

March 2023

ALGORITHMS

Time Allowed: 2.5 Hours

Full Marks: 60

Answer to Question No. 1 of Group A is compulsory and to be answered first. This answer is to be made in separate loose script(s) provided for the purpose. Maximum time allowed is 30 minutes, after which the loose answer scripts will be collected and fresh answer scripts for answering the remaining part of the question will be provided. On early submission of answer scripts of Question No. 1, a student will get the remaining script earlier.

Answer any Five (05) Questions from Group B.

Group A

1. Choose the correct answer from the given alternatives (any twenty): 1x20

- i) ADT full form
 - a) About Data Type
 - b) Abandoned Data Type
 - c) Abstract Data Type
 - d) Absolute Data Transaction.
- ii) In a multiset, elements are arranged in an unordered manner, with elements having a multiplicity of -----?
 - a) One
 - b) More than one
 - c) Zero
 - d) All of the above.
- iii) Binary Search can be categorized into which of the following?
 - a) Graph algorithm,
 - b) Divide and conquer,
 - c) Greedy algorithm,
 - d) Dynamic programming.
- iv) What is the time complexity of binary search with iteration?
 - a) $O(n \log n)$,
 - b) $O(\log n)$,
 - c) $O(n)$,
 - d) $O(n^2)$.
- v) Which of the following is/are property/properties of a dynamic programming problem?
 - a) Optimal substructure,
 - b) Overlapping sub-problems,
 - c) Greedy approach,
 - d) Both optimal substructure and overlapping sub-problems.
- vi) A circuit that does not repeat vertices is called
 - a) a cycle
 - b) a path
 - c) a tree
 - d) a directed graph
- vii) What is the time complexity of Kruskal's algorithm (E is the number of edges and V is the number of vertices of input graph)?
 - a) $O(\log V)$,
 - b) $O(E \log V)$,
 - c) $O(E^2)$,
 - d) $O(V \log E)$.

- viii) Time complexity of insertion sort is
- Linear,
 - Quadratic,
 - Cubic,
 - Exponential.
- ix) If $A = \{x, y, z\}$, number of elements of the power set of A is:
- 6
 - 8
 - 10
 - 12
- x) Which option contains two equal sets?
- $X = \{5, 6\}$ and $Y = \{6\}$
 - $X = \{5, 6, 8, 9\}$ and $Y = \{6, 8, 5, 9\}$
 - $X = \{5, 6, 9\}$ and $Y = \{5, 6\}$
 - $X = \{5, 6\}$ and $Y = \{5, 6, 3\}$
- xi) Time complexity depends on
- Compile time
 - Run time
 - both Compile time and Run time
 - None of these
- xii) Which of the following is a linear data structure?
- Array
 - AVL Trees
 - Binary Trees
 - Graphs
- xiii) What is the maximum number of swaps that can be performed in the Selection Sort algorithm?
- $n - 1$
 - n
 - 1
 - $n - 2$
- xiv) Which of the following has search efficiency of $O(1)$?
- Tree
 - Heap
 - Hash Table
 - Linked-List
- xv) MST full form is:
- Maximum Spanning Tree
 - Maximum Sub Tree
 - Minimum Spanning Tree
 - Minimum Sub Tree
- xvi) If the array is already sorted, which of these algorithms will exhibit the best performance
- Merge Sort
 - Insertion Sort
 - Quick Sort
 - Heap Sort
- xvii) What is the maximum number of swaps that can be performed in the Bubble Sort algorithm?
- $n - 1$
 - n
 - 1
 - $n*(n - 1)/2$

- xviii) To main measures of the efficiency of an algorithm are?
- Time and space complexity
 - Data and space
 - Processor and memory
 - Complexity and capacity
- xix) If several elements are competing for the same bucket in the hash table, what is it called?
- Diffusion
 - Replication
 - Collision
 - Duplication
- xx) Quick Sort algorithm is a
- Dynamic Programming
 - Computer programming
 - Divide & Conquer Algorithm
 - Greedy algorithm
- xxi) Name of the data structure uses by recursion is:
- Stack
 - Queue
 - Array
 - Linked list
- xxii) DAG full form is:
- Direct Aligned Graph
 - Direct Acyclic Graph
 - Defined Aligned Graph
 - Defined Acyclic Graph
- xxiii) Dijkstra's algorithm is known as
- All pair shortest path
 - All pair longest path
 - Single Source longest Path
 - Single Source shortest path
- xxiv) Which of the following is true?
- Prim's algorithm initializes with a vertex,
 - Prim's algorithm initializes with an edge,
 - Prim's algorithm initializes with a vertex which has smallest edge,
 - Prim's algorithm initializes with a forest.
- xxv) Which of the following algorithms are used to find the shortest path from a source node to all other nodes in a weighted graph?
- BFS.
 - Dijkstra's Algorithm.
 - Prims Algorithm.
 - Kruskal's Algorithm.

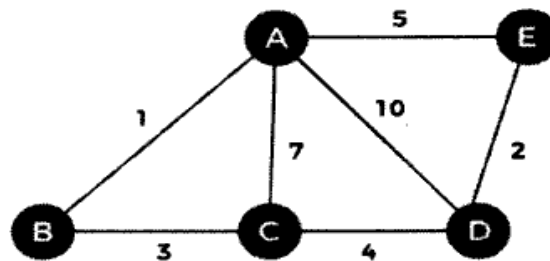
Group B

- What is Algorithm? Explain Big-Oh (O) asymptotic notation. 2+2
 - What is Time complexity? Why Are Time and Space Complexities important? 2+2
- Find time complexity of following: 4


```

i=1;
while (i ≤ n)
{
    printf ("CST\n");
    i = i * 2;
}
          
```
 - Explain the basic concept of divide and conquer algorithmic model. 4

4. a) State the conditions when linear search can be considered. 2
 b) Write an algorithm of binary search. Explain why complexity of binary search is $O(\log n)$? 4+2
5. a) Explain the signification and advantage of height balancing of binary search tree? 4
 b) Write a pseudo code of insertion operation in binary search tree. 4
6. a) How does the Prim's algorithm work? 3
 b) Construct a minimum spanning tree from this weighted graph using Kruskal's algorithm. 5



7. Explain Merge sort algorithm with suitable example. 8
8. a) What is hashing?
 b) Briefly discuss about different collision resolution techniques. 2+6
9. a) Write down Dijkstra's Shortest-Path Algorithm.
 b) Explain it with suitable example. 5+3
10. a) Write down Rabin- Karp algorithm for string matching.
 b) Compare Rabin Karp and KMP algorithm. 6+2