

Algorithms  
Assignment -#7

1. An algorithm is \_\_\_\_\_?  
A) A problem  
B) A procedure for solving a problem  
C) A real-life mathematical problem  
D) More than one of the above  
E) None of the above
2. The main measures of the efficiency of an algorithm are?  
A) Time and space complexity  
B) Data and space  
C) Processor and memory  
D) More than one of the above  
E) None of the above
3. What is the time complexity of the Floyd–Warshall algorithm to calculate all pairs shortest path in a graph with  $n$  vertices?  
A)  $O(n^2 \log(n))$   
B)  $\Theta(n^2 \log(n))$   
C)  $\Theta(n^3)$   
D) More than one of the above  
E) None of the above
4. Which of the following standard algorithms is not Dynamic Programming based?  
A) Bellman–Ford Algorithm for single source shortest path  
B) Floyd Warshall Algorithm for all pairs shortest paths  
C) Prim's Minimum Spanning Tree  
D) More than one of the above  
E) None of the above
5. Which of the following is not a backtracking algorithm?  
A) Knight tour problem  
B) N queen problem  
C) Tower of Hanoi  
D) More than one of the above  
E) None of the above

6. Consider the following table

Algorithms	Design Paradigms
(P) Dijkstra's Algorithm	(i) Divide and Conquer
(Q) Strassen's Matrix Multiplication	(ii) Greedy
(R) Fibonacci numbers	(iii) Dynamic Programming

Match the algorithm to the design paradigms they are based on:

- A) P-(ii), Q-(i), R-(iii)
  - B) P-(iii), Q-(i), R-(ii)
  - C) P-(i), Q-(ii), R-(iii)
  - D) More than one of the above
  - E) None of the above
7. A problem in NP is NP-complete if:
- A) It can be reduced to the 3-SAT problem in polynomial time
  - B) The 3-SAT problem can be reduced to it in polynomial time
  - C) It can be reduced to any other problem in NP in polynomial time
  - D) Some problem in NP can be reduced to it in polynomial time
  - E) More than one of the above
8. Which of the following is true about NP-Complete and NP-Hard problems?
- A) If we want to prove that a problem X is NP-Hard, we take a known NP-Hard problem Y and reduce Y to X
  - B) The first problem that was proved as NP-complete was the circuit satisfiability problem
  - C) NP-complete is a subset of NP Hard
  - D) More than one of the above
  - E) None of the above

9. Match the following:

List – I	List - II
(a) Sequential Search	(i) Dynamic programming principle
(b) Branch - and – bound	(ii) repeatedly double index
(c) Exponential Search	(iii) $O(\log N)$
(d) Binary Search	(iv) $O(N)$

codes:

a b c d

- A) (i) (iv) (iii) (ii)  
 B) (iv) (i) (ii) (iii)  
 C) (iv) (ii) (i) (iii)  
 D) More than one of the above  
 E) None of the above
10. Which of the following algorithms are used to find the shortest path from a source node to all other nodes in a weighted graph?  
 A) BFS  
 B) Dijkstra's Algorithm  
 C) Prim's Algorithm  
 D) More than one of the above  
 E) None of the above
11. Which of the following algorithms are used for string and pattern matching problems?  
 A) Z Algorithm  
 B) Rabin Karp Algorithm  
 C) KMP Algorithm  
 D) More than one of the above  
 E) None of the above
12. Which of the following is known to be not an NP-Hard Problem?  
 A) Vertex Cover Problem  
 B) 0/1 Knapsack Problem  
 C) Maximal Independent Set Problem  
 D) More than one of the above  
 E) None of the above

13. Which of the following is used for solving the N Queens Problem?

- A) Greedy algorithm  
 B) Dynamic programming  
 C) Backtracking  
 D) More than one of the above  
 E) None of the above

14. Dijkstra's algorithm is used to solve \_\_\_\_\_ problems?

- A) Network lock  
 B) Single source shortest path  
 C) All pair shortest path  
 D) More than one of the above  
 E) None of the above

15. Hamiltonian path problem is \_\_\_\_\_?

- A) NP problem  
 B) P class problem  
 C) NP-complete problem  
 D) More than one of the above  
 E) None of the above

16. Identify the approach followed in Floyd Warshall's algorithm?

- A) Linear programming  
 B) Dynamic Programming  
 C) Greedy Technique  
 D) More than one of the above  
 E) None of the above

17. Kruskal's Algorithm for finding the Minimum Spanning Tree of a graph is a kind of a?

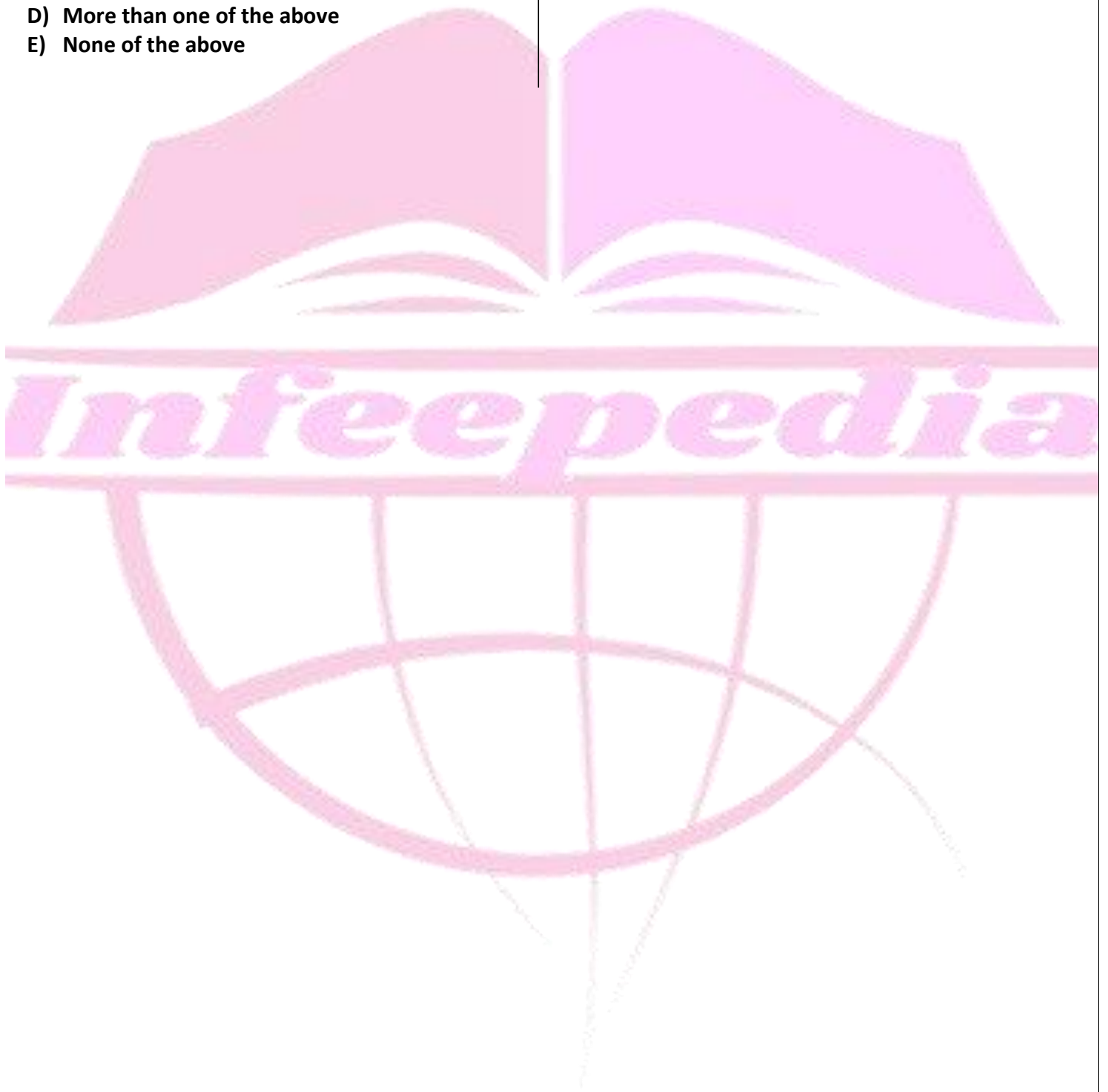
- A) DP Problem  
 B) Greedy Algorithm  
 C) Adhoc Problem  
 D) More than one of the above  
 E) None of the above

18. Select the correct recurrence relation for Tower of Hanoi?

- A)  $T(N) = 2T(N-1)+1$   
 B)  $T(N) = 2T(N/2)+1$   
 C)  $T(N) = 2T(N-1)+N$   
 D) More than one of the above  
 E) None of the above

19. The Bellman Ford Algorithm returns \_\_\_\_\_ value?

- A) String
- B) Boolean
- C) Double
- D) More than one of the above
- E) None of the above



Solution with Explanation

1. Answer - B) An algorithm is a procedure for solving a problem.

2. Answer - A) Time and space complexity are the main measures of the efficiency of an algorithm.

3. Answer C)  $O(n^3)$

Explanation: Floyd–Warshall algorithm uses three nested loops to calculate all pairs shortest path. So, the time complexity is  $\Theta(n^3)$ .

4. Answer C) Prim's Minimum Spanning Tree

Explanation: Prim's Minimum Spanning Tree is a Greedy Algorithm. All others are dynamic programming based. Hence (D) is the correct answer.

5. Answer C) Tower of Hanoi

Knight tour problem, N Queen problem and M coloring problem involve backtracking. Tower of hanoi uses simple recursion.

6. Answer A) - P-(ii), Q-(i), R-(iii):

Dijkstra's algorithm is Greedy technique to find the shortest path from a single source vertex to all other vertices in the given graph.

Strassen's Matrix Multiplication is Divide and conquer technique to multiply matrices in efficient way. Fibonacci numbers uses Dynamic programming.

7. Answer B) The 3-SAT problem can be reduced to it in polynomial time

A problem in NP becomes NPC if all NP problems can be reduced to it in polynomial time. This is the same as reducing any of the NPC problems to it. 3-SAT being an NPC problem, reducing it to an NP problem would mean that NP problem is NPC.

8. Answer D) More than one of the above (a,b,c)

9. Answer B) (iv) (i) (ii) (iii)

Explanation: Sequential Search takes  $O(N)$  time complexity for doing the search operation.

For branch and bound search Dynamic programming principle can be used to discard redundant partial paths. In Exponential Search, we repeatedly double the index until either  $i$  is greater than or equal to the length of the array or the value at index  $i$  is greater than or equal to the target value  $x$ .

Binary Search takes  $O(\log N)$  time complexity for doing the search operation.

10. Answer - B) Dijkstra's algorithm is used to find the shortest path from a source node to all other nodes in a weighted graph.

11. Answer - D) All the above algorithms are used for string and pattern matching.

12. Answer - B) The 0/1 Knapsack is not an NP-Hard problem.

13. Answer - C) Backtracking is used for solving the N Queens Problem.

14. Answer - B) Dijkstra's algorithm is used to solve single source shortest path problems.

15. Answer - C) Hamiltonian path problem is an NP-complete problem.

16. Answer - B) The approach followed in Floyd Warshall's algorithm is dynamic programming.

17. Answer - B) Kruskal's Algorithm works on the greedy algorithm of taking the lowest weight edges in the MST of a graph unless it forms a cycle.

18. Answer - A) The recurrence relation for Tower of Hanoi is  $T(N)=2T(N-1)+1$ ;

19. Answer - B) The Bellmann Ford Algorithm returns a boolean value.