Design & Analysis of Algorithms

UNIT-2

Part-A: Multiple Choice Questions (20 × 1 = 20 Marks)

Choose the correct answer.

1. A Disjoint Set data structure is used to:

a) Sort elements
b) Store graphs
c) Maintain non-overlapping sets
d) Search elements

2. Which operation determines the set to which an element belongs?

a) Union
b) Merge
c) Find
d) Insert

3. The Union operation in a Disjoint Set:

a) Splits a set
b) Combines two sets
c) Searches an element
d) Deletes an element

4. Which of the following applications commonly uses Disjoint Sets?

a) Minimum Spanning Tree
b) Binary Search
c) Heap Sort
d) Graph Coloring

5. A Priority Queue is a data structure in which:

a) Elements are processed randomly
b) Elements are processed according to priority
c) Elements are processed in FIFO order
d) Elements are processed in LIFO order

6. Which data structure is commonly used to implement a Priority Queue?

a) Linked List
b) Heap
c) Queue
d) Stack

7. A Max Heap satisfies:

a) Parent ≤ Children
b) Parent ≥ Children
c) All elements equal
d) Elements are sorted

8. In a Min Heap:

a) Root contains the largest element
b) Root contains the smallest element
c) Leaf contains the smallest element
d) Elements are sorted

9. The time complexity of inserting an element into a heap is:

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

10. Heapsort is based on:

a) Queue
b) Stack
c) Heap
d) Tree Traversal

11. The worst-case time complexity of Heapsort is:

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

12. Backtracking is a:

a) Dynamic Programming technique
b) Greedy method
c) General algorithmic technique for exploring solutions
d) Sorting algorithm

13. Backtracking generates solutions using:

a) Breadth First Search only
b) Trial and Error
c) Hashing
d) Sorting

14. The N-Queens problem aims to place N queens:

a) In the same row
b) Without attacking each other
c) In the same column
d) On diagonal cells only

15. In the 8-Queens problem, the number of queens placed is:

a) 4
b) 6
c) 8
d) 16

16. Sum of Subsets problem is used to find:

a) Largest subset
b) Subsets whose sum equals a target value
c) Minimum subset
d) Sorted subsets

17. Graph Coloring aims to:

a) Remove vertices
b) Assign colors to vertices without conflicts
c) Add edges
d) Traverse graphs

18. In Graph Coloring, adjacent vertices should:

a) Have the same color
b) Have different colors
c) Have no color
d) Be removed

19. Hamiltonian Cycle is a cycle that:

a) Visits every edge exactly once
b) Visits every vertex exactly once and returns to the start

c) Visits only adjacent vertices
d) Contains no cycle

20. Which of the following problems is NOT typically solved using Backtracking?

a) N-Queens
b) Graph Coloring
c) Hamiltonian Cycle
d) Binary Search

Part-B: Fill in the Blanks (20 × 1 = 20 Marks)

1. A collection of non-overlapping sets is called a _____ set.

2. The _____ operation determines the representative of a set.

3. The _____ operation combines two disjoint sets.

4. Disjoint Sets are widely used in _____ algorithms.

5. A Priority Queue serves elements according to their _____.

6. A _____ is a complete binary tree used to implement a Priority Queue.

7. In a Max Heap, the root contains the _____ element.

8. In a Min Heap, the root contains the _____ element.

9. The time complexity of heap insertion is _____.

10. Heapsort uses a _____ data structure.

11. The worst-case time complexity of Heapsort is _____.

12. Backtracking systematically searches for a solution by _____ choices.

13. The N-Queens problem is a classic _____ problem.

14. In the N-Queens problem, no two queens can attack each other along rows, columns, or _____.

15. The Sum of Subsets problem searches for subsets whose sum equals a given _____ value.

16. Graph Coloring assigns _____ to graph vertices.

17. Adjacent vertices in Graph Coloring must have _____ colors.

18. A Hamiltonian Cycle visits every vertex exactly _____.

19. A Hamiltonian Cycle starts and ends at the _____ vertex.

20. N-Queens, Graph Coloring, and Hamiltonian Cycle are applications of _____.

ANSWERS

Part-A: MCQs

1. c
2. c
3. b
4. a
5. b
6. b
7. b
8. b
9. b
10. c
11. c
12. c
13. b
14. b
15. c
16. b
17. b
18. b
19. b
20. d

Part-B: Fill in the Blanks

1. Disjoint
2. Find
3. Union
4. Graph
5. Priority
6. Heap
7. Largest
8. Smallest

9. O(log n)
10. Heap
11. O(n log n)
12. Backtracking
13. Backtracking
14. Diagonals
15. Target
16. Colors
17. Different
18. Once
19. Starting
20. Backtracking