

**INDIAN INSTITUTE OF TECHNOLOGY ROORKEE**

**ROORKEE – 247 667**

**Data Structures (CSN 102), B.Tech CSE and ECE**

Assignment: 5

Spring Semester 2015-16

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1. The n-queens problem consists in placing n non-attacking queens on an n-by-n chess board. A queen can attack another queen vertically, horizontally, or diagonally. E.g. placing a queen on a central square of the board blocks the row and column where it is placed, as well as the two diagonals (rising and falling) at whose intersection the queen was placed. Write a program in JAVA/C++ to solve this problem using recursion as well as without recursion.
  2. Write an algorithm/C++ code for the following operations in DEQUE. Also write the same operations for input restricted and output restricted DEQUE.
    - (i) **insert()**
    - (ii) **delete()**
  3. What is meant by Priority Queue? Give general and computer oriented examples.
  4. Write insertion and deletion operations in queues using circular linked list with header node.
  5. Write the following operations in doubly linked list.
    - (ii) **addToHead(int)**
    - (iii) **addToTail(int)**
    - (iv) **deleteFromHead()**
    - (v) **deleteFromTail()**
    - (vi) **deleteNode(int)**
    - (vii) **addNode(int)**
    - (viii) **isInList(int)**
    - (ix) **printForward()**
    - (x) **printBackward()**
  6. Write a C++ or JAVA function **pop()** and **pop\_bottom()** for the stack.
  7. For hashing index, how to resolve the collision problem? Provide at least two solutions with idea first followed by an example.
  8. Let us assume that input data given to us is  $n$  integers between 1 and 10000. The size of hash table is 1029. The hash value of an element  $x \in \{1,2,3...10000\}$  (denoted by  $h(x)$ ) is given by the following formula,  $h(x) = x \bmod 1029$ . Use separate chain for storing the data. Now  $m$  integers in the range  $\{1,2,3...10000\}$  will be given and you have to search whether the given integer is present or not in the hash table. Let S be sum of steps that

you need to execute for a given set of  $m$  elements. Now  $S/m$  is the average complexity of the  $m$  searches.

The Pseudo code for the prescribed procedure is as follows.

```
for (k=1 to n)
{ generate random integers uniformly from the range
{1,2,...,10000};
  store the element in the hash table at appropriate
location;
}
Sum=0;
for (k=1 to m)
{generate random integers uniformly from the range
{1,2,...,10000};
check if the generated number is present in hash
table;
Let Search_k be the number of steps to search kth
element, then
Sum=Sum+ Search_k;
}
Average_Complexity=Sum/m;
```

Write a C++/JAVA program to perform the experiment of various values of  $n$ , say in the increment of 100 starting from 1000 till 9000 and  $m=5000$ . Also plot the value of average complexity versus  $n$ .

9. Implement Radix Sort using Linked List.
10. Suppose you wish to sort two thousand 32-bit keys. You have decided to use radix sort for this and want to decide how many bits each radix sort digit. Which is the best among having 1 bit per radix sort digit, 4 bits per radix sort digit, 8 bits per radix sort digit or 16 bits per radix sort digit?
11. Give examples for lossy and lossless compression.
12. Encode the following string using LZW algorithm

**banana\_ananabd**

13. Decode the following using LZW algorithm

**<97>, <98>, <99 >, <256 >, <258 >, <257 >, <259 >, <262 >, <261>, <264>, <260 >, <266 >, <263>, <99>**