

Register No.: Name:

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

THIRD SEMESTER B.TECH DEGREE EXAMINATION (R,S), DECEMBER 2023**COMPUTER SCIENCE AND ENGINEERING****(2020 SCHEME)****Course Code : 20CST201****Course Name: Data Structures****Max. Marks : 100****Duration: 3 Hours****PART A****(Answer all questions. Each question carries 3 marks)**

1. Is $2^{n+1} = O(2^n)$? Why?
2. What are the characteristics of an algorithm?
3. Convert the following infix expression into postfix expression.
($B^2 - 4 * A * C$) $^ (1 / 2)$
4. Write the queue full and queue empty condition for a circular queue.
5. Represent the polynomial $5x^3y + 3xy^2 + 7$ using a singly linked list.
6. Write an algorithm to find the maximum value in a singly linked list.
7. Write a recursive algorithm for pre-order traversal in a binary tree.
8. Draw the binary tree whose sequential representation is given below:

1	2	3	4	5	6	7	8	9	10	11
/	+	-	A	*	C	D			B	C

9. Differentiate between min-heap and max-heap.
10. Explain any 2 hashing functions.

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

11. a) Calculate the run-time efficiency of the following program segment using frequency count analysis. (5)


```
for (i = 1; i <= n; i++)
for (j = 1; j <= i; j++)
printf ("%d %d \n", i, j);
```
- b) Describe the various notations used to describe the asymptotic running time of an algorithm. (9)

OR

12. a) Write an algorithm to find the sum of two square matrices and find the time complexity of the algorithm using frequency count method. (6)

- b) Write a brief note on system life cycle and discuss all the phases of life cycle. (8)

MODULE II

13. a) Write an algorithm to insert and delete elements from a priority queue. (6)
 b) Write an algorithm to evaluate postfix expression. Trace the algorithm on the following input $2\ 7\ +\ 9\ 3\ /\ 2\ 3\ -\ 5\ 2\ \wedge\ +\ * -$ (all numbers are single digits) (8)

OR

14. a) Describe the various operations involved in double ended queue. (6)
 b) Distinguish between linear search and binary search. Illustrate the steps to find the element 47 using linear search and binary search from the given set of elements: 11, 24, 29, 32, 35, 47, 58. (8)

MODULE III

15. a) Free memory blocks of size (in the order) 300K, 700K, 400K, 500K and 800K are available. Show the memory allocation for a sequence of job requests of size (in the order) 410K, 615K, 110K and 625K in first-fit, best-fit and worst-fit allocation strategies. (6)
 b) Given a singly linked list, write an algorithm that removes a node with a particular value from the list and inserts it in the front. (8)

OR

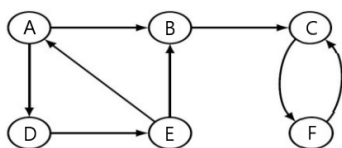
16. a) Write an algorithm to reverse a singly linked list. (6)
 b) Write an algorithm to delete the first node from a doubly linked list and insert it at the end. (8)

MODULE IV

17. a) Write an algorithm to construct a binary search tree. Create a binary search tree for the following elements 9, 4, 13, 6, 11, 17, 14 and 12. (8)
 b) Perform preorder, inorder and postorder traversal of the binary search tree constructed in question 17 a. (6)

OR

18. a) Write the algorithms for DFS and BFS traversal on a graph. (8)
 b) Perform DFS and BFS on the given graph starting from vertex E (8)



MODULE V

19. a) Write an algorithm to implement insertion sort. Show all the passes using insertion sort for the following list 25, 7, 46, 11, 85. (8)
- b) Write an algorithm for merge sort technique. (6)

OR

20. a) What are the characteristics of a good hash function? (4)
- b) Given the values {2341, 4234, 2839, 430, 22, 397, 3920} a hash table of size 7 and a hash function $h(x) = x \text{ mod } 7$, show the resulting table after inserting the values in the given order with each of the following collision strategies. (10)
- (i) separate chaining
 - (ii) linear probing
 - (iii) double hashing with second hash function $h^1(x) = (2x - 1) \text{ mod } 7$.
