

LAB ASSIGNMENT

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Question 1

Given an array of integers. The task is to rearrange elements of the array such that no two adjacent elements in the array are same.

Date :

01/06/2021

Write the code with proper **indentation**

```
#include <bits/stdc++.h>
using namespace std;
#define fast ios::sync_with_stdio(0);cin.tie(0);cout.tie(0);
typedef long long ll;typedef long double ld;typedef pair<int,int> pii;
#define F first
#define S second
#define PB push_back
#define MP make_pair

void solve(int a[],int n){
    int i;int j=n-1;
    for(i=0;i<n;){
        if(a[i]!=a[i+1]){i++;}
        else if(a[i]!=a[j]){
            swap(a[i+1],a[j]);
            j=n-1;i++;
        }
        else{
            j--;
        }
    }
    for(i=0;i<n;i++){
        cout<<a[i]<<" ";
    }
}

void solve_another(int a[],int n){
    int i;int j=1;
    for(i=0;i<n;i++){
        for(j=0;j<n;j++){
            if(a[i]!=a[j])
                {break;}
        }
    }
    swap(a[i],a[j]);
}
```

```

    }
    for(i=0;i<n;i++){
        cout<<a[i]<<" ";
    }
}

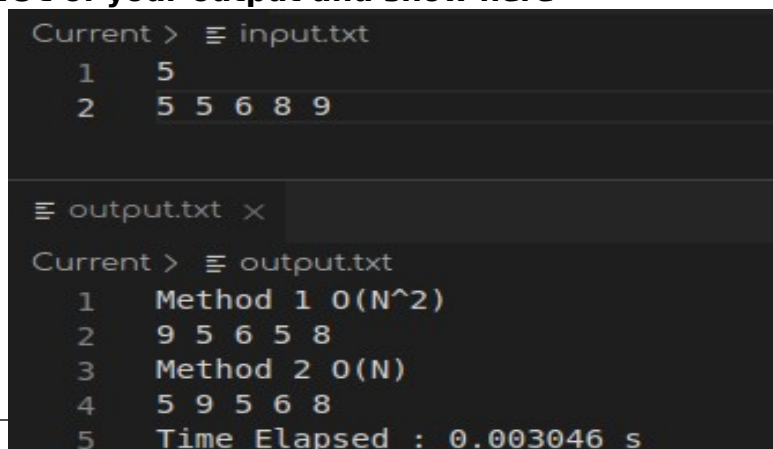
int main(){
    fast;
    int n;int i;
    int t = 1;
    cin >> n;
    int a[n];
    for(i=0;i<n;i++){
        cin>>a[i];
    }
    int b[n];
    for(i=0;i<n;i++){
        b[i]=a[i];
    }
    while(t--){
        cout<<"Method 1 O(N^2)"<<endl;
        solve_another(a,n);
        cout<<endl;
        cout<<"Method 2 O(N)"<<endl;
        solve(b,n);

    }
    #ifndef ONLINE_JUDGE
        cout<<"\nTime Elapsed : " << 1.0*clock() / CLOCKS_PER_SEC << " s\n";
    #endif

    return 0;
}

```

Take a screenshot of your output and show here



The screenshot shows a terminal window with two tabs: 'input.txt' and 'output.txt'. The 'input.txt' tab is active, showing the following content:

```

1 5
2 5 5 6 8 9

```

The 'output.txt' tab is also visible, showing the following content:

```

1 Method 1 O(N^2)
2 9 5 6 5 8
3 Method 2 O(N)
4 5 9 5 6 8
5 Time Elapsed : 0.003046 s

```

Question 2

Sort an array iteratively and recursively by using bubble sort technique.

Date :
01/06/2021

Write the code with proper **indentation**

```
#include <bits/stdc++.h>
using namespace std;
#define fast ios::sync_with_stdio(0);cin.tie(0);cout.tie(0);
typedef long long ll;typedef long double ld;typedef pair<int,int> pii;
#define F first
#define S second
#define PB push_back
#define MP make_pair
```

```
void solve_iteratively(int a[],int n){
    int i,j;
    for(i=0;i<n;i++){
        for(j=0;j<n-1;j++){
            if(a[j+1]<a[j]){
                swap(a[j],a[j+1]);
            }
        }
    }

    for(i=0;i<n;i++){
        cout<<a[i]<<" ";
    }
}
```

```
void solve_recursively(int a[],int n){
    int j;
    if(n==1){return;}
    for(j=0;j<n-1;j++){
        if(a[j+1]<a[j]){
            swap(a[j],a[j+1]);
        }
    }
    n--;
    solve_recursively(a,n);
}
```

```
int main(){
    fast;
    int n;int i;
```

```

int t = 1;
cin >> n;

int a[n];
for(i=0;i<n;i++){
    cin>>a[i];
}
int b[n];
for(i=0;i<n;i++){
    b[i]=a[i];
}
while(t--){

    cout<<"Iterative method"<<endl;
    solve_iteratively(a,n);
    cout<<endl;
    cout<<"Recursive method"<<endl;

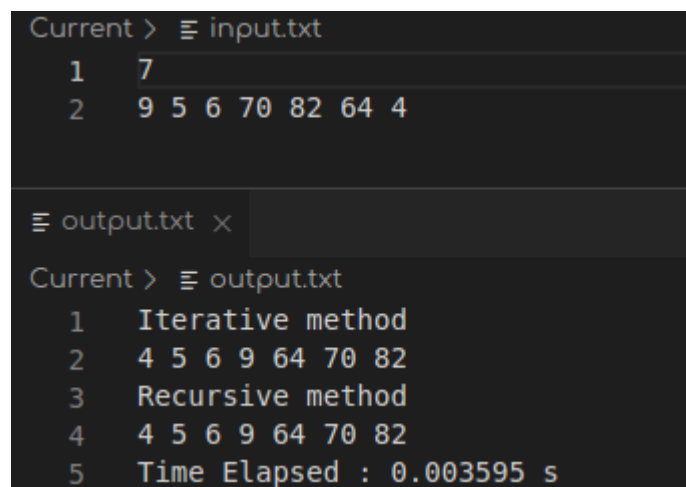
    solve_recursively(b,n);
    for(i=0;i<n;i++){
        cout<<b[i]<<" ";
    }
}

#ifdef ONLINE_JUDGE
    cout<<"\nTime Elapsed : " << 1.0*clock() / CLOCKS_PER_SEC << " s\n";
#endif

return 0;
}

```

Take a **screenshot** of your output and show here



The screenshot shows a code editor with two files open: 'input.txt' and 'output.txt'. The 'input.txt' file contains two lines of input: '1 7' and '2 9 5 6 70 82 64 4'. The 'output.txt' file contains the program's output, which includes the results of the iterative and recursive methods for each input, followed by the total time elapsed.

```

Current > ≡ input.txt
1 7
2 9 5 6 70 82 64 4

≡ output.txt ×
Current > ≡ output.txt
1 Iterative method
2 4 5 6 9 64 70 82
3 Recursive method
4 4 5 6 9 64 70 82
5 Time Elapsed : 0.003595 s

```

Question 3	Sort an array iteratively and recursively by using insertion sort technique and also show it's time complexity for best case.	Date : 01/06/2021
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Write the code with proper **indentation**

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

#define fast ios::sync_with_stdio(0);cin.tie(0);cout.tie(0);
typedef long long ll;typedef long double ld;typedef pair<int,int> pii;
#define F first
#define S second
#define PB push_back
#define MP make_pair

void solve_iteratively(int a[],int n){
    int i;int temp;int j;

    for(i=1;i<n;i++){
        temp=a[i];
        j=i-1;
        while(j>=0 && a[j]>temp)
        {
            a[j+1]=a[j];
            j--;
        }
        a[j+1]=temp;
    }

    for(i=0;i<n;i++){
        cout<<a[i]<<" ";
    }
}

void solve_recursively(int a[],int i,int n){
    int temp;int j;

    if(i>=n){return;}

    solve_recursively(a,i+1,n);

    temp=a[i];
```

```

    j=i+1;
    while(j<=n && a[j]<temp)
    {
        a[j-1]=a[j];
        j++;
    }
    a[j-1]=temp;

}

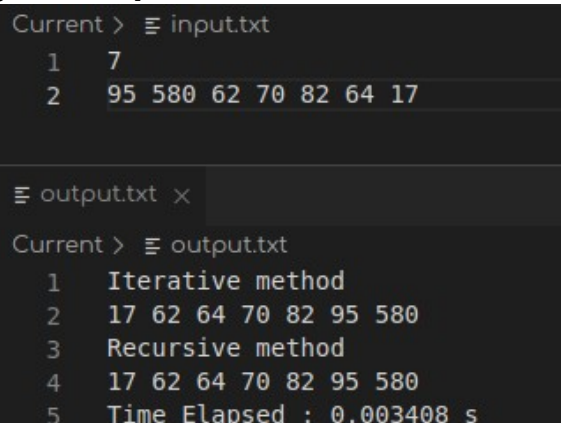
int main(){
    fast;
    int n;int i;
    int t = 1;
    cin >> n;
    int a[n];
    for(i=0;i<n;i++){
        cin>>a[i];
    }
    int b[n];
    for(i=0;i<n;i++){
        b[i]=a[i];
    }
    while(t--){
        cout<<"Iterative method"<<endl;
        solve_iteratively(a,n);
        cout<<endl;
        cout<<"Recursive method"<<endl;

        solve_recursively(b,0,n);
        for(i=0;i<n;i++){
            cout<<b[i]<<" ";
        }
    }
    #ifndef ONLINE_JUDGE
        cout<<"\nTime Elapsed : " << 1.0*clock() / CLOCKS_PER_SEC << " s\n";
    #endif

    return 0;
}

```

Take a **screenshot** of your output and show here



```

Current > ≡ input.txt
1 7
2 95 580 62 70 82 64 17

≡ output.txt ×
Current > ≡ output.txt
1 Iterative method
2 17 62 64 70 82 95 580
3 Recursive method
4 17 62 64 70 82 95 580
5 Time Elapsed : 0.003408 s

```

It's time complexity for best case is $\Omega(N)$.

Question 4

Sort an array iteratively and recursively by using Selection sort technique and also show it's time complexity for Worst case.

Date :
01/06/2021

Write the code with proper **indentation**

```
#include <bits/stdc++.h>
using namespace std;
#define fast ios::sync_with_stdio(0);cin.tie(0);cout.tie(0);
typedef long long ll;typedef long double ld;typedef pair<int,int> pii;
#define F first
#define S second
#define PB push_back
#define MP make_pair
```

```
void solve_iteratively(int a[],int n){
    int i,j;int min;
    for(i=0;i<n;i++){
        min=i;
        for(j=i+1;j<n;j++){
            if(a[j]<a[min]){
                min=j;
            }
        }
        swap(a[min],a[i]);
    }

    for(i=0;i<n;i++){
        cout<<a[i]<<" ";
    }
}

void solve_recursively(int a[],int i,int n){
    int j;int min;
    if(i>=n){return;}
```

```

min=i;
for(j=i+1;j<n;j++){
    if(a[j]<a[min]){
        min=j;
    }

}
swap(a[min],a[i]);

solve_recursively(a,i+1,n);
}

```

```

int main(){
    fast;
    int n;int i;
    int t = 1;
    cin >> n;
    int a[n];
    for(i=0;i<n;i++){
        cin>>a[i];
    }
    int b[n];
    for(i=0;i<n;i++){
        b[i]=a[i];
    }
    while(t--){

        cout<<"Iterative method"<<endl;
        solve_iteratively(a,n);
        cout<<endl;
        cout<<"Recursive method"<<endl;

        solve_recursively(b,0,n);

        for(i=0;i<n;i++){
            cout<<b[i]<<" ";
        }
    }

    #ifndef ONLINE_JUDGE
        cout<<"\nTime Elapsed : " << 1.0*clock() / CLOCKS_PER_SEC << " s\n";
    #endif

    return 0;
}

```


Take a **screenshot** of your output and show here

```
Current > ≡ input.txt
1 7
2 91 8 26 7 28 46 71

≡ output.txt ×
Current > ≡ output.txt
1 Iterative method
2 7 8 26 28 46 71 91
3 Recursive method
4 7 8 26 28 46 71 91
5 Time Elapsed : 0.004782 s
```

It's time complexity for worst case is $O(N^2)$.

Question 5	Sort an array iteratively and recursively by using Heap sort technique and also show it's time complexity for For Average case.	Date : 01/06/2021
<p>Write the code with proper indentation</p> <pre>#include <bits/stdc++.h> using namespace std; #define fast ios::sync_with_stdio(0);cin.tie(0);cout.tie(0); typedef long long ll;typedef long double ld;typedef pair<int,int> pii; #define F first #define S second #define PB push_back #define MP make_pair void heapifye(int a[],int n,int i) { int lar=i; int l=2*i+1; int r=2*i+2; if(l<n && a[lar]<a[l]){ lar=l; }</pre>		

```

    }
    if(r<n && a[lar]<a[r]){
        lar=r;
    }
    if(lar!=i){
        swap(a[i],a[lar]);
        heapifye(a,n,lar);
    }
}

void heap_sort(int a[],int n){
    int i;
    for(i= (n/2-1);i>=0;i--){
        heapifye(a,n,i);
    }

    for(i=n-1;i>0;i--){
        swap(a[0],a[i]);
        heapifye(a,i,0);
    }

    for(i=0;i<n;i++){
        cout<<a[i]<<" ";
    }
}

int main(){
    fast;
    int n,int i;
    int t = 1;
    cin >> n;
    int a[n];
    for(i=0;i<n;i++){
        cin>>a[i];
    }

    while(t--){

        heap_sort(a,n);
        cout<<endl;

    }

#ifdef ONLINE_JUDGE
    cout<<"\nTime Elapsed : " << 1.0*clock() / CLOCKS_PER_SEC << " s\n";
#endif

    return 0;
}

```

Take a **screenshot** of your output and show here

```
Current > ≡ input.txt
1      8
2     10 18 26 87 58 96 101 19

≡ output.txt ×
Current > ≡ output.txt
1     10 18 19 26 58 87 96 101
2
3    Time Elapsed : 0.005735 s
```

It's time complexity for average case is $O(N \cdot \log N)$.

Instruction:

- 1 Don't try to copy and paste the code from each other or from the internet and write all the lab assignment in the above format only.
- 2 After writing all the lab assignments convert the word file to PDF then submit it in the google classroom in the assignment section.
- 3 All the file names must be your roll number in proper format .