Shri Vile Parle Kelavani Mandal's
DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING
(Autonomous College Affiliated to the University of Mumbai)
NAAC Accredited with "A" Grade (CGPA : 3.18)

Department of Information Technology

COURSE CODE: DJS22ITC403 **DATE:12/10/2023**

COURSE NAME: Design and Analysis of Algorithms **CLASS: I1-Batch1**

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Experiment No.2

Aim: Merge Sort and Min_Max using Divide and Conquer

1) **Analysis of Merge Sort**

Code:

```
#include <stdio.h>
#include <stdlib.h>
#include <math.h>

int ctr = 0;

void merge(int arr[], int l, int m, int r)
{
    int i, j, k;
    int n1 = m - l + 1;
    int n2 = r - m;

    int L[n1], R[n2];

    for (i = 0; i < n1; i++) {
        L[i] = arr[l + i];
    }

    for (j = 0; j < n2; j++) {
        R[j] = arr[m + 1 + j];
    }

    i = 0;
    j = 0;
    k = l;
```

```
    while (i < n1 && j < n2) {
        if (L[i] <= R[j]) {
            arr[k] = L[i];
            i++;
        }
        else {
            arr[k] = R[j];
            j++;
        }
        k++;
        ctr++;
    }

    while (i < n1) {
        arr[k] = L[i];
        i++;
        k++;
    }

    while (j < n2) {
        arr[k] = R[j];
        j++;
        k++;
    }
}

void mergeSort(int arr[], int l, int r)
{
    if (l < r) {
        int m = l + (r - l) / 2;

        mergeSort(arr, l, m);
        mergeSort(arr, m + 1, r);

        merge(arr, l, m, r);
        ctr++; // Counting the divide-and-conquer steps
    }
}

void printArray(int A[], int size)
```

```
{
    int i;
    for (i = 0; i < size; i++)
        printf("%d ", A[i]);
    printf("\n");
}

int main()
{
    int arr[] = {6, 5, 12, 10, 9, 1};
    int arr_size = sizeof(arr) / sizeof(arr[0]);

    // printf("Given array is \n");
    // printArray(arr, arr_size);

    mergeSort(arr, 0, arr_size - 1);

    // printf("\nSorted array is \n");
    // printArray(arr, arr_size);

    printf("Size of input is %d | ", arr_size);
    printf("Number of divide-and-conquer steps: %d | ", ctr);

    printf("Logarithmic value of array size: %d", (int)log2(arr_size));

    return 0;
}
```

Output:

```
Size of input is 6 | Number of divide-and-conquer steps: 15 | Logarithmic value of array size: 2

...Program finished with exit code 0
Press ENTER to exit console.
```

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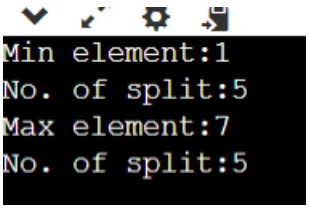
Analysis of Min Max

Code:

```c
#include <stdio.h>

int main()
{
    int arr[5] = {3, 1, 5, 7, 2};
    int n=5;
    int max = arr[0];
    int min = arr[0];
    int ctr = 0;

    for (int i = 1; i < 5; i++)
    {
        ctr++;
        if (min > arr[i])
        {
            min = arr[i];
        }
    }
    for (int i = 1; i < 5; i++)
    {
        ctr++;
        if (max < arr[i])
        {
            max = arr[i];
        }
    }
    printf("Input size is %d | ", n);

    printf("No. of comparison is %d | ", ctr);

    printf("Time Complexity: O(%d)\n",n);

    return 0;
}
```

Output:



Conclusion: We implemented analysis of merge sort and analysis of min max in this experiment using divide and conquer method.