Analysis and Design of Algorithms Lab

Assignment -4

Dated: 17-02-2021

Sub Code: CSE-228

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CSE - 3

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Date: 17/02/2021

ADA: LAB-ASSIGNMENT 4 (17-02-2021)

1) Finding the maximum and minimum value in an array using the divide and conquer approach.

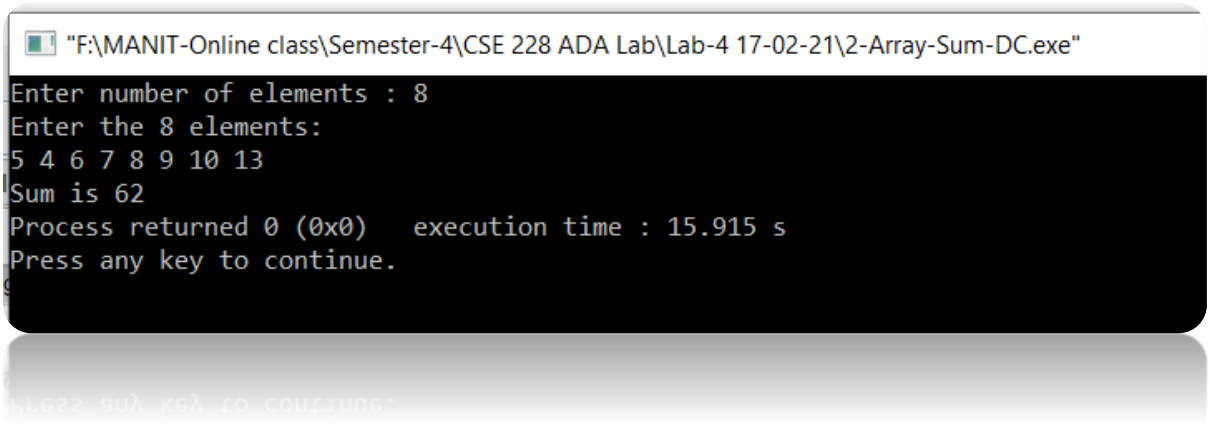
```
#include <bits/stdc++.h>
using namespace std;

struct Pair
{
    int min;
    int max;
};

struct Pair getMinMax(int arr[], int low, int high)
{
    struct Pair minmax, mml, mmr;
    int mid;
    if (low == high)
    {
        minmax.max = arr[low];
        minmax.min = arr[low];
        return minmax;
    }
    if (high == low + 1)
    {
        if (arr[low] > arr[high])
        {
            minmax.max = arr[low];
            minmax.min = arr[high];
        }
        else
        {
            minmax.max = arr[high];
            minmax.min = arr[low];
        }
        return minmax;
    }
    mid = (low + high) / 2;
    mml = getMinMax(arr, low, mid);
    mmr = getMinMax(arr, mid + 1, high);

    if (mml.min < mmr.min)
        minmax.min = mml.min;
```

```
    else
        minmax.min = mmr.min;

    if (mml.max > mmr.max)
        minmax.max = mml.max;
    else
        minmax.max = mmr.max;

    return minmax;
}

int main()
{
    int n;
    cout << "Enter number of elements : ";
    cin >> n;
    int arr[n];
    cout << "Enter the " << n << " elements:\n";
    for (int i = 0; i < n; i++)
    {
        cin >> arr[i];
    }

    struct Pair minmax = getMinMax(arr, 0, n - 1);

    cout << "Minimum element is "
         << minmax.min << endl;
    cout << "Maximum element is "
         << minmax.max;

    return 0;
}
```

```
"F:\MANIT-Online class\Semester-4\CSE 228 ADA Lab\Lab-4 17-02-21\1-Min-Max-DC.exe"
Enter number of elements : 5
Enter the 5 elements:
2 3 5 4 1
Minimum element is 1
Maximum element is 5
Process returned 0 (0x0)   execution time : 14.658 s
Press any key to continue.
```

2) Computes the sum of an array of integers using the divide and conquer approach.

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

int sum(int arr[], int l, int r)
{
    //Base case
    if (l == r)
        return arr[l];

    //Divide & Conquer
    int mid = (l + r) / 2;
    int lsum = sum(arr, l, mid);
    int rsum = sum(arr, mid+1, r);
    return lsum + rsum;
}

int main()
{

    int n;
    cout << "Enter number of elements : ";
    cin >> n;
    int arr[n];
    cout << "Enter the " << n << " elements:\n";
    for (int i = 0; i < n; i++)
    {
        cin >> arr[i];
    }

    cout << "Sum is " << sum(arr, 0, n - 1);
    return 0;
}
```



3) What is a recursive Quick Sort? Write an algorithm and analyze the Time complexity of the Algorithm.

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

int partition(int A[], int low, int high)
{
    int pivot = A[low];
    int i = low;
    int j = high;

    do
    {
        do
        {
            i++;
        } while (A[i] <= pivot);

        do
        {
            j--;
        } while (A[j] > pivot);

        if (i < j)
        {
            swap(A[i], A[j]);
        }
    } while (i < j);

    swap(A[low], A[j]);

    return j;
}

void quickSort(int A[], int low, int high)
{
    if (low < high)
    {
        int q = partition(A, low, high);
        quickSort(A, low, q);
        quickSort(A, q + 1, high);
    }
}
int main()
{
    int num;
    cout << "Enter number of elements to be sorted:";
    cin >> num;
```

```
    int A[num];
    cout << "Enter the " << num << " elements:\n";
    for (int i = 0; i < num; i++)
    {
        cin >> A[i];
    }
    quickSort(A, 0, num);
    cout << endl;
    cout << "Sorted array\n";
    for (int i = 0; i < num; i++)
    {
        cout << A[i] << "\t";
    }
    return 0;
}
```