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Computer Science Grade 12 — Chapter 2

Computational Thinking and Algorithms

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Independent practice MCQs from the supplied Class 12 Computer Science notes pack. Total: 50 questions.

A. Important / Main Topics

1. A data structure is best defined as:

(A) A way to store and organize data in memory
(B) A method of communication
(C) A system for internet access
(D) A graphical interface design

Correct Answer: A

Explanation: A data structure defines the way for organizing and storing data so that it can efficiently be accessed and modified.

2. Which data structure stores elements in contiguous memory locations?

(A) Linked List
(B) Array
(C) Stack
(D) Queue

Correct Answer: B

Explanation: Arrays use contiguous memory locations to store elements, which are identified by indexes.

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

(A) Queue
(B) Array
(C) Stack
(D) Linked List

Correct Answer: C

Explanation: Stacks use the LIFO principle, where the most recently added element is the first to be removed.

4. Which data structure uses the FIFO (First-In, First-Out) principle?

(A) Stack
(B) Tree
(C) Graph
(D) Queue

Correct Answer: D

Explanation: Queues use the FIFO principle, where the first element added is the first to be removed.

5. In a singly linked list, each node contains:

(A) Data and a reference to the next node
(B) Data and a reference to the previous node
(C) Only data
(D) Index value and data

Correct Answer: A

Explanation: In a singly linked list, each node contains Data and a reference to the next node.

6. Which data structure models complex relationships and networks using nodes and edges?

(A) Array
(B) Graph
(C) Stack
(D) Queue

Correct Answer: B

Explanation: Graph — this correctly answers the question.

7. The topmost node of a tree is called the:

(A) Leaf
(B) Parent
(C) Root
(D) Child

Correct Answer: C

Explanation: The topmost node of a tree is called the root.

8. A node in a tree that does not have any children is called a:

(A) Root node
(B) Sibling node
(C) Parent node
(D) Leaf node

Correct Answer: D

Explanation: A node with no children is referred to as a leaf node.

9. Which operation adds a new element at the top of a stack?

(A) Push
(B) Enqueue
(C) Dequeue
(D) Pop

Correct Answer: A

Explanation: Push — this correctly answers the question.

10. Which operation removes an element from the front of a queue?

(A) Enqueue
(B) Dequeue
(C) Push
(D) Pop

Correct Answer: B

Explanation: Dequeue — this correctly answers the question.

11. Which of the following is a criterion for evaluating computational solutions?

(A) Popularity
(B) Complexity of code
(C) Correctness
(D) Length of code

Correct Answer: C

Explanation: The three criteria are correctness, clarity, and efficiency. Popularity and code length are not criteria.

12. An algorithm is considered correct if it:

(A) Is short and concise
(B) Uses minimal memory
(C) Is written in Python
(D) Generates the expected output for all valid inputs

Correct Answer: D

Explanation: Correctness means the algorithm produces the expected output for all valid inputs, including edge cases.

13. Which of the following is a measure of efficiency in computational solutions?

(A) Time complexity
(B) Clarity
(C) Correctness

(D) Code length

Correct Answer: A

Explanation: Efficiency is measured using time complexity and space complexity, often expressed in Big O notation.

14. The time complexity of binary search is:

(A) O(1)
(B) O(log n)
(C) O(n)
(D) O(n²)

Correct Answer: B

Explanation: The time complexity of binary search is O(log n).

15. The time complexity of linear search is:

(A) O(1)
(B) O(log n)
(C) O(n)
(D) O(n²)

Correct Answer: C

Explanation: The time complexity of linear search is O(n).

16. Which of the following is a disadvantage of arrays?

(A) Fast access by index
(B) Contiguous memory allocation
(C) Simple implementation
(D) Fixed size that must be declared at the start

Correct Answer: D

Explanation: Arrays are fixed in size; resizing is costly because it requires creating a new array and shifting elements.

17. Which data structure is most suitable when elements need to be inserted and deleted frequently?

(A) Linked List
(B) Array
(C) Stack
(D) Queue

Correct Answer: A

Explanation: Linked lists are dynamic in size and allow easy insertion and deletion at any position.

18. In a doubly linked list, each node contains:

(A) Data and a reference to the next node only
(B) Data and references to both the previous and next nodes
(C) Only data
(D) An index value and data

Correct Answer: B

Explanation: In a doubly linked list, each node contains Data and references to both the previous and next nodes.

19. In a circular linked list, the last node:

(A) Contains NULL
(B) Is deleted
(C) Points back to the first node
(D) Has no data

Correct Answer: C

Explanation: In a circular linked list, the last node Points back to the first node.

20. Which operation returns the start element of a queue without removing it?

(A) Enqueue
(B) Dequeue

(C) IsEmpty
(D) Front

Correct Answer: D

Explanation: Front — this correctly answers the question.

21. A graph where at least one path exists between every pair of nodes is called a:

(A) Connected graph
(B) Directed graph
(C) Weighted graph
(D) Cyclic graph

Correct Answer: A

Explanation: A graph where at least one path exists between every pair of nodes is called a Connected graph.

22. A graph where edges have a direction associated with them is called a:

(A) Connected graph
(B) Directed graph
(C) Undirected graph
(D) Weighted graph

Correct Answer: B

Explanation: In a directed graph, edges have a direction associated with them.

23. In in-order traversal of a binary tree, the order of visiting nodes is:

(A) Root → Left → Right
(B) Left → Right → Root
(C) Left → Root → Right
(D) Right → Root → Left

Correct Answer: C

Explanation: In in-order traversal of a binary tree, the order of visiting nodes is Left → Root → Right.

24. In pre-order traversal of a binary tree, the order of visiting nodes is:

(A) Left → Root → Right
(B) Left → Right → Root
(C) Right → Left → Root
(D) Root → Left → Right

Correct Answer: D

Explanation: In pre-order traversal of a binary tree, the order of visiting nodes is Root → Left → Right.

25. In post-order traversal of a binary tree, the order of visiting nodes is:

(A) Left → Right → Root
(B) Root → Left → Right
(C) Left → Root → Right
(D) Right → Root → Left

Correct Answer: A

Explanation: In post-order traversal of a binary tree, the order of visiting nodes is Left → Right → Root.

B. Less Important / Secondary Topics

26. In-order traversal is often used with binary search trees because:

(A) It visits nodes in ascending order
(B) It visits the root first
(C) It visits the root last
(D) It skips the left subtree

Correct Answer: A

Explanation: In-order traversal of a BST visits nodes in ascending order, making it useful for sorting and searching.

27. Which traversal is often used for deleting nodes or freeing memory?

(A) In-order
(B) Post-order
(C) Pre-order
(D) Level-order

Correct Answer: B

Explanation: Post-order traversal processes children before their parent, which is useful for deleting nodes or freeing memory.

28. Which traversal is useful when we need to work with the root node before its children?

(A) In-order
(B) Post-order
(C) Pre-order
(D) Level-order

Correct Answer: C

Explanation: Pre-order traversal visits the root before its children, making it useful when the root must be processed first.

29. Which of the following is an advantage of linked lists over arrays?

(A) Fast access by index
(B) Contiguous memory allocation
(C) Fixed size
(D) Dynamic size

Correct Answer: D

Explanation: Linked lists can grow and shrink as needed, unlike arrays which have a fixed size.

30. An algorithm is considered clear if:

(A) Its steps are logically structured and easily understandable
(B) It is short
(C) It uses minimal memory
(D) It runs quickly

Correct Answer: A

Explanation: Clarity means the algorithm's steps are logically structured and easily understood, often aided by descriptive names and comments.

31. Which of the following is an example of O(1) complexity?

(A) Binary search
(B) Accessing the first element of an array by index
(C) Linear search
(D) Bubble sort

Correct Answer: B

Explanation: O(1) constant time means the running time is constant regardless of input size, as in accessing an array element by index.

32. Which of the following is an example of $O(n^2)$ complexity?

(A) Binary search
(B) Linear search
(C) Bubble sort
(D) Accessing the first element of an array

Correct Answer: C

Explanation: Bubble sort uses nested loops and has a time complexity of $O(n^2)$.

33. The space complexity of the Euclidean Algorithm is:

(A) O(log n)
(B) O(n)
(C) $O(n^2)$
(D) O(1)

Correct Answer: D

Explanation: The Euclidean Algorithm uses only a few variables, giving a constant space complexity of O(1).

34. The time complexity of the Euclidean Algorithm is:

(A) O(log min(a, b))
(B) O(1)
(C) O(n)
(D) O(n²)

Correct Answer: A

Explanation: The Euclidean Algorithm reduces the problem size significantly with each iteration, giving a logarithmic time complexity.

35. Counting vowels in a string requires examining each character once. Its time complexity is:

(A) O(1)
(B) O(n)
(C) O(log n)
(D) O(n²)

Correct Answer: B

Explanation: Counting vowels in a string requires examining each character once. Its time complexity is O(n).

36. A programmer must store a fixed-size table of student marks where fast access by row and column is required. Which data structure is most suitable?

(A) Linked list
(B) Stack
(C) Two-dimensional array
(D) Queue

Correct Answer: C

Explanation: A 2-D array (matrix) stores elements in rows and columns with contiguous memory, allowing fast access by two indexes.

37. A system needs to process tasks in the exact order they arrive. Which data structure should be used?

(A) Stack
(B) Tree
(C) Graph
(D) Queue

Correct Answer: D

Explanation: Queue — this correctly answers the question.

38. A system needs to handle "undo" operations, where the most recent action is reversed first. Which data structure is most suitable?

(A) Stack
(B) Queue
(C) Array
(D) Graph

Correct Answer: A

Explanation: The LIFO principle of a stack matches the "undo" behavior, where the most recent action is reversed first.

39. A binary tree has the following in-order traversal: 4 → 2 → 5 → 1 → 3 → 6. Which node is the root?

(A) 4
(B) 1
(C) 2
(D) 6

Correct Answer: B

Explanation: In in-order traversal (Left → Root → Right), the root appears between the left and right subtrees. Here, 1 is between the left group (4, 2, 5) and the right group (3, 6), so 1 is the root.

40. A binary tree has the following pre-order traversal: 1 → 2 → 4 → 5 → 3 → 6. Which node is the root?

(A) 4
(B) 2
(C) 1
(D) 6

Correct Answer: C

Explanation: Pre-order traversal visits the root first, so the first node in the sequence (1) is the root.

41. A binary tree has the following post-order traversal: 4 → 5 → 2 → 6 → 3 → 1. Which node is the root?

(A) 4
(B) 5
(C) 3
(D) 1

Correct Answer: D

Explanation: Post-order traversal visits the root last, so the last node in the sequence (1) is the root.

42. An algorithm produces the correct output for normal inputs but fails for an empty array. Which criterion is not fully satisfied?

(A) Correctness
(B) Clarity
(C) Efficiency
(D) Popularity

Correct Answer: A

Explanation: Correctness requires the algorithm to produce the expected output for all valid inputs, including edge cases like an empty array.

43. A sorting algorithm takes 10 seconds for 100 elements and 40 seconds for 200 elements. Which Big O complexity is most consistent with this behavior?

(A) O(1)
(B) $O(n^2)$
(C) O(log n)
(D) O(n)

Correct Answer: B

Explanation: When the input size doubles (100 → 200), the time quadruples (10 → 40 seconds). This is characteristic of $O(n^2)$ quadratic time.

44. A search algorithm takes 1 second for 1,000 elements and 2 seconds for 2,000 elements. Which Big O complexity is most consistent with this behavior?

(A) O(1)
(B) O(log n)
(C) O(n)
(D) $O(n^2)$

Correct Answer: C

Explanation: When the input size doubles and the time also doubles, the behavior is linear, consistent with O(n).

45. Two algorithms solve the same problem. Algorithm X is correct but unclear and inefficient. Algorithm Y is clear and efficient but fails for some valid inputs. Which statement is best?

(A) Algorithm X is better because it is correct
(B) Algorithm Y is better because it is efficient
(C) Both are equally acceptable
(D) Neither is fully satisfactory; a good solution must balance correctness, clarity, and efficiency

Correct Answer: D

Explanation: A good computational solution must satisfy all three criteria: correctness, clarity, and efficiency. Each algorithm fails at least one criterion.

46. In the Euclidean Algorithm, what happens when b becomes zero?

(A) The algorithm stops and a contains the GCD
(B) The algorithm restarts
(C) The algorithm returns zero
(D) The algorithm continues with new values

Correct Answer: A

Explanation: The algorithm stops and a contains the GCD — this correctly answers the question.

47. A programmer must store data that can grow and shrink dynamically, with frequent insertion and deletion at arbitrary positions. Which data structure is most suitable?

(A) Array
(B) Linked list
(C) Stack
(D) Queue

Correct Answer: B

Explanation: Linked lists are dynamic in size and allow easy insertion and deletion at any position, unlike arrays with fixed size.

48. A tree traversal visits the root, then the left subtree, then the right subtree. Which traversal is this?

(A) In-order
(B) Post-order
(C) Pre-order
(D) Level-order

Correct Answer: C

Explanation: Pre-order — this correctly answers the question.

49. An algorithm's time complexity is O(log n). If the input size increases from 1,000 to 1,000,000, the number of steps increases approximately:

(A) By a factor of 1,000
(B) By a factor of 1,000,000
(C) It remains constant
(D) By a factor of 2

Correct Answer: D

Explanation: For O(log n), the number of steps grows logarithmically. log□(1,000) ≈ 10 and log□(1,000,000) ≈ 20, so the steps roughly double.

50. A student claims that an algorithm is efficient because it uses few lines of code. Which statement best evaluates this claim?

(A) The claim is incorrect; efficiency is about time and space complexity, not code length
(B) The claim is correct; fewer lines always mean better efficiency
(C) The claim is correct only for sorting algorithms
(D) The claim is correct only for search algorithms

Correct Answer: A

Explanation: Efficiency refers to how well an algorithm uses computer resources (time and memory), measured by time and space complexity, not by the number of lines of code.