

# Unit -1MCQ

**MCQ 1 What is the first step in algorithm design and analysis?** A) Choosing a data structure  
B) Understanding the problem  
C) Proving an algorithm's correctness  
D) Analyzing an algorithm

**Correct Answer:** B) Understanding the problem

**MCQ 2 Which of the following refers to the selection of an appropriate way to organize and store data?** A) Algorithm Design Techniques  
B) Data Structure  
C) Time Complexity  
D) Space Complexity

**Correct Answer:** B) Data Structure

**MCQ 3 What type of algorithm executes instructions one after another?** A) Parallel Algorithm  
B) Sequential Algorithm  
C) Approximate Algorithm  
D) Exact Algorithm

**Correct Answer:** B) Sequential Algorithm

**MCQ 4 Which of the following is NOT a key property of an algorithm?** A) Input  
B) Output  
C) Complexity  
D) Definiteness

**Correct Answer:** C) Complexity

**MCQ 5 What is the purpose of proving an algorithm's correctness?** A) To ensure it runs quickly  
B) To confirm it uses minimal memory  
C) To verify it yields the required result for every legitimate input  
D) To simplify the algorithm

**Correct Answer:** C) To verify it yields the required result for every legitimate input

**MCQ 6 Which of the following is a characteristic of an efficient algorithm?** A) It uses more memory  
B) It executes in less time  
C) It is complex  
D) It is difficult to understand

**Correct Answer:** B) It executes in less time

**MCQ 7 What does time complexity measure?** A) The actual time taken by an algorithm  
B) The number of basic operations performed relative to input size  
C) The amount of memory used  
D) The simplicity of the algorithm

**Correct Answer:** B) The number of basic operations performed relative to input size

**MCQ 8 Which of the following is a design technique for algorithms?** A) Proving correctness  
B) Analyzing efficiency  
C) Divide and Conquer  
D) Understanding the problem

**Correct Answer:** C) Divide and Conquer

**MCQ 9 What is the focus of space complexity analysis?** A) The number of operations  
B) The amount of memory space required for execution  
C) The speed of execution  
D) The clarity of the algorithm

**Correct Answer:** B) The amount of memory space required for execution

**MCQ 10 Why is simplicity important in algorithm design?** A) Simpler algorithms are harder to understand  
B) Simpler algorithms usually contain more bugs  
C) Simpler algorithms are easier to understand and program  
D) Simplicity has no impact on algorithm design

**Correct Answer:** C) Simpler algorithms are easier to understand and program

**Question 11 What does space complexity refer to in the context of an algorithm?**

A) The total time taken by the algorithm to execute  
B) The amount of memory required by the algorithm to execute and produce a result  
C) The number of operations performed by the algorithm  
D) The speed of the CPU

**Correct Answer:** B) The amount of memory required by the algorithm to execute and produce a result

**Question 12 Which of the following is NOT a type of memory space required by an algorithm?** A)

Instruction Space

B) Data Space

- C) Environment Space
- D) Execution Space

**Correct Answer:** D) Execution Space

**Question 13** What is the time complexity of the iterative approach to find the sum of the first  $n$  natural numbers? A)  $O(1)$

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

**Correct Answer:** B)  $O(n)$

**Question 14** In the formula-based approach to find the sum of the first  $n$  natural numbers, what is the time complexity? A)  $O(n)$

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

**Correct Answer:** C)  $O(1)$

**Question 15** Why is it important to minimize space complexity in algorithm design? A) To increase the number of operations

- B) To improve performance, especially in resource-limited environments
- C) To make the algorithm more complex
- D) To ensure the algorithm runs faster

**Correct Answer:** B) To improve performance, especially in resource-limited environments

**Question 16** What is the purpose of asymptotic notations in algorithm analysis? A) To represent the exact execution time of an algorithm

- B) To simplify and standardize the representation of time and space complexity
- C) To measure the physical memory used by an algorithm
- D) To provide a graphical representation of algorithm performance

**Correct Answer:** B) To simplify and standardize the representation of time and space complexity

**Question 17** Which of the following asymptotic notations represents the average case of an algorithm? A) Big-Oh ( $O$ )

- B) Big-Omega ( $\Omega$ )
- C) Big-Theta ( $\Theta$ )
- D) None of the above

**Correct Answer:** C) Big-Theta ( $\Theta$ )

**Question 18** If the time complexity of an algorithm is given as  $T(n) = n^2 + 8n + 2$ , what is its Big-Theta ( $\Theta$ ) notation? A)  $\Theta(n)$

B)  $\Theta(n^2)$

C)  $\Theta(n^3)$

D)  $\Theta(1)$

**Correct Answer:** B)  $\Theta(n^2)$

**Question 19** What does Big-O ( $O$ ) notation represent in algorithm analysis? A) The average case time complexity

B) The lower bound of an algorithm's time complexity

C) The upper bound or worst-case time complexity

D) The exact time taken by an algorithm

**Correct Answer:** C) The upper bound or worst-case time complexity

**Question 20** In the context of time complexity, what does the term "asymptotic" refer to? A) The exact time taken by an algorithm

B) The behavior of an algorithm as the input size approaches infinity

C) The average time taken for small inputs

D) The maximum time taken for any input

**Correct Answer:** B) The behavior of an algorithm as the input size approaches infinity

**Question 21** What is the time complexity of the binary search algorithm? A)  $O(n)$

B)  $O(\log n)$

C)  $O(n \log n)$

D)  $O(1)$

**Correct Answer:** B)  $O(\log n)$

**Question 22** Which of the following statements is true regarding Big-Omega ( $\Omega$ ) notation? A) It represents the upper bound of an algorithm's time complexity.

B) It represents the average case time complexity.

C) It defines the lower bound of an algorithm's time complexity.

D) It is used to ignore constant factors in time complexity.

**Correct Answer:** C) It defines the lower bound of an algorithm's time complexity.

**Question 23** In the linear search algorithm, what is the worst-case time complexity? A)  $O(1)$

B)  $O(n)$

C)  $O(\log n)$

D)  $O(n^2)$

**Correct Answer:** B)  $O(n)$

**Question 24** When analyzing the time complexity  $T(n) = 20n^2 + 8n$ , what is the Big-O notation? A)

O(n)

B)  $O(n^2)$

C)  $O(1)$

D)  $O(n^3)$

**Correct Answer:** B)  $O(n^2)$

**Question 25** In the binary search algorithm, what condition is checked to determine if the target value is found? A) If the target is less than the middle element

B) If the target is greater than the middle element

C) If the target is equal to the middle element

D) All of the above

**Correct Answer:** D) All of the above

**Question 26** What does a recurrence relation describe? A) A function in terms of its own values at larger inputs

B) A function in terms of its own values at smaller inputs

C) A fixed value for all inputs

D) A linear function

**Correct Answer:** B) A function in terms of its own values at smaller inputs

**Question 27** In the recurrence relation  $T(n) = c + 2T(n - 1)$ , what does the term  $c$  represent?

A) The time complexity of the algorithm

B) A constant time taken for each recursive call

C) The base case of the recurrence

D) The maximum time complexity

**Correct Answer:** B) A constant time taken for each recursive call

**Question 28** What is the time complexity of the recurrence relation  $T(n) = T(1)$  if  $n = 1$  and  $T(n) = c + T(n/2)$  if  $n > 1$

A)  $\Theta(1)$

B)  $\Theta(n)$

C)  $\Theta(\log n)$

D)  $\Theta(n^2)$

**Correct Answer:** C)  $\Theta(\log n)$

**Question 29** What is the sum of the geometric series  $1 + 2 + 4 + \dots + 2^{n-1}$ ?

- A)  $2^n - 1$
- B)  $2^n$
- C)  $n$
- D)  $n^2$

**Correct Answer:** A)  $2^n - 1$

**Question 30** In the iterative substitution method, what is the purpose of recognizing a pattern? A)

- To find the exact value of the function
- B) To simplify the recurrence relation into a summation
- C) To determine the base case
- D) To ignore the constants in the analysis

**Correct Answer:** B) To simplify the recurrence relation into a summation

**Question 31** What is a base case in a recursive function? A) A condition that allows the function to call itself

- B) A terminating scenario that does not use recursion
- C) A variable that stores the result of the recursion
- D) A function that calls another function

**Correct Answer:** B) A terminating scenario that does not use recursion

**Question 32** What happens if a base case is not defined in a recursive function? A) The function will execute correctly

- B) The function will return a default value
- C) A stack overflow error may occur
- D) The function will terminate immediately

**Correct Answer:** C) A stack overflow error may occur

**Question 33** Which of the following is an example of direct recursion? A) A function calling another function

- B) A function calling itself
- C) A function calling multiple functions
- D) A function calling a library function

**Correct Answer:** B) A function calling itself

**Question 34** In the context of recursion, what is indirect recursion? A) A function that does not call itself

- B) A function that calls itself directly
- C) A function that calls another function, which in turn calls the first function
- D) A function that calls a library function

**Correct Answer:** C) A function that calls another function, which in turn calls the first function

**Question 35 What is the primary advantage of using recursion?** A) It always executes faster than iterative solutions

B) It requires less memory than iterative solutions

C) It can make code more readable and concise

D) It eliminates the need for base cases

**Correct Answer:** C) It can make code more readable and concise

**Question 36 What is a tail recursive function?** A) A function that does not call itself

B) A function where the recursive call is the last operation executed

C) A function that calls itself multiple times

D) A function that uses loops instead of recursion

**Correct Answer:** B) A function where the recursive call is the last operation executed

**Question 37 Which of the following statements is true about memory management in recursion?** A) Memory is allocated only once for all recursive calls

B) Each recursive call allocates new memory for local variables

C) Memory is not used in recursive functions

D) Memory is freed immediately after the first recursive call

**Correct Answer:** B) Each recursive call allocates new memory for local variables

**Question 38 What is the base case for the factorial function  $\text{fact}(n)$  ?** A)  $n = 0$

B)  $n = 1$

C)  $n \leq 1$

D) All of the above

**Correct Answer:** D) All of the above

**Question 39 In the recursive definition of factorial, what is the recursive case?**

A)  $F(n) = 1$  if  $n = 0$

B)  $F(n) = n \times F(n - 1)$  if  $n$

C)  $F(n) = 0$  if  $n < 0$

D) None of the above

**Correct Answer:** B)  $F(n) = n \times F(n - 1)$  if  $n$

**Question 40 What is the main disadvantage of using recursion?** A) It is always easier to implement

B) It can lead to stack overflow errors

C) It requires fewer lines of code

D) It is always faster than iterative solutions

**Correct Answer:** B) It can lead to stack overflow errors

**Question 41 Which of the following is NOT a characteristic of a well-defined recursive function?** A)

It has a base case

B) It calls itself directly or indirectly

C) It has no terminating condition

D) It progresses towards the base case

**Correct Answer:** C) It has no terminating condition

**Question 42 What is the output of the following code if n = 3?**

```
int fact(int n) {  
    if (n == 0)  
        return 1;  
    else  
        return n * fact(n - 1);  
}
```

A) 0

B) 1

C) 6

D) 3

**Correct Answer:** C) 6

**Question 43 What is the purpose of tail call elimination in tail recursive functions?** A) To reduce the number of recursive calls

B) To optimize memory usage by reusing the current function's stack frame

C) To convert tail recursion into iterative loops

D) To eliminate the need for base cases

**Correct Answer:** B) To optimize memory usage by reusing the current function's stack frame

**Question 44 Which of the following is a common use case for recursion?** A) Sorting algorithms

B) Searching algorithms

C) Calculating Fibonacci numbers

D) All of the above

**Correct Answer:** D) All of the above



**Question 45** In the context of recursion, what does the term "stack" refer to? A) A data structure used to store global variables  
B) A data structure that stores function calls and local variables  
C) A method for optimizing recursive functions  
D) A type of loop

**Correct Answer:** B) A data structure that stores function calls and local variables