DAA Lab-9

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Q-8.1) Write a menu-based program to implement the priority queue operations.
User Choice:
1 (to insert an element)
2 (to get maximum)
3 (to extract maximum)
4 (to increase the specified key to a given value)
5 (print order-level traversal of queue), and
6 (to exit).

In the beginning as well as after every operation you are supposed to print the options 1-6 to get an (user) input.

Program:

```
/*
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Idea of the solution:
        INSERT(S,x): inserts the element x into the set S, which is equivalent to the operation S = S x ∪
        MAXIMUM(S): returns the element of S with the largest key EXTRACT-MAX(S): removes and
        returns the element of S with the largest key INCREASE-KEY(S,x,k): increases the value of
        element x's key to the new value k, which is assumed to be at least as large as x's current key
        value
*/

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

void heapMax(int a[])                                  //prints maximum heap element
{
   cout<<a[0];
}
void heapify(int a[], int n, int i)                    //make max heap
{
   int l,r,largest=i;
   l=2*i+1;
   r=2*i+2;
   if (l<n&&a[l]>a[largest])
      largest=l;
   if (r<n&&a[r]>a[largest])
      largest=r;
   if (largest!=i)
   {
      int t=a[i];
```
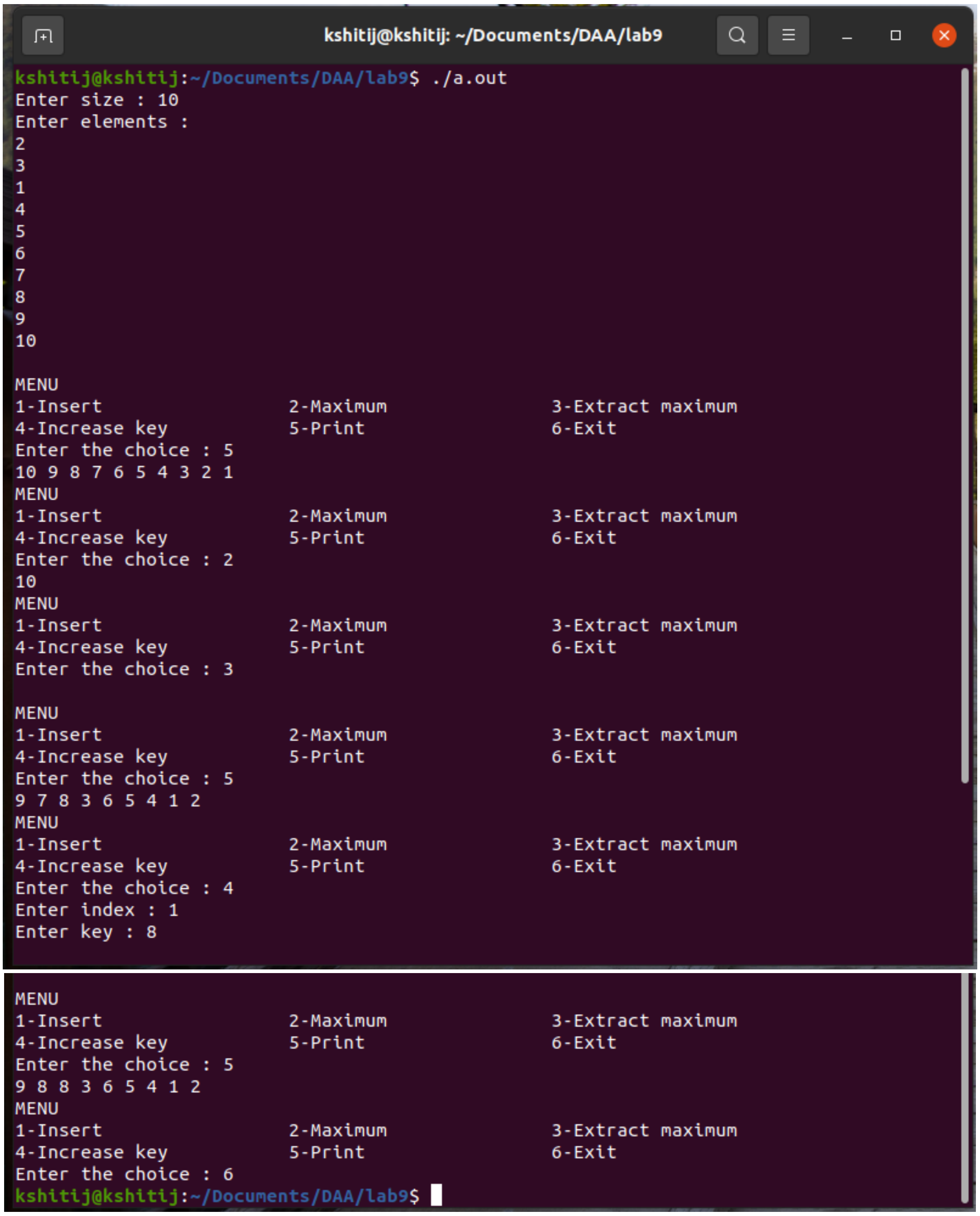

```
        a[i]=a[largest];
        a[largest]=t;
        heapify(a,n,largest);
    }
}
void heapExtractMax(int a[],int& n)                     //deletes the max element
{
    int l=a[n-1];
   a[0]=l;
   n=n-1;
   heapify(a,n,0);
}
void heapIncreaseKey(int a[],int n,int i)               //increases the key value
{
     int p=(i-1)/2;
    if(a[p]>0)
    {
        if(a[i]>a[p])
        {
            swap(a[i],a[p]);
            heapIncreaseKey(a,n,p);
        }
    }
}
void maxHeapInsert(int a[],int& n, int k)
{
    n=n+1;
    a[n-1]=k;
    heapIncreaseKey(a,n,n-1);
}
void print(int a[],int n)
{
    int i;
    for(i=0;i<n;i++)
        cout<<a[i]<<" ";
}
void increaseKey(int a[],int i,int k)
{
    if(k<a[i])
        {
            cout<<"Error \n";
            return;
        }
    a[i]=k;
    while(i>1 && a[(i-1)/2]<a[i])
    {
        swap(a[i],a[(i-1)/2]);
        i=(i-1)/2;
    }
}
int main()                                                                    //driver code
{
    int n;
    cout<<"Enter size : ";
    cin>>n;
    int i,a[n],ch;
    cout<<"Enter elements : \n";
    for(i=0;i<n;i++)
        cin>>a[i];
    sort(a,a+n,greater<int>());
    do
    {
        cout<<"\n";
        cout<<"MENU \n";
        cout<<"1-Insert      \t\t 2-Maximum \t\t 3-Extract maximum \n";
        cout<<"4-Increase key \t\t 5-Print   \t\t 6-Exit \n";
        cout<<"Enter the choice : ";
        cin>>ch;
        if(ch==1)
        {
            int k;
            cout<<"Enter key to insert : ";
            cin>>k;
            maxHeapInsert(a,n,k);
        }
        if(ch==2)
            heapMax(a);
        if(ch==3)
            heapExtractMax(a,n);
        if(ch==4)
        {
            int k,j;
            cout<<"Enter index : ";
            cin>>j;
            cout<<"Enter key : ";
            cin>>k;
            increaseKey(a,j,k);
        }
        if(ch==5)
            print(a,n);
    }while(ch<6);
}
```

Output:



```
kshitij@kshitij:~/Documents/DAA/lab9$ ./a.out
Enter size : 10
Enter elements :
2
3
1
4
5
6
7
8
9
10

MENU
1-Insert                 2-Maximum               3-Extract maximum
4-Increase key           5-Print                 6-Exit
Enter the choice : 5
10 9 8 7 6 5 4 3 2 1
MENU
1-Insert                 2-Maximum               3-Extract maximum
4-Increase key           5-Print                 6-Exit
Enter the choice : 2
10
MENU
1-Insert                 2-Maximum               3-Extract maximum
4-Increase key           5-Print                 6-Exit
Enter the choice : 3

MENU
1-Insert                 2-Maximum               3-Extract maximum
4-Increase key           5-Print                 6-Exit
Enter the choice : 5
9 7 8 3 6 5 4 1 2
MENU
1-Insert                 2-Maximum               3-Extract maximum
4-Increase key           5-Print                 6-Exit
Enter the choice : 4
Enter index : 1
Enter key : 8

MENU
1-Insert                 2-Maximum               3-Extract maximum
4-Increase key           5-Print                 6-Exit
Enter the choice : 5
9 8 8 3 6 5 4 1 2
MENU
1-Insert                 2-Maximum               3-Extract maximum
4-Increase key           5-Print                 6-Exit
Enter the choice : 6
kshitij@kshitij:~/Documents/DAA/lab9$
```