

Register No.: ..... Name: .....

**SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)**

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

**SEVENTH SEMESTER B.TECH DEGREE EXAMINATION (R), DECEMBER 2023****ROBOTICS AND AUTOMATION****(2020 SCHEME)****Course Code : 20RBT401****Course Name: Algorithms and Data Structures****Max. Marks : 100****Duration: 3 Hours****PART A*****(Answer all questions. Each question carries 3 marks)***

1. Differentiate linear and non-linear data structures with the help of examples.
2. What do you mean by the time complexity and space complexity of an algorithm?
3. Write the algorithm / pseudocode to insert element x at a given position k in an array of n elements.
4. With suitable example explain sparse matrix.
5. Differentiate binary tree and binary search tree.
6. How does priority queue differ from normal queue? List the applications of priority queue.
7. Differentiate B-tree and B+ tree.
8. Explain the concept of hashing using example.
9. What are randomized algorithms?
10. Write the pseudocode of greedy algorithm.

**PART B*****(Answer one full question from each module, each question carries 14 marks)*****MODULE I**

11. a) Define Big O, Big  $\Omega$  and Big  $\theta$  Notation and illustrate them graphically. (6)
- b) Explain substitution method for solving recurrence relation with the help of an example. (8)

**OR**

12. a) Explain the iteration method for solving recurrences and solve the following recurrence equation using iteration method. (7)

$$T(n) = 2T(n/2) + 2n+3; T(1) = 2$$

- b) What is a recursive algorithm? Explain different types of recursive algorithms with examples. (7)

**MODULE II**

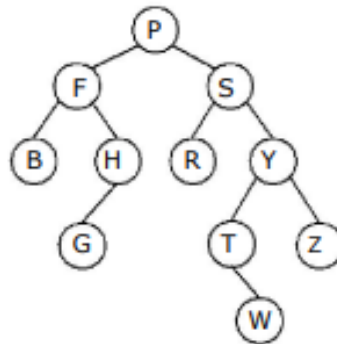
13. a) Assume that a queue is represented using a linked list. Write algorithms for the following operations: - (i) Insertion (ii) Deletion. (7)
- b) Apply infix to postfix algorithm to get the equivalent postfix expression for the given expression:  $A+B-C*D+(E^F)*P/X/Y*Q+T$  (7)

**OR**

14. a) Differentiate singly linked list and doubly linked list. Design algorithms to delete a node from: (8)
- (i) the beginning.
- (ii) end of the doubly linked list.
- b) Write an algorithm to perform push and pop operations on stack using array. (6)

**MODULE III**

15. a) List the order in which the following binary tree is traversed using preorder, post order and in order methods.

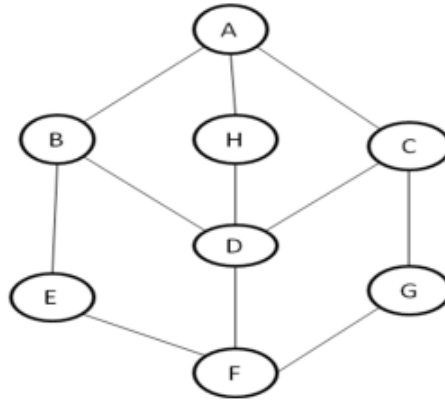


(6)

- b) Illustrate various graph traversal algorithms. (8)

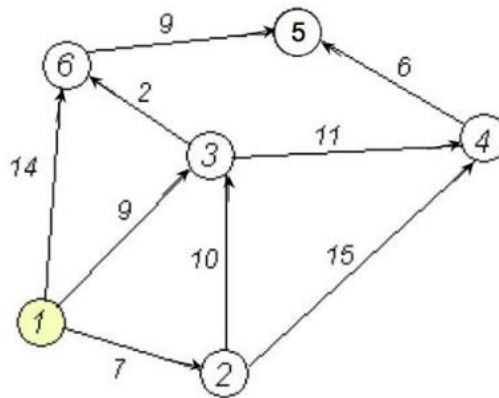
**OR**

16. a) Explain with example the various ways in which graphs can be represented. Enumerate the advantages and disadvantages of each representation. (7)
- b) Apply DFS and BFS traversal algorithms on the given graph. (7)



**MODULE IV**

17. a) Apply Dijkstra’s algorithm to find the shortest path from node 1 to all other nodes in the graph.



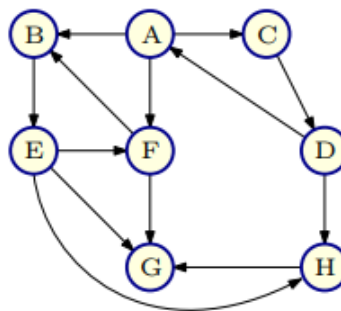
(7)

- b) Write the algorithm to perform binary search in an array of n elements. Using binary search algorithm search for the element 19 in the set [7, 11, 19, 27, 33, 45, 52, 71]

(7)

**OR**

18. a) What do you mean by strongly connected components of a graph? Obtain the strongly connected components of the given graph.



(7)

- b) Write the algorithm to perform insertion sort in an array of n elements. Sort the array elements [4, 1, 3, 9, 7, 5] in ascending order using insertion sort.

(7)

**MODULE V**

19. a) With suitable example explain the divide and conquer algorithm design strategy. (7)
- b) What are the necessary conditions for a decision problem to be NP complete? Explain NP complete problem in detail with example. (7)

**OR**

20. a) Illustrate the working of branch and bound algorithm. (7)
- b) Explain dynamic programming in detail with example. (7)

\*\*\*\*\*