
- b) Minimizing data redundancy
- c) Enhancing user interfaces
- d) Storing encrypted data

Answer: b

262. **Which SQL command is used to create a view?**

- a) CREATE TABLE
- b) CREATE VIEW
- c) ALTER TABLE
- d) CREATE INDEX

Answer: b

Monolith vs Microservices Architecture

263. **In a monolithic architecture:**

- a) The application is divided into multiple independent services
- b) All components are tightly integrated into a single application
- c) Components communicate through APIs
- d) Scaling is easier than microservices

Answer: b

264. **Microservices architecture provides:**

- a) Tight coupling of services
- b) High flexibility and scalability
- c) Centralized database structure
- d) Limited technology stack options

Answer: b

265. **What is a major challenge in microservices architecture?**

- a) Implementation speed
- b) Distributed system complexity
- c) Lack of modularity
- d) Fixed scalability

Answer: b

266. **Which technology is commonly used for communication in microservices?**

- a) REST APIs
- b) DDL commands
- c) JavaScript frameworks

d) Static pages

Answer: a

267. Which of the following is a significant advantage of microservices over monolithic architecture?

- a) Easier debugging
- b) Independent deployment of services
- c) Centralized data management
- d) Simple to set up

Answer: b

Tree Traversal Strategies (BFS and DFS)

268. Which traversal strategy would you use to find the shortest path in an unweighted graph?

- a) Depth-First Search
- b) Breadth-First Search
- c) Pre-order traversal
- d) Post-order traversal

Answer: b

269. What is the worst-case time complexity of BFS for a graph with V vertices and E edges?

- a) $O(V)O(V)O(V)$
- b) $O(E)O(E)O(E)$
- c) $O(V+E)O(V+E)O(V+E)$
- d) $O(V^2)O(V^2)O(V^2)$

Answer: c

270. What is the typical data structure used for storing the recursion stack in DFS?

- a) Queue
- b) Array
- c) Implicit system stack
- d) Priority Queue

Answer: c

271. Which of the following best describes a back edge in DFS?

- a) An edge pointing to an already visited node that is an ancestor
- b) An edge connecting two child nodes
- c) An edge to a node that hasn't been visited yet
- d) An edge leading to the root node

Answer: a

272. In BFS, what happens if we process the neighbors of a node in reverse order?

- a) The BFS traversal order changes
- b) BFS becomes DFS
- c) BFS traversal remains unaffected
- d) The graph gets disconnected

Answer: a

Digital Signatures and Encryption

273. **Which cryptographic technique ensures data integrity in a digital signature?**
- a) Symmetric encryption
 - b) Hashing
 - c) Salting
 - d) Key exchange
- Answer: b**
274. **In asymmetric encryption, who generates the private key?**
- a) Sender
 - b) Receiver
 - c) Both sender and receiver
 - d) A trusted third party
- Answer: b**
275. **In public-private key encryption, which key is used for encrypting the data?**
- a) Public key of the sender
 - b) Private key of the receiver
 - c) Public key of the receiver
 - d) Symmetric key
- Answer: c**
276. **How does a digital signature verify the authenticity of a message?**
- a) By matching the encrypted message with the sender's private key
 - b) By using the sender's private key and receiver's public key
 - c) By decrypting the hash of the message with the sender's public key
 - d) By encrypting the message with the sender's public key
- Answer: c**
277. **Which of the following protocols uses digital signatures for secure communication?**
- a) HTTP
 - b) HTTPS
 - c) FTP
 - d) SMTP
- Answer: b**

OWASP Top 10 Web Security Risks

278. **Which OWASP risk is associated with improper authentication mechanisms?**
- a) Insecure Design
 - b) Broken Authentication
 - c) Sensitive Data Exposure
 - d) SQL Injection
- Answer: b**
279. **What is the primary goal of a security misconfiguration attack?**
- a) To exploit default settings or unused services in an application
 - b) To perform brute force password attacks
 - c) To crash the application server

d) To redirect user traffic

Answer: a

280. **What kind of OWASP vulnerability arises from poorly managed credentials?**

- a) SQL Injection
- b) Broken Access Control
- c) Security Misconfiguration
- d) Broken Authentication

Answer: d

281. **What is the best way to prevent injection flaws in web applications?**

- a) Use parameterized queries and prepared statements
- b) Rely on input validation only
- c) Use longer session timeouts
- d) Disable certain database features

Answer: a

282. **Insecure direct object references (IDOR) is primarily an example of:**

- a) SQL Injection
- b) Broken Access Control
- c) Security Misconfiguration
- d) Cross-Site Scripting

Answer: b

Database Concepts (DDL, DML, SQL Functions)

283. **Which of the following is a DML command?**

- a) CREATE
- b) DELETE
- c) COMMIT
- d) GRANT

Answer: b

284. **What does the TRUNCATE command do?**

- a) Deletes all rows and removes the table structure
- b) Deletes all rows without logging individual row deletions
- c) Deletes specific rows from a table
- d) Removes specific columns from a table

Answer: b

285. **Which type of SQL function is used to calculate totals like SUM or AVG?**

- a) Scalar functions
- b) Aggregate functions
- c) String functions
- d) Date functions

Answer: b

286. **What is a cursor in SQL?**

- a) A tool for modifying database schema
- b) A database object used to retrieve row-by-row data
- c) A SQL function to execute triggers

d) A SQL command for committing transactions

Answer: b

287. **What is the main purpose of a database trigger?**

- a) To automatically perform an action in response to an event
- b) To speed up query execution
- c) To define relationships between tables
- d) To enforce primary keys

Answer: a

Monolith vs Microservices Architecture

288. **Monolithic architecture is best suited for:**

- a) Highly scalable systems with independent modules
- b) Small-scale applications requiring minimal infrastructure
- c) Systems with independent deployment cycles
- d) Decentralized data storage

Answer: b

289. **Which of the following is a challenge in a monolithic architecture?**

- a) Communication between services
- b) Scalability limitations
- c) Independent deployments
- d) Use of REST APIs

Answer: b

290. **What is the most significant advantage of microservices over monolithic architecture?**

- a) Scalability and fault isolation
- b) Simpler codebase
- c) Fewer resource requirements
- d) Single deployment pipeline

Answer: a

291. **In microservices, how are services typically connected?**

- a) Tightly coupled function calls
- b) RESTful APIs or message queues
- c) Shared memory spaces
- d) Global variables

Answer: b

292. **Which deployment strategy is more suitable for microservices architecture?**

- a) Centralized build and deployment
- b) Independent pipelines for each service
- c) All-or-nothing deployment strategy
- d) Manual configuration updates

Answer: b