Okay, good luck with your lab quiz! Here are 100+ quiz-style questions covering the topics you listed, with answers provided.

Arrays

1. **MCQ:** Which of the following data structures stores elements of the same data type in contiguous memory locations? a) Linked List b) Tree c) **Array** d) Queue **Answer:** c) Array

2. **Fill in the blank:** The index of the first element in an array is typically _____. **Answer:** 0

3. **True/False:** Accessing an element in an array by its index has a time complexity of O(n). **Answer:** False (O(1))

4. **MCQ:** What is the process of increasing the size of an array called when it becomes full? a) Overflow b) **Resizing** c) Underflow d) Allocation **Answer:** b) Resizing

5. **Fill in the blank:** In a 2D array, elements are accessed using two _____. **Answer:** indices

6. **True/False:** Arrays can only store primitive data types. **Answer:** False (They can store objects/references in many languages)

7. **MCQ:** Which operation is generally faster in arrays compared to linked lists? a) Insertion at the beginning b) Deletion in the middle c) **Accessing an element by index** d) Searching for an element **Answer:** c) Accessing an element by index

8. **Fill in the blank:** The number of dimensions an array has is called its _____. **Answer:** rank (or dimensionality)

9. **True/False:** The size of a static array can be changed during runtime. **Answer:** False

10. **MCQ:** What happens if you try to access an array element at an index that is out of bounds? a) The program crashes. b) It returns a default value. c) **It leads to an error (e.g., IndexOutOfBoundsException).** d) The array automatically resizes. **Answer:** c) It leads to an error (e.g., IndexOutOfBoundsException).

Records (or Structures)

11. **MCQ:** A record is a collection of _____. a) elements of the same data type b) **fields, possibly of different data types** c) nodes connected by pointers d) elements following the FIFO principle **Answer:** b) fields, possibly of different data types

12. **Fill in the blank:** Each component of a record is called a _____. **Answer:** field (or member)

13. **True/False:** Records allow you to group related data items together. **Answer:** True

14. **MCQ:** Which of the following is a common use case for records? a) Implementing stacks b) Representing graphs c) **Storing information about an entity (e.g., a student)** d) Managing queues **Answer:** c) Storing information about an entity (e.g., a student)

15. **Fill in the blank:** To access a specific field within a record, we typically use the _____ operator (e.g., `.` or `->`). **Answer:** dot

Pointers

16. **MCQ:** A pointer is a variable that stores the _____ of another variable. a) value b) **memory address** c) data type d) size **Answer:** b) memory address

17. **Fill in the blank:** The operation used to get the memory address of a variable is often denoted by the _____ symbol (`&`). **Answer:** ampersand

18. **True/False:** Pointer arithmetic allows you to perform standard arithmetic operations like addition and subtraction directly on pointer values. **Answer:** True (with some constraints related to the size of the pointed-to data type)

19. **MCQ:** What happens if you dereference a null pointer? a) It returns a default value. b) The program continues without any issues. c) **It typically leads to a runtime error or program crash.** d) The pointer automatically points to a valid memory location. **Answer:** c) It typically leads to a runtime error or program crash.

20. **Fill in the blank:** The operation used to access the value stored at the memory location pointed to by a pointer is called _____ and is often denoted by the asterisk symbol (`*`). **Answer:** dereferencing

21. **True/False:** Pointers can only point to primitive data types. **Answer:** False (They can point to any data type, including user-defined types and other pointers)

22. **MCQ:** Which of the following data structures heavily relies on the use of pointers? a) Array b) Stack c) Queue d) **Linked List Answer:** d) Linked List

23. **Fill in the blank:** Dynamic memory allocation, which involves allocating memory during runtime, often uses _____ to manage memory addresses. **Answer:** pointers

24. **True/False:** Using pointers can sometimes lead to memory management issues like memory leaks. **Answer:** True

25. **MCQ:** What is a dangling pointer? a) A pointer that points to a valid memory location. b) **A pointer that points to a memory location that has been freed.** c) A pointer that stores the value 0. d) A pointer that hasn't been initialized. **Answer:** b) A pointer that points to a memory location that has been freed.

Linked List

26. **MCQ:** A linked list is a linear data structure where elements are not stored in contiguous memory locations. Instead, elements are linked using _____. a) indices b) **pointers** c) keys d) values

Answer: b) pointers

27. **Fill in the blank:** Each element in a singly linked list is called a _____ and contains data and a pointer to the next element. **Answer:** node

28. **True/False:** Inserting an element at the beginning of a singly linked list has a time complexity of O(1). **Answer:** True

29. **MCQ:** Which type of linked list allows traversal in both forward and backward directions? a) Singly linked list b) **Doubly linked list** c) Circular linked list d) Ordered linked list **Answer:** b) Doubly linked list

30. **Fill in the blank:** The first node in a linked list is called the _____. **Answer:** head

31. **True/False:** Accessing the nth element in a singly linked list generally takes O(1) time. **Answer:** False (O(n))

32. **MCQ:** What is a circular linked list? a) A linked list where the last node points to null. b) **A linked list where the last node points back to the first node.** c) A linked list with only one node. d) A linked list where nodes are sorted. **Answer:** b) A linked list where the last node points back to the first node.

33. **Fill in the blank:** To insert a node in the middle of a singly linked list, you need to update the _____ of the preceding node. **Answer:** next pointer

34. **True/False:** Linked lists generally have better memory utilization than static arrays because they only allocate memory when needed. **Answer:** True

35. **MCQ:** Which of the following is an advantage of linked lists over arrays? a) Faster access to elements by index b) **Easier insertion and deletion of elements** c) Contiguous memory allocation d) Predictable memory usage **Answer:** b) Easier insertion and deletion of elements

Queue

36. **MCQ:** A queue follows the _____ principle. a) LIFO (Last-In, First-Out) b) **FIFO (First-In, First-Out)** c) FILO (First-In, Last-Out) d) LIFO (Last-In, First-Out) **Answer:** b) FIFO (First-In, First-Out)

37. **Fill in the blank:** The operation of adding an element to the rear of a queue is called _____. **Answer:** enqueue

38. **True/False:** The operation of removing an element from the front of a queue is called push. **Answer:** False (It's called dequeue)

39. **MCQ:** Which data structure can be used to implement a queue? a) Stack b) Tree c) **Array or Linked List** d) Graph **Answer:** c) Array or Linked List

40. **Fill in the blank:** In a circular queue, the _____ pointer wraps around to the beginning of the array when it reaches the end. **Answer:** rear

41. **True/False:** In a standard queue, the first element inserted is the last one to be removed. **Answer:** False

42. **MCQ:** What happens when you try to dequeue from an empty queue? a) It returns a default value. b) The program crashes. c) **It results in an underflow condition.** d) The queue automatically adds a dummy element. **Answer:** c) It results in an underflow condition.

43. **Fill in the blank:** The front of the queue points to the _____ element. **Answer:** first

44. **True/False:** Queues are commonly used in implementing function call stacks. **Answer:** False (Stacks are used for that)

45. **MCQ:** Which of the following is a typical application of a queue? a) Undo/redo functionality b) Evaluating arithmetic expressions c) **Handling requests in a server** d) Traversing a tree in a depth-first manner **Answer:** c) Handling requests in a server

Stack

46. **MCQ:** A stack follows the _____ principle. a) FIFO (First-In, First-Out) b) **LIFO (Last-In, First-Out)** c) FILO (First-In, Last-Out) d) OFIL (Out-First, In-Last) **Answer:** b) LIFO (Last-In, First-Out)

47. **Fill in the blank:** The operation of adding an element to the top of a stack is called _____. **Answer:** push

48. **True/False:** The operation of removing an element from the bottom of a stack is called pop. **Answer:** False (It's removing from the top)

49. **MCQ:** Which data structure is often used to implement the call stack in programming languages? a) Queue b) Tree c) **Stack** d) Linked List **Answer:** c) Stack

50. **Fill in the blank:** The pointer that keeps track of the top element in a stack is often called the _____ pointer. **Answer:** top

51. **True/False:** In a stack, the last element inserted is the first one to be removed. **Answer:** True

52. **MCQ:** What happens when you try to pop from an empty stack? a) It returns a default value. b) The program continues without any issues. c) **It results in an underflow condition.** d) The stack automatically adds a dummy element. **Answer:** c) It results in an underflow condition.

53. **Fill in the blank:** The process of removing an element from a stack is called _____. **Answer:** pop

54. **True/False:** Stacks are commonly used for implementing breadth-first search in graphs. **Answer:** False (Queues are used for BFS)

55. **MCQ:** Which of the following is a typical application of a stack? a) Managing print queues b) **Evaluating postfix expressions** c) Representing hierarchical data d) Finding the shortest path in a graph **Answer:** b) Evaluating postfix expressions

Tree

56. **MCQ:** A tree is a hierarchical data structure consisting of nodes connected by _____. a) arrays b) stacks c) **edges** d) queues **Answer:** c) edges

57. **Fill in the blank:** The topmost node in a tree is called the _____. **Answer:** root

58. **True/False:** A tree can have cycles. **Answer:** False (By definition, a tree has no cycles)

59. **MCQ:** A node in a tree that has no children is called a _____. a) parent b) ancestor c) **leaf** d) sibling **Answer:** c) leaf

60. **Fill in the blank:** The nodes directly below a given node are called its _____. **Answer:** children

61. **True/False:** The height of a tree is the number of edges on the longest path from the root to a leaf. **Answer:** True

62. **MCQ:** Which of the following is a common type of binary tree where the value of each node is greater than or equal to the value of its left child and less than or equal to the value of its right child? a) AVL tree b) B-tree c) **Binary Search Tree (BST)** d) Heap **Answer:** c) Binary Search Tree (BST)

63. **Fill in the blank:** Traversing a tree by visiting the root first, then the left subtree, and finally the right subtree is called _____ traversal. **Answer:** preorder

64. **True/False:** In a complete binary tree, all levels are completely filled except possibly the last level, which is filled from left to right. **Answer:** True

65. **MCQ:** Which tree traversal visits the left subtree, then the root, and then the right subtree? a) Preorder b) Postorder c) **Inorder** d) Breadth-first **Answer:** c) Inorder

66. **Fill in the blank:** A binary tree where each node has at most two children is called a _____ binary tree. **Answer:** full (or proper, if each non-leaf has exactly two children; or just binary tree)

67. **True/False:** Breadth-first search (BFS) on a tree typically uses a stack. **Answer:** False (It uses a queue)

68. **MCQ:** What is the height of a single-node tree? a) 1 b) **0** c) -1 d) Undefined **Answer:** b) 0 (depending on the definition)

69. **Fill in the blank:** The number of descendants a node has (including itself) is related to the size of its _____. **Answer:** subtree

70. **True/False:** All binary search trees are balanced. **Answer:** False (Unbalanced BSTs can exist)

Graph

71. **MCQ:** A graph is a data structure that consists of a set of _____ and a set of _____. a) nodes, stacks b) queues, edges c) **vertices, edges** d) leaves, branches **Answer:** c) vertices, edges

72. **Fill in the blank:** An edge in a graph that has direction is called a _____ edge. **Answer:** directed

73. **True/False:** In an undirected graph, the edge (u,v) is the same as the edge (v,u). **Answer:** True

74. **MCQ:** The number of edges connected to a vertex is called its _____. a) path b) cycle c) **degree** d) component **Answer:** c) degree

75. **Fill in the blank:** A graph where there is a path between every pair of vertices is called a _____ graph. **Answer:** connected

76. **True/False:** Depth-first search (DFS) on a graph typically uses a queue. **Answer:** False (It uses a stack or recursion)

77. **MCQ:** Which of the following is a common way to represent a graph? a) Array of structures b) Linked list of arrays c) **Adjacency matrix or Adjacency list** d) Stack of queues **Answer:** c) Adjacency matrix or Adjacency list

78. **Fill in the blank:** A sequence of vertices where each consecutive pair of vertices is connected by an edge is called a _____. **Answer:** path

79. **True/False:** A cycle in a graph is a path that starts and ends at the same vertex. **Answer:** True

80. **MCQ:** Which algorithm is commonly used to find the shortest path between two vertices in a weighted graph? a) Depth-first search

Graph (Continued)

81. **MCQ:** Which algorithm is commonly used to find the shortest path between two vertices in a weighted graph? a) Depth-first search b) Breadth-first search c) **Dijkstra's algorithm** d) Topological sort **Answer:** c) Dijkstra's algorithm

82. **Fill in the blank:** A directed acyclic graph is often abbreviated as _____. **Answer:** DAG

83. **True/False:** Breadth-first search explores all the neighbor vertices at the current depth prior to moving on to the vertices at the next depth level. **Answer:** True

84. **MCQ:** What is the time complexity of adjacency matrix representation to check if an edge (u,v) exists? a) $O(V+E)$ b) $O(V)$ c) **$O(1)$** d) $O(E)$ **Answer:** c) $O(1)$

85. **Fill in the blank:** A spanning tree of a connected graph G is a subgraph that is a tree and connects all the _____ of G. **Answer:** vertices

86. **True/False:** A graph with V vertices can have at most $V(V-1)/2$ edges if it is undirected and has no self-loops. **Answer:** True

87. **MCQ:** Which of the following algorithms can be used to detect cycles in a directed graph? a) Prim's algorithm b) Kruskal's algorithm c) **Depth-first search** d) Breadth-first search **Answer:** c) Depth-first search

88. **Fill in the blank:** The process of ordering the vertices in a directed acyclic graph such that for every directed edge from vertex u to vertex v, u comes before v in the ordering is called _____ sort. **Answer:** topological

89. **True/False:** In an adjacency list representation of a graph, finding all neighbors of a vertex takes time proportional to the degree of the vertex. **Answer:** True

90. **MCQ:** What is the minimum number of edges required to make a graph with V vertices connected? a) V b) V−2 c) **V−1** d) V+1 **Answer:** c) V−1

Mixed Questions (Covering all topics)

91. **MCQ:** Which data structure is best suited for implementing an undo/redo feature in software? a) Queue b) **Stack** c) Linked List d) Array **Answer:** b) Stack

92. **Fill in the blank:** A _____ is a linear data structure where elements can be inserted and deleted from both ends. **Answer:** deque (double-ended queue)

93. **True/False:** In a binary heap, the parent node's key is always greater than or equal to (in a max-heap) or less than or equal to (in a min-heap) the keys of its children. **Answer:** True

94. **MCQ:** Which data structure is efficient for searching in O(logn) time, provided it is balanced? a) Unsorted Array b) Linked List c) **Binary Search Tree** d) Queue **Answer:** c) Binary Search Tree

95. **Fill in the blank:** The process of arranging elements in a specific order is called _____. **Answer:** sorting

96. **True/False:** Merge sort has a time complexity of O(n2) in the worst case. **Answer:** False (O(nlogn))

97. **MCQ:** Which of the following data structures is non-linear? a) Array b) Linked List c) Stack d) **Tree** **Answer:** d) Tree

98. **Fill in the blank:** A hash table uses a _____ function to map keys to indices in an array. **Answer:** hash

99. **True/False:** Collision is a situation in a hash table where two different keys map to the same index. **Answer:** True

100. **MCQ:** Which of the following is a common technique for resolving collisions in a hash table? a) First-in, first-out b) Last-in, first-out c) **Separate chaining** d) Depth-first search **Answer:** c) Separate chaining

101. **Fill in the blank:** In a doubly linked list, each node has pointers to both the next and the _____ node. **Answer:** previous

102. **True/False:** Arrays provide constant time complexity for insertion and deletion at any position. **Answer:** False (Insertion/deletion in the middle or beginning is O(n))

103. **MCQ:** What is the primary advantage of using a linked list over an array when the frequency of insertions and deletions is high? a) Faster element access b) **More efficient insertion and deletion** c) Contiguous memory allocation d) Fixed size **Answer:** b) More efficient insertion and deletion

104. **Fill in the blank:** A priority queue is a queue where each element has a priority. Elements with higher priority are dequeued before elements with lower priority, regardless of their insertion order. This can be implemented using a _____. **Answer:** heap

105. **True/False:** The height of a balanced binary search tree with n nodes is typically O(logn). **Answer:** True

106. **MCQ:** Which graph traversal algorithm is often used to find the shortest path in an unweighted graph? a) Depth-first search b) **Breadth-first search** c) Dijkstra's algorithm d) Topological sort **Answer:** b) Breadth-first search

107. **Fill in the blank:** The number of levels in a tree is also referred to as its _____. **Answer:** depth (or height + 1, depending on definition)

108. **True/False:** A complete graph is a graph in which every pair of distinct vertices is connected by a unique edge. **Answer:** True

109. **MCQ:** What is the time complexity to search for an element in a sorted array using binary search? a) O(n) b) **O(logn)** c) O(1) d) O(nlogn) **Answer:** b) O(logn)

110. **Fill in the blank:** The process of visiting all nodes in a tree or graph is called _____. **Answer:** traversal

More Overall Questions

111. **MCQ:** Which data structure allows efficient insertion and deletion at both ends? a) Stack b) Queue c) **Deque** d) Linked List (singly) **Answer:** c) Deque

112. **Fill in the blank:** A self-referential data type is often used in the implementation of _____. **Answer:** linked lists and trees (nodes contain pointers to nodes of the same type)

113. **True/False:** The worst-case time complexity of searching in an unsorted array is O(1). **Answer:** False (O(n))

114. **MCQ:** Which of the following is a non-comparison based sorting algorithm? a) Merge Sort b) Quick Sort c) Heap Sort d) **Counting Sort Answer:** d) Counting Sort

115. **Fill in the blank:** A binary tree is said to be _____ if every level, except possibly the last, is completely filled, and all nodes in the last level are as far left as possible. **Answer:** complete

116. **True/False:** In a min-heap, the root node always contains the smallest element. **Answer:** True

117. **MCQ:** What is the space complexity of an array of size n? a) O(logn) b) O(1) c) **O(n)** d) O(n2) **Answer:** c) O(n)

118. **Fill in the blank:** The process of dividing a problem into smaller overlapping subproblems and storing the results to avoid redundant computations is called _____. **Answer:** dynamic programming

119. **True/False:** A queue can be used to implement a stack. **Answer:** True (though it might not be the most efficient way)

120. **MCQ:** Which of the following tree traversals would typically be used to get the elements of a Binary Search Tree in sorted order? a) Preorder b) Postorder c) **Inorder** d) Level order **Answer:** c) Inorder

121. **Fill in the blank:** The number of children a node has in a tree is called its _____. **Answer:** degree

122. **True/False:** All graphs are either directed or undirected, but not both. **Answer:** False (A graph can have both directed and undirected edges)

123. **MCQ:** Which algorithm is used to find a Minimum Spanning Tree? a) Dijkstra's algorithm b) Bellman-Ford algorithm c) **Kruskal's algorithm** d) Floyd-Warshall algorithm **Answer:** c) Kruskal's algorithm

124. **Fill in the blank:** In a hash table, the ratio of the number of keys to the size of the table is called the _____ factor. **Answer:** load

125. **True/False:** A stack is typically used for implementing recursion. **Answer:** True

126. **MCQ:** Which of the following has the best average-case time complexity for searching? a) Linked List b) Binary Search Tree (unbalanced) c) Array (unsorted) d) **Hash Table Answer:** d) Hash Table

127. **Fill in the blank:** A graph that is not connected consists of multiple _____. **Answer:** components

128. **True/False:** Inserting at the end of a singly linked list always takes O(1) time. **Answer:** False (O(n) if you don't maintain a tail pointer)

129. **MCQ:** What is the height of a balanced binary tree with 7 nodes? a) 7 b) 4 c) **3** (e.g., a complete binary tree) d) 2 **Answer:** c) 3

130. **Fill in the blank:** The process of converting a key into an index in a hash table is done by a _____ function. **Answer:** hash

131. **True/False:** Dequeues can be implemented using either arrays or linked lists. **Answer:** True

132. **MCQ:** Which sorting algorithm has a worst-case time complexity of O(n2) and is often efficient for small datasets? a) Merge Sort b) Quick Sort c) **Insertion Sort** d) Heap Sort **Answer:** c) Insertion Sort

133. **Fill in the blank:** A graph with no edges is called an _____ graph. **Answer:** empty (or null)

134. **True/False:** Breadth-first search can be used to find the shortest path in a weighted graph.
     Answer: False (Dijkstra's or Bellman-Ford are typically used for weighted graphs)

135. **MCQ:** What is the time complexity of the `push` operation in a stack implemented using an array (assuming no resizing is needed)? a) O(n) b) **O(1)** c) O(logn) d) O(nlogn) **Answer:** b) O(1)

136. **Fill in the blank:** A tree where each node has at most k children is called a _____ tree. **Answer:** k-ary

137. **True/False:** In a circular linked list, the last node's `next` pointer points to `null`. **Answer:** False (It points to the head)

138. **MCQ:** Which data structure is often used to implement a cache? a) Stack b) **Linked List (with a mechanism to move recently used items to the front)** c) Tree d) Array **Answer:** b) Linked List (with a mechanism to move recently used items to the front)

139. **Fill in the blank:** The number of edges in a tree with n nodes is always _____. **Answer:** n−1

140. **True/False:** Quick sort has an average time complexity of O(nlogn). **Answer:** True

More Fill-in-the-Blank Questions (Aiming for 150 total)

141. In an array, elements are stored in _____ memory locations. **Answer:** contiguous

142. A record allows grouping of _____ data types. **Answer:** possibly different

143. A pointer holds the _____ of a variable. **Answer:** memory address

144. The first node of a linked list is called the _____. **Answer:** head

145. Queues follow the _____ principle. **Answer:** FIFO (First-In, First-Out)

146. Stacks follow the _____ principle. **Answer:** LIFO (Last-In, First-Out)

147. The topmost node in a tree is the _____. **Answer:** root

148. A graph consists of _____ and _____. **Answer:** vertices, edges

149. Inserting an element into a full static array typically requires _____. **Answer:** resizing

150. Accessing an element by index in an array takes _____ time. **Answer:** constant (O(1))

151. Each piece of data in a record is called a _____. **Answer:** field

152. Dereferencing a pointer using `*` gives the _____ at that address. **Answer:** value

153. In a singly linked list, each node points to the _____ node. **Answer:** next

154. Adding to the rear of a queue is called _____. **Answer:** enqueue

155. Removing from the top of a stack is called _____. **Answer:** pop

156. A node with no children in a tree is a _____. **Answer:** leaf

157. The degree of a vertex in a graph is the number of _____ connected to it. **Answer:** edges

158. Dynamic arrays automatically _____ their size when needed. **Answer:** resize

159. The size of a record is the sum of the sizes of its _____. **Answer:** fields

160. A null pointer does not point to any valid _____. **Answer:** memory location

161. In a doubly linked list, the last node's `next` pointer is usually _____. **Answer:** null

162. Removing from the front of a queue is called _____. **Answer:** dequeue

163. Adding to the top of a stack is called _____. **Answer:** push

164. The height of a tree is the length of the longest path from the root to a _____. **Answer:** leaf

165. A path in a graph that starts and ends at the same vertex is a _____. **Answer:** cycle

166. The process of allocating memory during runtime is called _____ memory allocation. **Answer:** dynamic

167. A structure in C/C++ is an example of a _____. **Answer:** record

168. Pointer arithmetic should be done carefully to avoid accessing invalid _____. **Answer:** memory

169. In a circular queue, the rear pointer wraps around to the _____ of the array. **Answer:** beginning (or front)

170. The last element inserted into a stack is the first one to be _____. **Answer:** removed

171. The children of a node in a tree are its direct _____. **Answer:** descendants

172. A graph where all vertices are connected to each other is a _____ graph. **Answer:** complete

173. Memory allocated dynamically needs to be _____ to avoid leaks. **Answer:** freed (or deallocated)

174. A union in C/C++ is similar to a record, but all members share the same _____ location. **Answer:** memory

175. Using a pointer to access the members of a structure can be done with the _____ operator (`->`). **Answer:** arrow

176. In a linked list, elements are linked using _____. **Answer:** pointers

177. A priority queue can be implemented using a _____. **Answer:** heap

178. The root of a binary search tree has a value that is greater than all nodes in its _____ subtree and smaller than all nodes in its _____ subtree. **Answer:** left, right

179. Depth-first search explores as far as possible along each _____ before backtracking. **Answer:** branch

180. Breadth-first search explores all the neighbors of the current vertex before moving to the next _____ of vertices. **Answer:** level