Introduction To Hashmap

Highest Frequency Character

Easy

1. You are given a string str.
2. You are required to find the character with maximum frequency.

Constraints

```
0 < str.length() <= 100
There will be a single character with highest frequency
```

Format

Input

A string str

Output

The character with highest frequency

Example

Sample Input

```
zmszeqxllzvheqwrofgcuntypejcxovtaqbnqyqlmrwitc
```

Sample Output

```
q
```

```cpp
#include <bits/stdc++.h>
using namespace std;

int main() {

  string str;
  cin >> str;

// write your code here
  unordered_map<char, int> occ;
  for(int i {}; i< str.size(); i++){
    occ[str[i]]++;
  }

  int max = INT_MIN;
  char ans;
  for(pair<char, int> p : occ){
    if(p.second > max ){
      max = p.second;
      ans = p.first;
    }
  }

  cout<<ans<<endl;
  return 0;
}
```

Get Common Elements - 1

Easy

1. You are given a number n1, representing the size of array a1.
2. You are given n1 numbers, representing elements of array a1.
3. You are given a number n2, representing the size of array a2.
4. You are given n2 numbers, representing elements of array a2.
5. You are required to print all elements of a2 which are also present in a1 (in order of their occurence in a2). Make sure to not print duplicates (a2 may have same value present many times).

Constraints

```
1 <= n1, n2 <= 100
0 <= a1[i], a2[i] < 10
Time complexity should be O(n)
```

Format

Input

A number n1
n1 number of elements line separated
A number n2
n2 number of elements line separated

Output

All relevant elements of a2 in separate lines (no duplicacy)

Example

Sample Input

```
9
5
5
9
8
5
5
8
0
3
18
9
7
1
0
3
6
5
9
1
1
8
0
2
4
2
9
1
5
```

Sample Output

```
9
0
3
5
8
```

```
#include <iostream>
#include <unordered_map>
using namespace std;

int main() {
  int n1,n2;
  cin >> n1;
  int arr1[n1];
  unordered_map <int,int> mp;

  for (int i = 0; i < n1; i++) {
    cin>>arr1[i];
    mp[arr1[i]]++;
  }
  cin >> n2;
  int arr2[n2];
  for (int i = 0; i < n2; i++) {
    cin >> arr2[i];

    // write your code here
    if(mp.find(arr2[i]) != mp.end() ){
      cout<<arr2[i]<<endl;
      mp.erase(arr2[i]);
    }

  }
}
```

Get Common Elements - 2

Easy

1. You are given a number n1, representing the size of array a1. 2. You are given n1 numbers, representing elements of array a1. 3. You are given a number n2, representing the size of array a2. 4. You are given n2 numbers, representing elements of array a2. 5. You are required to find the intersection of a1 and a2. To get an idea check the example below: if a1 -> 1 1 2 2 2 3 5 and a2 -> 1 1 1 2 2 4 5 intersection is -> 1 1 2 2 5 Note -> Don't assume the arrays to be sorted. Check out the question video.

Constraints

1 <= n1, n2 <= 100 0 <= a1[i], a2[i] < 10 Time complexity should be O(n)

Format

Input

A number n1 n1 number of elements line separated A number n2 n2 number of elements line separated

Output

All relevant elements of intersection in separate lines The elements of intersection should be printed in order of their occurence in a2.

Example

Sample Input

```
7
1
1
2
2
2
3
5
7
1
1
1
2
2
4
5
```

Sample Output

```
1
1
2
2
5
```

```cpp
#include <iostream>
#include <unordered_map>
using namespace std;

int main() {

  //write your code here
  int n1{};
  cin >> n1;
  unordered_map <int,int> um;
  for(int i {};i < n1;i++){
    int a ;
    cin>> a;
    um[a]++;
  }

  int n2{};
  cin>>n2;
  for(int i{} ; i< n2;i++){
    int a{};
    cin>> a;
    if(um.find(a) != um.end() && um[a] > 0){
      cout<<a<<endl;
      um[a]--;
    }
  }
  return 0;


}
```

Longest Consecutive Sequence Of Elements

Hard

1. You are given a number n, representing the size of array a.
2. You are given n numbers, representing elements of array a.
3. You are required to print the longest sequence of consecutive elements in the array (ignoring duplicates).

Note -> In case there are two sequences of equal length (and they are also the longest), then print the one for which the starting point of which occurs first in the array.

Constraints

```
1 <= n <= 30
0 <= n1, n2, .. n elements <= 15
```

Format

Input

A number n
n1
n2
.. n number of elements

Output

Elements of longest sequence of consecutive elements of array in separate lines (ignoring duplicates)

Example

Sample Input

```
17
12
5
1
2
10
2
13
7
11
8
9
11
8
9
5
6
11
```

Sample Output

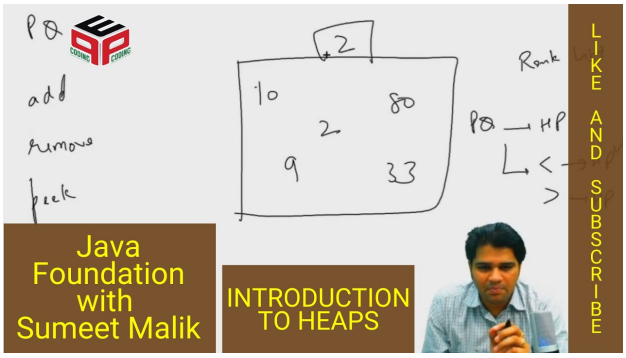
```
5
6
7
8
9
10
11
12
13
```

```cpp
#include <iostream>
#include <vector>
#include <unordered_map>
using namespace std;

void longestConsecutive(vector<int> &num) {

//write your code here
//on leet code my solution was more efficient in time complexity
but less in space
  unordered_map <int, bool> um;
  for(int n : num){
    um[n] = true;
  }
  for(int n: num){
    if(um.find(n-1) != um.end()) {
      um[n] = false; // it is not the starting of any sequence
    }
  }
  int max_start_ele{};
  int max_length{};
  for(int n: num){
    if(um[n] == true) {
      int t_length{1};
      while(um.find(n + t_length) != um.end()){
        t_length++;
      }
      // cout<<n<<"--"<<t_length<<endl;
      if(t_length > max_length){
        max_length = t_length;
        max_start_ele = n;
      }

    }
  }
  int a = max_start_ele;
  // cout<<max_start_ele<<"--"<<max_length<<endl;
  for(int i {} ;i < max_length ;i++){
    cout<<a<<endl;
    a++;
  }

}

int main()
{
  vector<int>arr;
  int n;
  cin >> n;
  for (int i = 0 ; i < n; i++) {
    int data;
    cin >> data;
```

```
    arr.push_back(data);
  }
    longestConsecutive(arr);

  return 0;
}
/*
my solution

#include <iostream>
#include <vector>
#include <unordered_map>
using namespace std;

int length_from_this_element(int ele,unordered_map <int, int> &um)
{
  if(um.find(ele) == um.end()){
    return 0;
  }
  if(um[ele] > 0){
    return um[ele];
  }
  int ahead_lenght = length_from_this_element(ele+1,um);

  um[ele] = ahead_lenght + 1;

  return um[ele];

}


void longestConsecutive(vector<int> &num) {
//write your code here
    int start_ele {};
    // int start_ele_ind {};
    int max_conse_length{};

    unordered_map <int,int> um;
    for(int i{} ;i < num.size() ; i++ ) {
      um[num[i]] = 0;
    }

    int this_length {};
    for(int i{} ;i < num.size() ; i++ ) {
      if(um[num[i]] == 0){
        this_length = length_from_this_element(num[i], um);
      }
      if(this_length > max_conse_length){
        start_ele = num[i];
        // start_ele_ind = i;
        max_conse_length = this_length;
      }
```

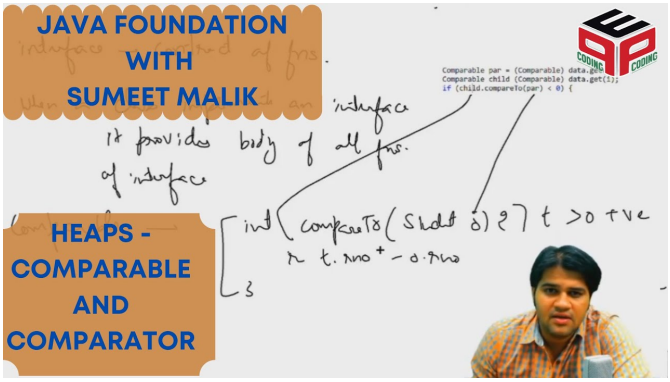
```
    }

  for(int i {};i < max_conse_length ;i++){
    cout<<start_ele<<endl;
    start_ele++;
  }
}

int main()
{
  vector<int>arr;
  int n;
  cin >> n;
  for (int i = 0 ; i < n; i++) {
    int data;
    cin >> data;
    arr.push_back(data);
  }
    longestConsecutive(arr);

  return 0;
}
*/
```

Introduction To Heap



Efficient Heap Constructor

Heap - Comparable V/S Comparator



K Largest Elements

Easy

1. You will be given an Array with its length
2. You will also be given an integral value k
3. You need to find k largest elements from the given array
4. Input is handled for you
5. It is a functional problem ,please do not modify main()

Constraints

```
1 <= N <= 100
 K <= N
 -1000 <= C[i] <= 1000
```

Format

Input

Input is handled for you

Output

Output MUST be in descending order

Example

Sample Input

```
8
44 -5 -2 41 12 19 21 -6
2
```

Sample Output

```
44 41
```

```
#include<iostream>
 #include<vector>
 #include<string>
 #include<queue>
 using namespace std;
 // ------------------------------------------------------
 // This is a functional problem. Only this function has to be
written.
 // This function takes as input an array,n length of array and k.
 // It should print required output.
 void solve(int n,vector<int>& arr,int k){
     //Write your code here
     priority_queue<int,vector<int>,greater<int>> pq;
     for(int a:arr){
         if(pq.size() < k){
            pq.push(a);
         }else{
             if(a > pq.top()){
                 pq.pop();
                 pq.push(a);
             }
         }
     }
    string ans{""};
```

```
    while(pq.size() >0){
        ans = to_string(pq.top()) + " "+ans;
        pq.pop();
    }
    cout<<ans<<endl;

}

int main(int argc,char** argv){
    int n;
    cin>>n;

    vector<int> v(n);
    for(int i=0;i<n;i++)
        cin>>v[i];

    int k;
    cin>>k;
    solve(n,v,k);
}
```

Sort K-sorted Array

Easy

1. You are given a number n, representing the size of array a.
2. You are given n numbers, representing elements of array a.
3. The array is nearly sorted. Every element is at-max displaced k spots left or right to it's position in the sorted array. Hence it is being called k-sorted array.
4. You are required to sort and print the sorted array.

Note -> You can use at-max k extra space and nlogk time complexity.

Constraints

```
1 <= n <= 30
0 <= n1, n2, .. n elements <= 100
0 < k <= n
```

Format

Input

Input is managed for you

Output

Print the elements of sorted array in separate lines.

Example

Sample Input

```
9
3
2
4
1
6
5
7
9
8
3
```

Sample Output

```
1
2
3
4
5
6
7
8
9
```

```
#include <bits/stdc++.h>
using namespace std;
// #include <iostream>
// #include <vector>
// #include <queue>
// using namespace std;

void sortK(int arr[], int n, int k){

//write your code here
```

```
    priority_queue<int,vector<int>,greater<int>> pq;

    // cout<<"-----------------------------"<<endl;
    //queue size k
    //  for(int i{} ;i < n ;i++) {
    //      if(pq.size() < k){
    //         pq.push(arr[i]);
    //      }else{
    //          if(arr[i] > pq.top()){
    //              cout<<pq.top()<<endl;
    //              pq.pop();
    //              pq.push(arr[i]);
    //          }else{
    //              cout<<arr[i]<<endl;
    //          }
    //      }
    //  }
    //

    //queue size k+1
    for(int i{} ; i <= k ;i++) {
        pq.push(arr[i]);
    }
    for(int i{k+1} ;i< n;i++){
        cout<<pq.top()<<endl;
        pq.pop();
        pq.push(arr[i]);
    }
     while(pq.size() > 0) {
         cout<<pq.top()<<endl;
         pq.pop();
     }


}

int main()
{
    int n;
    cin>>n;
    int arr[n];
    for(int i = 0 ; i<n ; i++){
        int data;
        cin>>data;
        arr[i]=data;
    }
    int k;
    cin>>k;
    sortK(arr, n, k);
    return 0;
}
```

Median Priority Queue

Hard

1. You are required to complete the code of our MedianPriorityQueue class. The class should mimic the behaviour of a PriorityQueue and give highest priority to median of it's data.
2. Here is the list of functions that you are supposed to complete
2.1. add -> Should accept new data.
2.2. remove -> Should remove and return median value, if available or print "Underflow" otherwise and return -1
2.3. peek -> Should return median value, if available or print "Underflow" otherwise and return -1
2.4. size -> Should return the number of elements available
3. Input and Output is managed for you.

Note -> If there are even number of elements in the MedianPriorityQueue, consider the smaller median as median value.

Constraints

None

Format

Input

Input is managed for you

Output

Output is managed for you

Example

Sample Input

```
add 10
add 20
add 30
add 40
peek
add 50
peek
remove
peek
remove
peek
remove
peek
remove
peek
quit
```

Sample Output

```
20
30
30
20
20
40
40
10
10
50
```

```cpp
#include <iostream>
#include <vector>
#include <queue>
using namespace std;

class MedianPriorityQueue {
    public:
    priority_queue <int> left;
    priority_queue <int, vector<int>, greater<int>> right;

    void push(int val) {
       //write your code here
       //can see sir solution in video
       //my solution
       if(left.size() == right.size()) {
           if(left.size() == 0 || val < left.top()){
               left.push(val);
           }else{
               right.push(val);
               left.push(right.top());
               right.pop();
           }

       }else{
           if(right.size() == 0 || val < right.top()){
               left.push(val);
               right.push(left.top());
               left.pop();
           }else{
               right.push(val);
           }

       }
    }

    int pop() {
        //write your code here
        if(left.size() == 0){
            cout<<"Underflow"<<endl;
            return -1;
        }
        int median = left.top();
        left.pop();
        if(left.size() < right.size()){
            left.push(right.top());
            right.pop();
        }
        return median;
    }

    int top() {
```

```
         //write your code here
        if(left.size() == 0){
            cout<<"Underflow"<<endl;
            return -1;
        }
        return left.top();;
    }

    int size() {
      //write your code here
      return left.size() + right.size();
    }
};

int main() {
    MedianPriorityQueue pq;

    string str;
    cin >> str;
    while(str!="quit"){
        if(str=="add"){
            int val;
            cin >> val;
            pq.push(val);
        }
        else if(str=="remove"){
            int val = pq.pop();
            if(val != -1) {
                cout<<val<<endl;
            }
        }
        else if(str=="peek"){
            int val = pq.top();
            if(val != -1) {
                cout<<val<<endl;
            }
        }
        else if(str=="size"){
            cout<<pq.size()<<endl;
        }
        cin >> str;
    }

    return 0;
}
```

Merge K Sorted Lists

Hard

1. You are given a list of lists, where each list is sorted.
2. You are required to complete the body of mergeKSortedLists function. The function is expected to merge k sorted lists to create one sorted list.

Constraints

```
Space complextiy = O(k)
Time complexity = nlogk
where k is the number of lists and n is number of
elements across all lists.
```

Format

Input

Input is managed for you

Output

Output is managed for you

Example

Sample Input

```
4
5
10 20 30 40 50
7
5 7 9 11 19 55 57
3
1 2 3
2
32 39
```

Sample Output

```
1 2 3 5 7 9 10 11 19 20 30 32 39 40 50 55 57
```

```cpp
#include<iostream>
#include<queue>
#include<unordered_map>
#include<vector>
using namespace std;
class Pair{
    public:
    int val;
    int vi;
    int di;

    Pair(int val, int vi,int di) {
        this-> val = val;
        this-> vi = vi;
        this-> di = di;
    }
};
struct my_comp{
    bool operator()(const Pair & a, const Pair &  b){
```

```
        return a.val > b.val;
    }
};
vector<int> mergeKSortedLists(vector<vector<int>>&lists) {
  vector<int> rv;
   //write your code here
   priority_queue<Pair,vector<Pair>, my_comp> pq;
   for(int i{};i<lists.size() ;i++) {
       Pair pr (lists[i][0],i,0);
        pq.push(pr);
   }
   while(pq.size() > 0) {
       Pair a = pq.top();
       pq.pop();
       rv.push_back(a.val);
       a.di++;
       if(a.di < lists[a.vi].size()){
           a.val = lists[a.vi][a.di];
           pq.push(a);
       }
   }

//    without using pair class in priority_queue

//    priority_queue<int,vector<int>, greater<int>> pq;
//    unordered_map<int,int> um;
//    for(int i{};i<lists.size() ;i++) {
//      um[lists[i][0]] = i;
//      pq.push(lists[i][0]);
//    }
//    vector<int> index (lists.size(),1);
//    cout<<"11111"<<endl;
// // //    cout<<"--"<<pq.top()<<endl;
// //    int t = 5;
//    while(pq.size() > 0) {
//    cout<<"--"<<pq.top()<<endl;
//      int t = pq.top();pq.pop();
//      rv.push_back(t);
//      int v_index = um[t];
//      if(index[v_index] < lists[v_index].size() ){
//        um[lists[v_index][index[v_index]]] =um[t];
//        um.erase(t);
//        pq.push(lists[v_index][index[v_index]]);
//        index[v_index]++;
//      }
//    }
  return rv;
}

int main() {
  int k;
  cin >> k;
```

```
  vector<vector<int>>lists;
  for (int i = 0; i < k; i++) {
    vector<int>list;

    int n;
    cin >> n;
    for (int j = 0; j < n; j++) {
      int data;
      cin >> data;
      list.push_back(data);
    }

    lists.push_back(list);
  }

  vector<int> mlist = mergeKSortedLists(lists);
  for (int val : mlist) {
    cout << val << " ";
  }
  cout <<endl;
  return 0;
}
```

Write Priority Queue Using Heap

Easy

1. You are required to complete the code of our Priority Queue class using the heap data structure. Please watch the question video carefully. The theoretical details of required functionality is explained in detail there. Implement the functions to achieve what is explained in the theoretical discussion in question video.
2. Here is the list of functions that you are supposed to complete:
   2.1. add -> Should accept new data.
   2.2. remove -> Should remove and return smallest value, if available or print "Underflow" otherwise and return -1.
   2.3. peek -> Should return smallest value, if available or print "Underflow" otherwise and return -1.
   2.4. size -> Should return the number of elements available.
3. Input and Output is managed for you.

Constraints

None

Format

Input

Input is managed for you

Output

Output is managed for you

Example

Sample Input

```
add 10
add 20
add 30
add 40
peek
add 50
peek
remove
peek
remove
peek
remove
peek
remove
peek
quit
```

Sample Output

```
10
10
10
20
20
30
30
40
40
50
```

```
#include<bits/stdc++.h>
using namespace std;
// #include<iostream>
// #include<string>
// #include<vector>
// using namespace std;

    vector<int> data;

    int _size() {
        //write your code here
        return
data.size();//----------------------------------------
    }

    void swap(int a , int b){
        int temp = data[a];
        data[a] = data[b];
        data[b] = temp;
    }



    void upheapify(int index) {
        if(index == 0 ) {
            return ;
        }
        int pi = (index - 1) / 2;
        if(data[index] < data[pi]){
            //swap
            swap(index, pi);
            //upheapify
            upheapify(pi);
        }

    }
    void add(int val) {
       // write your code here
       data.push_back(val);
       upheapify(data.size() - 1);

    }


    void down_heapify(int p_index) {
        int min = p_index;
        int li = (2 * p_index) +1;
        if(li < data.size() && data[li] < data[min]){
            min = li;
        }
        int ri = (2 * p_index) +2;
        if(ri < data.size() && data[ri] < data[min]) {
```

```
            min = ri;
        }
        if(min != p_index){
            swap(p_index, min);
            down_heapify(min);
        }
    }

    int _remove() {
     //write your code here
        if(data.size() == 0){
            cout<<"Underflow"<<endl;
            return -1;
        }

        //swap 1st and last
        swap(0,data.size() -1);
        //remove last
        int ans = data[data.size() -1];
        data.pop_back();

        //down_heapify
        down_heapify(0);

        return ans;

    }



    int peek() {
     //write your code here
        if(data.size() == 0){
            cout<<"Underflow"<<endl;
            return -1;
        }
        return data[0];
    }




int main(){


  while(1){
      string str;
        getline(cin,str);
      if(str[0]=='a'){
          string num=str.substr(4,str.length());
          int val=stoi(num);
```

```
            add(val);
        }else if(str[0]=='r'){
            int val=_remove();
            if(val!=-1){
                cout<<val<<endl;
            }
        }else if(str[0]=='p'){
            int val=peek();
            if(val!=-1){
                cout<<val<<endl;
            }
        }else break;
    }


}
```

Write Hashmap

Easy

1. You are required to complete the code of our Hashmap class. Please watch the question video carefully. The theoretical details of required functionality is explained in detail there. Implement the functions to achieve what is explained in the theoretical discussion in question video.
2. Input and Output is managed for you.

Constraints

None

Format

Input

Input is managed for you

Output

Output is managed for you

Example

Sample Input

```
put India 135
put Aus 5
put Canada 3
display
get China
remove Aus
get Aus
containsKey US
put US 10
put UK 20
remove US
containsKey US
put Pak 80
put China 200
display
put Utopia 0
display
put Nigeria 3
display
put India 138
display
put Sweden 1
display
put finland 20
display
quit
```

Sample Output

```
Display Begins
Bucket0 .
Bucket1 .
Bucket2 Canada@3 .
Bucket3 India@135 Aus@5 .
Display Ends
null
```

```
5
null
false
10
false
Display Begins
Bucket0 .
Bucket1 .
Bucket2 Canada@3 UK@20 Pak@80 .
Bucket3 India@135 China@200 .
Display Ends
Display Begins
Bucket0 Utopia@0 .
Bucket1 .
Bucket2 Canada@3 UK@20 Pak@80 .
Bucket3 India@135 China@200 .
Display Ends
Display Begins
Bucket0 Utopia@0 .
Bucket1 .
Bucket2 Canada@3 UK@20 Pak@80 .
Bucket3 India@135 China@200 Nigeria@3 .
Display Ends
Display Begins
Bucket0 Utopia@0 .
Bucket1 .
Bucket2 Canada@3 UK@20 Pak@80 .
Bucket3 India@138 China@200 Nigeria@3 .
Display Ends
Display Begins
Bucket0 Utopia@0 Sweden@1 .
Bucket1 .
Bucket2 Canada@3 UK@20 Pak@80 .
Bucket3 India@138 China@200 Nigeria@3 .
Display Ends
Display Begins
Bucket0 Utopia@0 .
Bucket1 .
Bucket2 Pak@80 finland@20 .
Bucket3 .
Bucket4 Sweden@1 .
Bucket5 .
Bucket6 Canada@3 UK@20 .
Bucket7 India@138 China@200 Nigeria@3 .
Display Ends
```

//no submission

I think there is little bit in base case (vscode)