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Total No. of Pages : 03

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B.Tech.(CSE / AI & DS / AI & ML / Block Chain / Cyber Security / DS / Robotics & Artificial Intelligence / Internet of Things and Cyber Security including Block Chain Technology) (Sem.-3)

DATA STRUCTURE & ALGORITHMS

Subject Code : BTCS-301-18

M.Code : 76436

Date of Examination : 02-01-2025

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY** consisting of **TEN** questions carrying **TWO** marks each.
2. **SECTION-B** contains **FIVE** questions carrying **FIVE** marks each and students have to attempt any **FOUR** questions.
3. **SECTION-C** contains **THREE** questions carrying **TEN** marks each and students have to attempt any **TWO** questions.

SECTION-A

1. **Write briefly:**

- a) What is time and space complexity? Give suitable example of each.
- b) What is Big O notation? Give the Big O of inserting an element in a linear array.
- c) Given sorted array with 32 elements find the time complexity in worst case (in term of number of comparisons) for linear search, and binary search algorithm.
- d) Give any two applications of stack data structure.
- e) What is Big O for enqueue (), dequeue(), isempty(), isfull() operations for array implementation of circular queue?
- f) Give any two advantages of doubly linked list over single linked list.
- g) What is the advantage of using AVL tree over binary search tree?
- h) Give the worst case time complexity (as Big O) for bubble sort, heap sort, selection sort and merge sort.
- i) Give adjacency list and adjacency matrix representations of graph data structures.
- j) Define complete graph, strongly connected graph.

SECTION-B

2. Draw the binary search tree of the following 14,10,17,12, 11, 20, 12, 18, 25, 28, 22, 23
Delete the item say 20 from binary search tree and give the whole solution step by step diagrammatically.
3. Find the time complexity of the following code and mention it in Big O

```
int fun(int n)
{
    int count = 0;
    for (int i = n; i > 0; i /= 2)
        for (int j = 0; j < i; j++)
            count += 1;
    return count;
}
```
4. Write an algorithm to remove second last occurrence of an item from single linked list.
5. The keys 12, 18, 13, 2, 3, 23, 5 and 15 are inserted into an initially empty hash table of length 10 using open addressing with hash function $h(k) = k \bmod 10$ and linear probing. What is the resultant hash table (also show intermediate tables)?
6. Suppose you are given an implementation of a queue of integers. The operations that can be performed on the queue are :
 - a) isEmpty (Q) — returns true if the queue is empty, false otherwise.
 - b) delete (Q) — deletes the element at the front of the queue and returns its value.
 - c) insert (Q, i) — inserts the integer i at the rear of the queue.

Consider the following function :

```
void f(queue Q){
    int i;
    if (!isEmpty(Q)) {
        i = delete(Q);
        f(Q);
        insert(Q, i);
    }
}
```

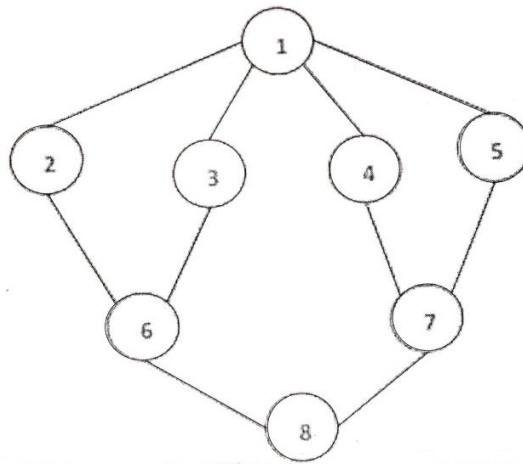
What operation is performed by the above function f()? Give step by step explanation with suitable example.

SECTION-C

7. Using the algorithms first convert infix to postfix and then evaluate postfix (give the step by step solution) for evaluating the following expression P.

$$P: (12/(7-3)) + (1 + 5)*2$$

8. Illustrate the execution of heap sort (in increasing order) in the sequence 3, 6, 17, 5, 11, 23, 38, 19, 26, 14.
9. What is DFS and BFS traversal of graph? Give the DFS and BFS traversal (starting with node 1) of graph. Show all intermediate steps.



NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.