JANUARY 2024

# ALGORITHMS

*Time Allowed: 2.5 Hours* *Full Marks: 60*

**Answer to Question No. 1 of Group A must be written in the main answer script. In Question No. 1, out of 2 marks for each MCQ, 1 mark is allotted for right answer and 1 mark is allotted for correct explanation of the answer.**
**Answer any Five (05) Questions from Group-B.**

## GROUP-A

1. **Choose the correct answer from the given alternatives and explain your answer (any ten): 2x10=20**

i) LIFO scheme is used in _____ data structure.
a) stack, b) queue, c) linked list, d) tree.

ii) Which of the following sorting algorithms has a worst-case time complexity of $O(n \log n)$?
a) Bubble sort, b) Merge sort, c) Selection sort, d) Insertion sort.

iii) $O$-notation provides an asymptotic
a) upper bound, b) lower bound, c) light bound, d) tight bound.

iv) Time complexity of worst case for Linear Search is
a) $O(1)$, b) $O(\log n)$, c) $O(n)$, d) $O(n^2)$.

v) Which of the following algorithm design technique is used in the Marge sort algorithm?
a) Dynamic programming, b) Greedy Method, c) Divide and conquer, d) Backtracking.

vi) Which of the following is false in the case of a spanning tree of a graph $G$?
a) It is tree that spans $G$, b) It is a sub-graph of the $G$, c) It includes every vertex of the $G$, d) It can be either cyclic or acyclic.

vii) Which of the following is true?
a) Prim's algorithm initializes with a vertex, b) Prim's algorithm initializes with an edge, c) Prim's algorithm initializes with a vertex which has smallest edge, d) Prim's algorithm initializes with a forest.

viii) Topological sort can be applied to which of the following graphs?
a) Undirected Cyclic Graphs, b) Directed Cyclic Graphs, c) Undirected Acyclic Graphs, d) Directed Acyclic Graphs.

ix) A Circuit that does not repeat vertices is called
x) a) cycle, b) path, c) tree, d) directed graph.

xi) What is a hash table?
a) A structure that maps values to keys, b) A structure that maps keys to values, c) A structure used for storage, d) A structure used to implement stack and queue.

xii) Dijkstra's algorithm is used for finding
a) minimum spanning tree, b) shortest path, c) string matching, c) sorted sequence.

xiii) A graph is called a ____ if it is a connected acyclic graph.
a) cyclic graph, b) regular graph, c) tree, d) forest.

xiii) A binary tree is balanced if the difference of height between left and right sub-tree is not more than
a) 0, b) 1, c) 2, d) 3.

xiv) The following numbers are inserted into an empty binary search tree in the given order: 10, 1, 3, 5, 15, 12, 16. What is the number of leaf nodes of the binary search tree?
a) 3, b) 4, c) 5, d) 6.

xv) What is a Rabin and Karp Algorithm?
a) String Matching Algorithm, b) Shortest Path Algorithm, c) Spanning Tree Algorithm, d) Approximation Algorithm.

## GROUP-B

**Answer any Five (05) questions.** **8x5**

2. What is Algorithm? Explain the difference between set and multi-set. Write the pseudo code of PUSH and POP operation. 2+2+4

3. Write down the selection sort algorithm. Explain the steps of selection sort algorithm using an example. Find the worst-case time complexity of selection sort algorithm. 3+3+2

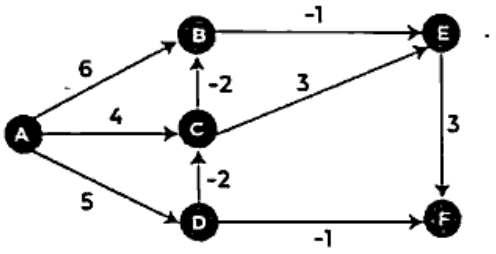
4. Write down the Prim's algorithm for finding minimum spanning tree. Explain the steps of Prim's algorithm using an example. 4+4

5. What is the significance of linear sort algorithm? Explain the limitations of linear sort. Discuss Bucket sort with an example. 2+2+4

6. Write and explain recursive Binary search algorithm. Is binary search useful for an unsorted array? Find Time complexity of Binary search algorithm. 4+1+3

7. What is Hashing? Describe the uses of Hash Table and Hash Function. Discuss Chaining method as Collision resolving technique. 2+3+3

8. Write down Bellman–Ford's Shortest-Path algorithm. Explain Bellman–Ford algorithm using the following graph. 4+4




9. Write a pseudocode of Naïve String-Matching Algorithm.
Given pattern: 101110, text: 1110101011101100. Find the occurrence of pattern in the text using Naïve String-Matching Algorithm. 4+4