1. **Which sorting algorithm uses the concept of divide and conquer?**
   A. Merge Sort
   B. Insertion Sort
   C. Bubble Sort
   D. Selection Sort
   **Answer:** A

2. **In a graph, which traversal algorithm uses a queue?**
   A. Depth First Search
   B. Breadth First Search
   C. Kruskal's Algorithm
   D. Dijkstra's Algorithm
   **Answer:** B

3. **Which of the following is a characteristic of a primary key in a database?**
   A. Allows duplicate values
   B. Can have NULL values
   C. Uniquely identifies each record
   D. Can be a foreign key
   **Answer:** C

4. **What is the default port number for HTTP?**
   A. 80
   B. 8080
   C. 443
   D. 21
   **Answer:** A

5. **Which of the following is NOT a type of cloud computing service model?**
   A. SaaS
   B. PaaS
   C. DaaS
   D. IaaS
   **Answer:** C

6. **In networking, which layer is responsible for end-to-end communication?**
   A. Network Layer
   B. Transport Layer
   C. Application Layer
   D. Data Link Layer
   **Answer:** B

7. **Which data structure is used to implement Breadth First Search in a graph?**
   A. Stack
   B. Queue
   C. Linked List
   D. Hash Table
   **Answer:** B

8. **What is the Big-O complexity of inserting an element in a binary search tree?**
   A. O(n)

B. O(log n)
C. O(1)
D. O(n^2)
**Answer:** B

9. **Which SQL command is used to delete a table?**
   A. DELETE
   B. DROP
   C. REMOVE
   D. CLEAR
   **Answer:** B

10. **In a cloud computing model, who manages the underlying hardware in an IaaS setup?**
    A. The user
    B. The service provider
    C. Third-party vendors
    D. System integrators
    **Answer:** B

11. **What type of data structure is used in a Depth First Search of a graph?**
    A. Queue
    B. Stack
    C. Hash Map
    D. Priority Queue
    **Answer:** B

12. **Which of the following is NOT a valid SQL constraint?**
    A. UNIQUE
    B. PRIMARY KEY
    C. INDEX
    D. FOREIGN KEY
    **Answer:** C

13. **What is the height of a full binary tree with 15 nodes?**
    A. 3
    B. 2
    C. 5
    D. 6
    **Answer:** A

14. **In cloud computing, which term is used to describe the ability to increase or decrease resources on demand?**
    A. Elasticity
    B. Virtualization
    C. Scalability
    D. Multitenancy
    **Answer:** A

15. **What does the TCP protocol ensure in data transmission?**
    A. Best effort delivery
    B. Reliable delivery

C. Unreliable delivery
D. Asynchronous delivery
**Answer:** B

16. **Which of the following algorithms is used for deadlock detection in operating systems?**
    A. Banker's Algorithm
    B. Floyd-Warshall Algorithm
    C. Dijkstra's Algorithm
    D. Bellman-Ford Algorithm
    **Answer:** A

17. **In a B-tree of order 4, what is the maximum number of keys that a node can hold?**
    A. 4
    B. 3
    C. 5
    D. 6
    **Answer:** B

18. **Which protocol is used for secure communication over the internet?**
    A. HTTP
    B. FTP
    C. HTTPS
    D. SNMP
    **Answer:** C

19. **What is the minimum number of edges in a connected graph with 6 vertices?**
    A. 4
    B. 5
    C. 6
    D. 7
    **Answer:** B

20. **In SQL, which command is used to modify the structure of an existing table?**
    A. ALTER
    B. UPDATE
    C. MODIFY
    D. RESTRUCTURE
    **Answer:** A

21. **Which hashing technique resolves collisions using chaining?**
    A. Open Addressing
    B. Linear Probing
    C. Separate Chaining
    D. Quadratic Probing
    **Answer:** C

22. **Which scheduling algorithm is non-preemptive?**
    A. Round Robin
    B. Priority Scheduling
    C. Shortest Job First (SJF)

D. Multilevel Queue Scheduling
**Answer:** C

23. **What is the maximum number of subnets that can be created with a subnet mask of /28 in IPv4?**
A. 16
B. 14
C. 32
D. 8
**Answer:** A

24. **What is the advantage of using ACID properties in database transactions?**
A. Data replication
B. Data consistency
C. Reduced storage
D. Faster indexing
**Answer:** B

25. **In which scenario does a binary tree become a skewed tree?**
A. When it is balanced
B. When all nodes have two children
C. When all nodes have only one child
D. When it is a full binary tree
**Answer:** C

26. **What is the output of the following postfix expression?**
7 3 - 4 2 / + 5 *
A. 25
B. 20
C. 30
D. 15
**Answer:** C

27. **Which layer in the OSI model is responsible for encryption and decryption?**
A. Physical Layer
B. Transport Layer
C. Presentation Layer
D. Network Layer
**Answer:** C

28. **What is the role of the hypervisor in cloud computing?**
A. Manages database transactions
B. Allocates hardware resources to virtual machines
C. Performs network routing
D. Ensures reliable data transmission
**Answer:** B

29. **Which traversal algorithm is used to check if a binary tree is a binary search tree?**
A. Preorder Traversal
B. Postorder Traversal
C. Inorder Traversal

D. Level-order Traversal
**Answer:** C

30. **In a relational database, which normal form eliminates transitive dependencies?**
A. First Normal Form (1NF)
B. Second Normal Form (2NF)
C. Third Normal Form (3NF)
D. Boyce-Codd Normal Form (BCNF)
**Answer:** C

31. **What is the Big-O time complexity of deleting the minimum element in a min-heap?**
A. O(1)
B. O(log n)
C. O(n)
D. O(n log n)
**Answer:** B
32. **Which network topology has a single point of failure?**
A. Star
B. Ring
C. Mesh
D. Bus
**Answer:** A
33. **Which of the following is used to ensure atomicity in database transactions?**
A. Indexing
B. Checkpoints
C. Log Files
D. Deadlocks
**Answer:** C
34. **What is the maximum height of an AVL tree with 15 nodes?**
A. 4
B. 5
C. 6
D. 7
**Answer:** A
35. **Which of the following algorithms is used for cycle detection in an undirected graph?**
A. Bellman-Ford Algorithm
B. Floyd-Warshall Algorithm
C. Union-Find Algorithm
D. Kruskal's Algorithm
**Answer:** C
36. **Which type of storage is used by the blob in cloud computing?**
A. Block storage
B. Object storage
C. File storage
D. Archive storage
**Answer:** B
37. **What is the IP address range for Class B networks?**
A. 128.0.0.0 to 191.255.255.255
B. 192.0.0.0 to 223.255.255.255

C. 0.0.0.0 to 127.255.255.255
D. 224.0.0.0 to 239.255.255.255
**Answer:** A

38. **In a relational database, which key is used to uniquely identify a record?**
A. Foreign Key
B. Primary Key
C. Composite Key
D. Candidate Key
**Answer:** B

39. **What is the primary advantage of using a circular queue over a normal queue?**
A. Simpler implementation
B. Optimized memory usage
C. Faster enqueue operation
D. Easier sorting
**Answer:** B

40. **Which algorithm is used in cryptography for secure key exchange?**
A. RSA
B. DES
C. Diffie-Hellman
D. AES
**Answer:** C

41. **In the OSI model, which layer is responsible for ensuring reliable message delivery?**
A. Session Layer
B. Application Layer
C. Transport Layer
D. Data Link Layer
**Answer:** C

42. **What is the maximum number of edges in a complete undirected graph with 7 vertices?**
A. 21
B. 15
C. 28
D. 42
**Answer:** A

43. **Which of the following is a constraint used to enforce data integrity in SQL?**
A. TRIGGER
B. INDEX
C. CHECK
D. JOIN
**Answer:** C

44. **What does an LRU cache replacement policy prioritize for replacement?**
A. The most recently used page
B. The least recently used page
C. The largest page
D. The smallest page
**Answer:** B

45. **Which cloud deployment model is exclusively used by a single organization?**
A. Public Cloud
B. Private Cloud

C. Hybrid Cloud
D. Community Cloud
**Answer:** B

46. **Which data structure is best for implementing a priority queue?**
A. Stack
B. Queue
C. Heap
D. Array
**Answer:** C

47. **What is the Big-O time complexity of searching for an element in a balanced binary search tree?**
A. O(log n)
B. O(1)
C. O(n)
D. O(n^2)
**Answer:** A

48. **Which protocol is used for remote login to a server?**
A. FTP
B. SSH
C. HTTP
D. SMTP
**Answer:** B

49. **What is the main characteristic of normalization in databases?**
A. Reduces data redundancy
B. Increases query speed
C. Simplifies database design
D. Ensures data encryption
**Answer:** A

50. **What is the best-case time complexity of QuickSort?**
A. O(n log n)
B. O(n)
C. O(n^2)
D. O(log n)
**Answer:** A

51. **Which of the following is NOT a collision resolution technique in hashing?**
A. Linear Probing
B. Double Hashing
C. Open Addressing
D. Divide and Conquer
**Answer:** D

52. **In a directed graph, what is the time complexity of detecting a cycle using Depth First Search (DFS)?**
A. O(V + E)
B. O(V^2)
C. O(E log V)
D. O(V log E)
**Answer:** A

53. **In the TCP/IP model, which protocol is used for email transmission?**
A. IMAP
B. POP3

C. SMTP
D. SNMP
**Answer:** C

54. **What is the maximum number of nodes in a binary tree with height h?**
A. 2^h
B. 2^{h+1} - 1
C. 2^h - 1
D. 2^{h-1}
**Answer:** B

55. **Which SQL command is used to remove a specific row from a table?**
A. DELETE
B. TRUNCATE
C. DROP
D. REMOVE
**Answer:** A

56. **In cloud computing, what does "scalability" refer to?**
A. Security of data
B. On-demand resource allocation
C. Ability to scale physical storage
D. Automatic error correction
**Answer:** B

57. **Which type of graph traversal uses a queue as its primary data structure?**
A. Depth-First Search
B. Breadth-First Search
C. Topological Sort
D. Dijkstra's Algorithm
**Answer:** B

58. **What is the role of a foreign key in a relational database?**
A. To uniquely identify rows in a table
B. To establish a relationship between two tables
C. To enforce uniqueness within a table
D. To improve query performance
**Answer:** B

59. **Which algorithm is used to find the shortest path in a graph with negative edge weights?**
A. Dijkstra's Algorithm
B. Prim's Algorithm
C. Kruskal's Algorithm
D. Bellman-Ford Algorithm
**Answer:** D

60. **What is the space complexity of Merge Sort?**
A. O(1)
B. O(n)
C. O(n log n)
D. O(n^2)
**Answer:** B

61. **In networking, which protocol operates at the transport layer and provides reliable data transfer?**
A. UDP
B. TCP

C. ICMP
D. HTTP
**Answer:** B

62. **What is the minimum number of disks required for RAID 5 configuration?**
A. 2
B. 3
C. 4
D. 5
**Answer:** B

63. **Which data structure is used for implementing recursion?**
A. Queue
B. Stack
C. Linked List
D. Array
**Answer:** B

64. **In IPv6, how many bits are used for an address?**
A. 32
B. 64
C. 128
D. 256
**Answer:** C

65. **What is the primary purpose of a cache in a computer system?**
A. To increase storage capacity
B. To reduce the time required to access frequently used data
C. To replace RAM
D. To store permanent data
**Answer:** B

66. **What is the postfix notation of the expression (A+B)×(C−D)(A + B) \times (C - D)?**
A. AB+CD−×
B. ABCD+−×
C. AB+CD×−
D. A+B×C−D

**Answer:** A

67. **In a relational database, what is the Cartesian Product of two tables?**
A. The sum of rows from both tables
B. A table with all possible combinations of rows from both tables
C. A table with only matching rows from both tables
D. A table with unique rows from both tables
**Answer:** B

68. **Which type of cloud model provides shared infrastructure for multiple organizations?**
A. Public Cloud
B. Private Cloud
C. Hybrid Cloud
D. Community Cloud
**Answer:** D

69. **What is the primary difference between a queue and a stack?**
    A. Queue uses LIFO; Stack uses FIFO
    B. Queue uses FIFO; Stack uses LIFO
    C. Queue is dynamic; Stack is static
    D. Queue stores pointers; Stack stores values
    **Answer:** B
70. **Which of the following data structures is used in Breadth-First Search?**
    A. Stack
    B. Queue
    C. Priority Queue
    D. Linked List
    **Answer:** B
71. **What is the best-case time complexity of Insertion Sort?**
    A. O(n^2)
    B. O(n log n)
    C. O(n)
    D. O(1)
    **Answer:** C
72. **Which data structure is most suitable for implementing an undo operation in a text editor?**
    A. Queue
    B. Stack
    C. Linked List
    D. Array
    **Answer:** B
73. **What is the maximum number of children a node can have in a binary tree?**
    A. 1
    B. 2
    C. 3
    D. Unlimited
    **Answer:** B
74. **In SQL, which command is used to remove a table completely from a database?**
    A. DELETE
    B. TRUNCATE
    C. DROP
    D. REMOVE
    **Answer:** C
75. **Which of the following cloud services is responsible for delivering hardware resources over the internet?**
    A. SaaS
    B. PaaS
    C. IaaS
    D. DaaS
    **Answer:** C
76. **What is the time complexity of finding the largest element in a max-heap?**
    A. O(1)
    B. O(log n)
    C. O(n)
    D. O(n log n)
    **Answer:** A

77. **Which algorithm uses a divide-and-conquer approach for sorting?**
    A. Bubble Sort
    B. Insertion Sort
    C. Merge Sort
    D. Selection Sort
    **Answer:** C
78. **What is the role of the Data Link Layer in the OSI model?**
    A. Routing
    B. Packet addressing
    C. Error detection and correction
    D. Data encryption
    **Answer:** C
79. **In a database, which normal form removes partial dependency?**
    A. 1NF
    B. 2NF
    C. 3NF
    D. BCNF
    **Answer:** B
80. **Which protocol is used for secure communication over the internet?**
    A. HTTP
    B. HTTPS
    C. FTP
    D. SMTP
    **Answer:** B
81. **What is the primary purpose of a DNS server?**
    A. Encrypt data during transmission
    B. Resolve domain names to IP addresses
    C. Monitor network traffic
    D. Secure email transmission
    **Answer:** B
82. **What is the height of a complete binary tree with 31 nodes?**
    A. 5
    B. 6
    C. 4
    D. 3
    **Answer:** A
83. **Which algorithm is used for minimum spanning tree in a graph?**
    A. Dijkstra's Algorithm
    B. Prim's Algorithm
    C. A* Algorithm
    D. Floyd-Warshall Algorithm
    **Answer:** B
84. **What is the default port number for HTTP?**
    A. 80
    B. 8080
    C. 443
    D. 22
    **Answer:** A
85. **Which database operation is used to extract specific rows based on a condition?**
    A. SELECT

B. UPDATE
C. DELETE
D. INSERT
**Answer:** A

86. **What is the maximum number of edges in a simple directed graph with n vertices?**
A. n^2
B. n(n-1)
C. n^2 - n
D. (n-1)^2
**Answer:** B

87. **Which of the following is not a characteristic of a binary search tree?**
A. Left subtree nodes are smaller than the root
B. Right subtree nodes are greater than the root
C. It allows duplicate nodes
D. Inorder traversal gives sorted order
**Answer:** C

88. **In a cloud computing model, which term refers to the ability to recover data after a failure?**
A. Scalability
B. Redundancy
C. Fault tolerance
D. Elasticity
**Answer:** C

89. **Which scheduling algorithm is non-preemptive?**
A. Round Robin
B. Shortest Job Next (SJN)
C. Multilevel Queue
D. Priority Scheduling
**Answer:** B

90. **In databases, which command is used to grant permissions to a user?**
A. GRANT
B. PERMIT
C. ALLOW
D. ENABLE
**Answer:** A

91. **What is the time complexity of searching for an element in a balanced binary search tree (BST)?**
A. O(n)
B. O(log n)
C. O(1)
D. O(n^2)
**Answer:** B

92. **Which protocol is used to convert IP addresses into MAC addresses?**
A. ARP
B. RARP
C. DNS
D. DHCP
**Answer:** A

93. **In SQL, which clause is used to filter records that meet a specified condition?**
    A. SELECT
    B. WHERE
    C. GROUP BY
    D. ORDER BY
    **Answer:** B
94. **What is the minimum number of moves required to solve the Tower of Hanoi problem with n disks?**
    A. 2^n
    B. 2^n - 1
    C. n^2
    D. n×2
    **Answer:** B
95. **Which cloud service model provides a platform allowing customers to develop, run, and manage applications?**
    A. SaaS
    B. PaaS
    C. IaaS
    D. DaaS
    **Answer:** B
96. **Which sorting algorithm is considered stable?**
    A. Quick Sort
    B. Merge Sort
    C. Heap Sort
    D. Selection Sort
    **Answer:** B
97. **Which networking device is used to connect multiple networks and forward packets between them?**
    A. Hub
    B. Switch
    C. Router
    D. Bridge
    **Answer:** C
98. **In a relational database, which key uniquely identifies a row in a table?**
    A. Foreign Key
    B. Primary Key
    C. Composite Key
    D. Candidate Key
    **Answer:** B
99. **What is the worst-case time complexity of Quick Sort?**
    A. O(n^2)
    B. O(n log n)
    C. O(n)
    D. O(1)
    **Answer:** A
100. **Which type of attack involves intercepting and altering data during transmission?**
    A. Phishing
    B. Man-in-the-Middle
    C. SQL Injection

D. Denial of Service
**Answer:** B

101. **Which scheduling algorithm allocates the CPU to the process with the shortest remaining time?**
A. Shortest Job First
B. Round Robin
C. Preemptive SJF
D. Priority Scheduling
**Answer:** C

102. **What does ACID stand for in database transactions?**
A. Atomicity, Consistency, Isolation, Durability
B. Accuracy, Consistency, Integrity, Dependency
C. Atomicity, Concurrency, Isolation, Durability
D. Atomicity, Consistency, Independence, Durability
**Answer:** A

103. **In a directed acyclic graph (DAG), which traversal method is used for topological sorting?**
A. Breadth-First Search
B. Depth-First Search
C. Inorder Traversal
D. Level Order Traversal
**Answer:** B

104. **Which data structure is commonly used for implementing Dijkstra's algorithm?**
A. Stack
B. Priority Queue
C. Linked List
D. Queue
**Answer:** B

105. **Which of the following is not a valid REST API constraint?**
A. Statelessness
B. Layered System
C. Caching
D. Multithreading
**Answer:** D

106. **In networking, which layer is responsible for ensuring end-to-end delivery of data?**
A. Transport Layer
B. Network Layer
C. Data Link Layer
D. Application Layer
**Answer:** A

107. **In a binary tree, if the total number of nodes is n, what is the number of leaf nodes in a complete binary tree?**
A. n/2
B. (n+1)/2
C. n−1
D. (n−1)/2
**Answer:** B

108. **Which SQL statement is used to modify existing records in a table?**
A. INSERT
B. UPDATE
C. ALTER
D. MODIFY
**Answer:** B

109. **What is the main purpose of RAID 1 configuration?**
A. Performance improvement
B. Data redundancy
C. Maximum storage utilization
D. Fault tolerance with parity
**Answer:** B

110. **Which traversal technique visits the left subtree, root, and then the right subtree in a binary tree?**
A. Preorder
B. Inorder
C. Postorder
D. Level Order
**Answer:** B

111. **In a B-tree of order mm, what is the maximum number of keys a node can have?**
A. m
B. m-1
C. 2m
D. 2m−1
**Answer:** B

112. **Which data structure is used in Kruskal's algorithm to detect cycles?**
A. Stack
B. Queue
C. Disjoint Set
D. Adjacency List
**Answer:** C

113. **Which scheduling algorithm may cause starvation if priorities are not adjusted dynamically?**
A. Round Robin
B. Priority Scheduling
C. First Come First Serve
D. Shortest Remaining Time
**Answer:** B

114. **In database normalization, which normal form eliminates transitive dependency?**
A. 1NF
B. 2NF
C. 3NF
D. BCNF
**Answer:** C

115. **What is the minimum number of spanning trees possible in a connected graph with n vertices?**
A. n
B. n−1

C. 1
D. 0
**Answer:** C

116. **Which of the following techniques is used to handle collisions in a hash table?**
A. Binary Search
B. Chaining
C. DFS
D. Sorting
**Answer:** B

117. **What is the CIDR notation for a subnet mask of 255.255.255.192?**
A. /24
B. /26
C. /28
D. /30
**Answer:** B

118. **Which type of database indexing improves the efficiency of searching records based on a range of values?**
A. Clustered Index
B. Hash Index
C. Bitmap Index
D. B-Tree Index
**Answer:** D

119. **In cloud computing, what is elasticity?**
A. Ability to recover after failure
B. Ability to scale resources up and down dynamically
C. Storing data across multiple locations
D. Encrypting data for security
**Answer:** B

120. **Which of the following algorithms is used for deadlock detection in operating systems?**
A. Banker's Algorithm
B. Depth-First Search
C. Floyd-Warshall Algorithm
D. Page Replacement Algorithm
**Answer:** A

121. **Which type of network topology is most resistant to failure?**
A. Star
B. Bus
C. Mesh
D. Ring
**Answer:** C

122. **What is the worst-case time complexity of Heap Sort?**
A. O(n log n)
B. O(n^2)
C. O(n)
D. O(log n)
**Answer:** A

123. **Which SQL clause is used to group records with similar values?**
A. GROUP BY

B. ORDER BY
C. DISTINCT
D. HAVING
**Answer:** A

124. **What is the time complexity of inserting an element into a Red-Black Tree?**
A. O(log n)
B. O(n)
C. O(1)
D. O(n^2)
**Answer:** A

125. **Which protocol is used for remote access to another computer over a network?**
A. FTP
B. Telnet
C. HTTP
D. SMTP
**Answer:** B

126. **Which type of join in SQL retrieves records that have matching values in both tables?**
A. INNER JOIN
B. LEFT JOIN
C. RIGHT JOIN
D. FULL OUTER JOIN
**Answer:** A

127. **In the context of cloud computing, which of the following describes serverless computing?**
A. A system without servers
B. A system where the cloud provider manages the servers
C. A system using virtual machines instead of physical servers
D. A system with decentralized databases
**Answer:** B

128. **Which of the following algorithms is used for shortest path in a weighted graph with negative weights?**
A. Dijkstra's Algorithm
B. Bellman-Ford Algorithm
C. Prim's Algorithm
D. Kruskal's Algorithm
**Answer:** B

129. **Which method is used in TCP to handle congestion in a network?**
A. Flow Control
B. Error Detection
C. Slow Start
D. Packet Fragmentation
**Answer:** C

130. **What is the maximum height of an AVL tree with n nodes?**
A. O(n)
B. O(log n)
C. O(n log n)

D. O(underroot of n)
**Answer:** B

131. **Which of the following network devices operates at the Data Link Layer (Layer 2) of the OSI model?**
A. Router
B. Switch
C. Hub
D. Gateway
**Answer:** B

132. **Which of the following anomalies is prevented by the use of BCNF in database design?**
A. Insertion Anomaly
B. Deletion Anomaly
C. Update Anomaly
D. All of the above
**Answer:** D

133. **In Prim's algorithm, the data structure used to select the minimum weight edge is typically:**
A. Stack
B. Queue
C. Priority Queue
D. Linked List
**Answer:** C

134. **Which of the following is NOT a component of the TCP/IP model?**
A. Application Layer
B. Session Layer
C. Transport Layer
D. Network Access Layer
**Answer:** B

135. **What is the maximum number of edges in a simple undirected graph with n vertices?**
A. n^2
B. n(n−1)/2
C. n(n+1)/2
D. 2^n
**Answer:** B

136. **Which type of SQL JOIN retrieves all records from the left table and the matching records from the right table?**
A. INNER JOIN
B. LEFT JOIN
C. RIGHT JOIN
D. FULL OUTER JOIN
**Answer:** B

137. **In cloud computing, which deployment model provides resources exclusively for a single organization?**
A. Public Cloud
B. Private Cloud
C. Hybrid Cloud
D. Community Cloud
**Answer:** B

138. **Which algorithm is used to detect deadlocks in a system with multiple instances of resources?**
A. Banker's Algorithm
B. Resource Allocation Graph
C. Depth-First Search
D. Wait-for Graph
**Answer:** A

139. **Which traversal order produces the elements of a Binary Search Tree in ascending order?**
A. Preorder
B. Inorder
C. Postorder
D. Level Order
**Answer:** B

140. **What is the purpose of a subnet mask in networking?**
A. To assign unique IP addresses
B. To define the host and network portions of an IP address
C. To resolve domain names to IP addresses
D. To provide encryption for data transmission
**Answer:** B

141. **Which sorting algorithm is best suited for nearly sorted data?**
A. Quick Sort
B. Insertion Sort
C. Heap Sort
D. Merge Sort
**Answer:** B

142. **What does CAP in the CAP theorem stand for in distributed systems?**
A. Consistency, Availability, Partition Tolerance
B. Communication, Allocation, Performance
C. Configuration, Authentication, Persistence
D. Cache, Application, Protocol
**Answer:** A

143. **Which database operation combines rows from two tables based on a related column?**
A. UNION
B. JOIN
C. INTERSECT
D. MERGE
**Answer:** B

144. **In a directed graph, which algorithm is used to find all-pairs shortest paths?**
A. Dijkstra's Algorithm
B. Bellman-Ford Algorithm
C. Floyd-Warshall Algorithm
D. Prim's Algorithm
**Answer:** C

145. **Which layer of the OSI model is responsible for error detection and correction?**
A. Application Layer
B. Transport Layer

C. Data Link Layer
D. Network Layer
**Answer:** C

146. **What is the minimum number of queues required to implement a priority queue?**
A. 1
B. 2
C. nn
D. Depends on the priority levels
**Answer:** D

147. **What is the result of the following postfix expression?**
```
5 6 7 * + 1 -
```
A. 42
B. 46
C. 50
D. 56
**Answer:** B

148. **In SQL, which command is used to remove all rows from a table without logging individual row deletions?**
A. DELETE
B. DROP
C. TRUNCATE
D. REMOVE
**Answer:** C

149. **Which data structure is used in the implementation of LRU (Least Recently Used) caching?**
A. Queue
B. Hash Map + Doubly Linked List
C. Stack
D. Binary Tree
**Answer:** B

151. **What is the time complexity of binary search in a sorted array?**
A. O(n)
B. O(log n)
C. O(n log n)
D. O(1)
**Answer:** B

152. **In which case does a Hash Table encounter the highest number of collisions?**
A. When the table size is too small
B. When the hash function is ideal
C. When all keys are distinct
D. When the keys are uniformly distributed
**Answer:** A

153. **Which of the following is NOT a property of a Red-Black Tree?**
A. The root is always black
B. Every leaf is red
C. Red nodes cannot have red children

D. Every path from a node to its descendant leaves has the same number of black nodes
**Answer:** B

154. **Which of the following algorithms is used to find the minimum spanning tree of a graph?**
A. Kruskal's Algorithm
B. Dijkstra's Algorithm
C. Bellman-Ford Algorithm
D. Floyd-Warshall Algorithm
**Answer:** A

155. **Which of the following methods is used for disk scheduling in an operating system?**
A. First-Come-First-Serve (FCFS)
B. Shortest Job First (SJF)
C. Elevator Algorithm
D. Round Robin
**Answer:** C

156. **In an AVL tree, what condition is checked to maintain the balance of the tree?**
A. Left subtree is greater than the right subtree
B. The height difference between left and right subtrees is at most 2
C. Left and right subtrees are equal in height
D. Both subtrees are empty
**Answer:** B

157. **Which protocol is used for secure data transmission over a network?**
A. HTTP
B. FTP
C. SSH
D. SMTP
**Answer:** C

158. **In which normal form are all non-prime attributes fully functionally dependent on every key?**
A. 1NF
B. 2NF
C. 3NF
D. BCNF
**Answer:** B

159. **Which type of algorithm is used to determine the shortest path between two vertices in a weighted graph?**
A. Depth First Search
B. Dijkstra's Algorithm
C. Merge Sort
D. Breadth First Search
**Answer:** B

160. **What is the space complexity of Quick Sort in the worst case?**
A. O(n)
B. O(log n)

C. O(n log n)
D. O(n^2)
**Answer:** A

161. **Which of the following is true about the process of fragmentation in memory management?**
A. External fragmentation occurs when the total memory is insufficient
B. Internal fragmentation occurs when memory is not allocated in contiguous blocks
C. External fragmentation occurs when free space is scattered in small chunks
D. Both A and C
**Answer:** C

162. **Which data structure is used to implement recursion in a program?**
A. Stack
B. Queue
C. Linked List
D. Binary Tree
**Answer:** A

163. **Which of the following protocols is used for sending emails?**
A. FTP
B. SMTP
C. POP3
D. HTTP
**Answer:** B

164. **In which of the following algorithms is the concept of divide and conquer used?**
A. Quick Sort
B. Bubble Sort
C. Selection Sort
D. Merge Sort
**Answer:** A

165. **What is the output of the following C++ code?**

```
int arr[] = {2, 4, 6, 8};

cout << arr[2] * arr[1];
```

A. 24

B. 32

C. 12

D. 16

Answer: A

166. **Which of the following is NOT a characteristic of a binary heap?**
A. It is a complete binary tree
B. It is an ordered binary tree
C. It is a complete binary tree and satisfies the heap property

D. It is not balanced
**Answer:** D

167. **What is the worst-case time complexity for searching an element in a balanced Binary Search Tree (BST)?**
A. O(n)
B. O(log n)
C. O(n log n)
D. O(1)
**Answer:** B

168. **What is the function of a MAC address in networking?**
A. It is used to route packets to their destination
B. It uniquely identifies devices on a local network
C. It provides encryption for secure communication
D. It defines the structure of an IP address
**Answer:** B

169. **Which of the following is a characteristic of a Trie data structure?**
A. It stores key-value pairs in an unordered manner
B. It stores strings by their prefixes
C. It is a type of binary search tree
D. It is used for storing integers
**Answer:** B

170. **What is the time complexity of accessing an element in a Hash Map with separate chaining for collision resolution?**
A. O(1)
B. O(log n)
C. O(n)
D. O(n^2)
**Answer:** A

171. **Which algorithm is used to find the shortest path between all pairs of vertices in a graph?**
A. Bellman-Ford
B. Dijkstra
C. Floyd-Warshall
D. Prim's Algorithm
**Answer:** C

172. **Which of the following is true about the TCP/IP protocol stack?**
A. It is a connectionless protocol
B. It operates in the Data Link Layer
C. It ensures reliable communication through error-checking
D. It operates in the Transport Layer only
**Answer:** C

173. **Which SQL command is used to remove a table from a database?**
A. DELETE
B. REMOVE

C. TRUNCATE
D. DROP
**Answer:** D

174. **In a graph, what is the degree of a vertex?**
A. The number of edges incident on the vertex
B. The maximum number of edges connected to the vertex
C. The number of vertices connected to the vertex
D. The number of paths to the vertex
**Answer:** A

175. **In which of the following does a process move when it is terminated in an operating system?**
A. Ready Queue
B. Blocked Queue
C. Terminated Queue
D. Suspended Queue
**Answer:** C

176. **Which of the following is true for a Directed Acyclic Graph (DAG)?**
A. It can have cycles
B. It has a unique path between any two vertices
C. It has no directed edges
D. It does not contain any cycles
**Answer:** D

177. **What is the time complexity of inserting an element into a heap?**
A. O(n)
B. O(log n)
C. O(1)
D. O(n log n)
**Answer:** B

178. **Which of the following is a characteristic of an Splay Tree?**
A. It is balanced like an AVL tree
B. It always ensures that the most recently accessed node is at the root
C. It is a complete binary tree
D. It is a type of B-tree
**Answer:** B

179. **Which data structure is used to implement a breadth-first search (BFS)?**
A. Stack
B. Queue
C. Linked List
D. Priority Queue
**Answer:** B

180. **Which of the following is used to resolve collisions in a hash table?**
A. Linear Probing
B. Binary Search
C. Merge Sort
D. Quick Sort
**Answer:** A

181. **What is the primary disadvantage of using a binary search tree?**
A. It requires a lot of space

B. It can become unbalanced, leading to inefficient operations
C. It is not suitable for dynamic data
D. It requires too many comparisons for insertion
**Answer:** B

182. **Which type of network is used to connect devices within a single building or campus?**
A. WAN
B. MAN
C. LAN
D. PAN
**Answer:** C

183. **Which of the following statements is true for a stack?**
A. It follows the First-In-First-Out (FIFO) principle
B. It follows the Last-In-First-Out (LIFO) principle
C. It can be implemented using a queue
D. It does not support dynamic memory allocation
**Answer:** B

184. **Which of the following is true for a Circular Queue?**
A. It uses a linked list for implementation
B. The rear pointer moves to the beginning of the queue when the end is reached
C. It is always full
D. It requires more memory than a normal queue
**Answer:** B

185. **What is the worst-case time complexity of insertion sort?**
A. O(n log n)
B. O(n)
C. O(n^2)
D. O(1)
**Answer:** C

186. **Which of the following is the best sorting algorithm for a small set of data?**
A. Merge Sort
B. Quick Sort
C. Insertion Sort
D. Heap Sort
**Answer:** C

187. **In the context of a binary search tree, which of the following operations has a time complexity of O(log n) in the average case?**
A. Searching for an element
B. Inserting an element
C. Deleting an element
D. All of the above
**Answer:** D

188. **Which of the following is the main advantage of using dynamic memory allocation over static memory allocation?**
A. Memory is allocated in fixed size blocks
B. Memory is allocated only when needed
C. Memory allocation is faster
D. It uses less memory
**Answer:** B

189. **Which of the following algorithms is used to find the shortest path from a source to all vertices in a weighted graph?**
A. Dijkstra's Algorithm
B. Bellman-Ford Algorithm
C. Floyd-Warshall Algorithm
D. Kruskal's Algorithm
**Answer:** A

190. **Which data structure is used for implementing a priority queue?**
A. Linked List
B. Stack
C. Heap
D. Queue
**Answer:** C

191. **Which of the following is the key difference between TCP and UDP?**
A. TCP is faster than UDP
B. TCP is connection-oriented, while UDP is connectionless
C. UDP is used for sending emails
D. UDP guarantees data delivery, while TCP does not
**Answer:** B

192. **In SQL, what does the JOIN operation do?**
A. It combines two or more tables based on a related column
B. It removes duplicates from a table
C. It updates records in a table
D. It combines data from multiple databases
**Answer:** A

193. **Which of the following is true for a full binary tree?**
A. Every node has either 0 or 2 children
B. Every node has exactly 2 children
C. Every leaf node is at the same level
D. It is always balanced
**Answer:** A

194. **Which algorithm is used to solve the problem of the knapsack problem in computer science?**
A. Greedy Algorithm
B. Dynamic Programming
C. Divide and Conquer
D. Backtracking
**Answer:** B

195. **What is the time complexity of finding the minimum element in a binary heap?**
A. O(1)
B. O(log n)
C. O(n)
D. O(n log n)
**Answer:** A

196. **Which of the following is a characteristic of an optimal merge pattern?**
A. The process minimizes the total cost of combining files
B. It is used only for large files
C. It follows the principle of divide and conquer

D. It uses dynamic memory allocation
**Answer:** A

197. **Which of the following is true for a Trie data structure?**
A. It is used for storing integers
B. It uses a binary tree for implementation
C. It stores keys by their prefixes
D. It is primarily used for sorting data
**Answer:** C

198. **Which protocol is used to assign IP addresses to devices on a local network?**
A. FTP
B. DHCP
C. DNS
D. ARP
**Answer:** B

199. **Which of the following sorting algorithms is a stable sort?**
A. Quick Sort
B. Merge Sort
C. Heap Sort
D. Selection Sort
**Answer:** B

200. **Which of the following is true about a B-Tree?**
A. It is a type of binary search tree
B. It is balanced and designed to work well on disk storage
C. It is used for searching in a sorted array
D. It is a type of heap
**Answer:** B

201. **Which of the following data structures is best for implementing a LRU (Least Recently Used) cache?**
A. Queue
B. Stack
C. Hash Map and Doubly Linked List
D. Binary Search Tree
**Answer:** C

202. **Which of the following sorting algorithms has the worst-case time complexity of O(n log n)?**
A. Bubble Sort
B. Merge Sort
C. Insertion Sort
D. Quick Sort
**Answer:** B

203. **What is the minimum number of edges in a graph with 10 vertices that is connected and has no cycles?**
A. 10
B. 9
C. 8
D. 7
**Answer:** B

204. **Which of the following algorithms is used for finding the minimum spanning tree of a graph?**

A. Dijkstra's Algorithm
B. Floyd-Warshall Algorithm
C. Prim's Algorithm
D. Bellman-Ford Algorithm
**Answer:** C

205. **What is the space complexity of a recursive algorithm that uses a stack for function calls and a fixed amount of additional memory?**
A. O(n)
B. O(log n)
C. O(1)
D. O(n^2)
**Answer:** A

206. **Which of the following protocols is used for secure data transmission over the internet?**
A. HTTP
B. FTP
C. SSL/TLS
D. SMTP
**Answer:** C

207. **Which of the following sorting algorithms has the best average case time complexity?**
A. Quick Sort
B. Merge Sort
C. Heap Sort
D. Bubble Sort
**Answer:** A

208. **What is the time complexity of accessing an element by index in an array?**
A. O(1)
B. O(n)
C. O(log n)
D. O(n^2)
**Answer:** A

209. **Which of the following statements about an AVL tree is true?**
A. It is an unbalanced binary search tree
B. The height difference between the left and right subtrees of any node is at most 2
C. It uses a priority queue for balancing
D. It is not used for dynamic data
**Answer:** B

210. **What is the primary purpose of the ARP (Address Resolution Protocol)?**
A. To convert IP addresses to MAC addresses
B. To convert domain names to IP addresses
C. To ensure security in communication
D. To manage routing in a network
**Answer:** A

211. **Which of the following best describes a HashMap?**
A. A data structure that stores values in a sorted order
B. A data structure that maps keys to values using a hash function
C. A data structure used for implementing a stack
D. A data structure that stores data in a balanced tree
**Answer:** B

212. **Which of the following operations has the worst-case time complexity of O(n) for a Linked List?**
A. Insertion at the front
B. Deletion from the front
C. Searching for an element
D. Insertion at the end
**Answer:** C

213. **In the context of cloud computing, which service model provides the infrastructure, including hardware, networking, and storage, as a service?**
A. SaaS
B. PaaS
C. IaaS
D. FaaS
**Answer:** C

214. **Which of the following is true about a Red-Black Tree?**
A. It is a type of AVL tree
B. It ensures that the tree is balanced and guarantees O(log n) time complexity for search operations
C. It uses a priority queue for balancing
D. It is not a binary search tree
**Answer:** B

215. **What is the time complexity of finding an element in a Hash Set?**
A. O(1)
B. O(n)
C. O(log n)
D. O(n^2)
**Answer:** A

216. **Which of the following is a property of a Binary Search Tree (BST)?**
A. The left subtree contains nodes greater than the root node
B. The right subtree contains nodes greater than the root node
C. Both left and right subtrees are not sorted
D. All the leaf nodes are at the same level
**Answer:** B

217. **What is the primary advantage of using a Trie for storing strings?**
A. It allows for faster searching than a hash table
B. It requires less memory than a hash table
C. It does not require sorting of strings
D. It guarantees balanced search time for all strings
**Answer:** A

218. **Which of the following is the correct description of the TCP three-way handshake process?**
A. SYN -> SYN-ACK -> ACK
B. SYN -> ACK -> SYN-ACK
C. SYN-ACK -> ACK -> SYN
D. ACK -> SYN -> SYN-ACK
**Answer:** A

219. **Which of the following types of data structures are implemented using a Linked List?**
A. Stack and Queue
B. Stack and Array

C. Queue and Array
D. Hash Map and Stack
**Answer:** A

220. **What is the purpose of a bloom filter?**
A. To find the minimum element in a set
B. To perform fast exact matches
C. To perform approximate set membership tests
D. To store large datasets in a compressed form
**Answer:** C

221. **Which of the following is true about a circular doubly linked list?**
A. It has only one pointer, which points to the next element
B. It allows for traversal in one direction only
C. It does not require extra memory for pointers
D. The last node points back to the first node, and the first node points back to the last node
**Answer:** D

222. **What is the space complexity of a recursive function that calls itself with a constant number of parameters and does not use additional memory?**
A. O(1)
B. O(n)
C. O(log n)
D. O(n^2)
**Answer:** B

223. **Which of the following data structures uses LRU (Least Recently Used) cache to replace the least recently used data?**
A. Stack
B. Queue
C. HashMap
D. Linked List
**Answer:** C

224. **Which algorithm can be used to find the longest common subsequence of two strings?**
A. Greedy Algorithm
B. Dynamic Programming
C. Divide and Conquer
D. Backtracking
**Answer:** B

225. **Which of the following statements about a Min-Heap is true?**
A. The root node has the largest value
B. The root node has the smallest value
C. Each node can have only two children
D. The heap is always balanced
**Answer:** B