

**BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI**  
**HYDERABAD CAMPUS,**  
**Data Structures and Algorithms**  
**CS F211**  
**Homework Assignment – 10**

1. Write a menu driven C program to implement a hash table of size 10. Consider input keys {71, 23, 73, 99, 44, 19, 49, 93, 81, 39} using the hash function  $h(k) = k \bmod 10$ . Upon collisions use chaining (linked-list). Your program must support the following operations.
  - a. Insert an element
  - b. Print the hash table
  - c. Searching an element (i.e., search (key))
  - d. Delete an element
  - e. Exit
2. Write a menu driven C program to implement a hash table of size 10. Consider input keys {71, 23, 73, 99, 44, 19, 49, 93, 81, 39} using the hash function  $h(k) = k \bmod 10$ . Upon collision you use another hashing function  $h'(k) = 7 - k \bmod 7$ , and on further collisions use chaining (use a doubly-linked list). Your program must support the following operations.
  - a. Insert an element
  - b. Print the hash table
  - c. Searching an element (i.e., search (key))
  - d. Delete an element
  - e. Exit
3. Write a menu driven C program to implement a hash table of size 10. Consider input keys {71, 23, 73, 99, 44, 19, 49, 93, 81, 39} using the hash function  $h(k) = k \bmod 10$ . Upon collisions use linear probing ( $h(k) = (k+i) \bmod 10$ ). Your program must support the following operations.
  - a. Insert an element
  - b. Print the hash table
  - c. Searching an element (i.e., search (key))
  - d. Delete an element
  - e. Exit
4. Write a menu driven C program to implement a hash table of size 10. Consider input keys {71, 23, 73, 99, 44, 19, 49, 93, 81, 39} using the hash function  $h(k) = k \bmod 10$ . Upon collisions use quadratic probing ( $h(k) = (k+i^2) \bmod 10$ ). Your program must support the following operations.
  - a. Insert an element
  - b. Print the hash table
  - c. Searching an element (i.e., search (key))
  - d. Delete an element
  - e. Exit
5. You are given a rectangular map of Japan. This map is stored in 2D array of  $M \times N$  where each cell contains 'L' or 'W'. 'L' represents land and 'W' represents water. 2 cells are adjacent to each other, if they share a side. So there can be at the most 4 neighbours for any cell (Up, Down, Left, Right). Now, an island is a piece of connected land. You have to find the number of islands present.

Input:

3 4

WWWL

LLWL

LWWL

Output:

2

Note: You should create dummy tree with integer data.

6. Write a C program to print post order traversal of a binary tree without using recursion.

Note: You should create dummy tree with integer data.

7. Write a C program to print the level order traversal of a binary tree.

Note: You should create dummy tree with integer data.

8. Red Black Trees: Implement a multi-set  $M$  (a set that allows multiple instances of the set's entries) that supports the following functionalities:

- i. Initialize – Creates an empty data structure  $M$  in  $O(1)$  time.
- ii. Insert element – Takes an element as input and inserts it into the tree in  $O(\log|M|)$  time.
- iii. Remove element – Takes an element as input and removes one copy of that element in  $O(\log|M|)$  time.
- iv. Frequency – Takes an element as input and returns the number of copies of that element present in  $M$  in  $O(\log|M|)$  time.
- v. Select – Returns the  $k$ th element in the sorted order of elements in  $M$  in  $O(\log|M|)$  time.

Note: Assume that the elements are integers.

9. Binary Search Trees: Construct a Binary Search Tree from its pre-order traversal. For example, if the given traversal is  $\{10, 5, 1, 7, 40, 50\}$ , then the output tree should be

```
10
 | \
5  40
|\  \
1 7  50
```

10. A king conducted "Swayamwar" of his daughter Rochelle.  $N$  princes wish to marry her. Rochelle will consider the proposal of only those princes who have some abilities. Rochelle has a list of  $M$  abilities which she wants in a prince. She can also consider those princes who have some extra qualities, provided they have at least all those qualities but it is mandatory to have the qualities that Rochelle wants. Find how many princes' proposal will Rochelle consider.

Input:

First line contains the integer  $M$ , denoting the number of qualities which Rochelle wants.

Next line contains  $M$  single space separated distinct integers.  $i$ th number will be ability  $i$  that rochelle wants.

Third line contains an integer  $N$ , denoting the number of boys.

Next follow N lines, ith line contains few single-space separated distinct integers, denoting the qualities of the ith prince.

Output:

Print the number of princes, whose proposals will be considered by Rochelle.

Constraints:

$$1 \leq M \leq 100$$
$$1 \leq N \leq 9 \times 10^3$$

1 ≤ Maximum no. of qualities possessed by princes ≤ 1000.

Qualities are positive non-zero integers such that  $1 \leq \text{Quality} \leq 10^4$

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