KIET Group of Institutions, Ghaziabad

Department of Computer Applications

(An ISO – 9001: 2015 Certified & 'A' Grade accredited Institution by NAAC)

Design and Analysis of Algorithm

RCA 352: Session 2020-21

DAA Lab

Experiment-No.8

Objective: Implement the **Heap_ sort** algorithm to sort the given list of N numbers and plot graph

Scheduled Date:	Compiled Date:	Submitted Date:
22-9-2020	22-9-2020	22-9-2020

Algorithm:

MaxHeapify(A, i)
```
 1. l  left(i)
 2. r  right(i)
 3. if l  heap-size[A] and A[l] > A[i]
 4. then largest  l
 5. else largest  i
 6. if r  heap-size[A] and A[r] > A[largest]
 7. then largest  r
 8. if largest i
 9. then exchange A[i] and A[largest]
10. MaxHeapify(A, largest)
```

BuildMaxHeap(A)
```
1. heap-size[A]  length[A]
2. for i  length[A]/2 downto 1
3. do MaxHeapify(A, i)
```

HeapSort(A)
```
1. Build-Max-Heap(A)
2. for i  length[A] downto 2
3. do exchange A[1] and A[i]
4. heap-size[A]  heap-size[A] – 1
5. MaxHeapify(A, 1)
```

```
Program file heap_sort.c :
#include <stdio.h>
#include <stdlib.h>
static int count=0;
int main()
{
    int a[50],n;
    void heap_sort(int a[],int);
    void bulid_heap(int [],int);
    void heapify(int [],int,int);
    void get_data(int [],int);
    void put_data(int [],int);
    printf("Enter the size of an array should be less than 50:\n");
    scanf("%d",&n);
    printf("Enter the array elements:\n");
    get_data(a,n);
    printf("\n array before sorting\n");
    put_data(a,n);
    heap_sort(a,n);
    printf("\n array after sorting\n");
    put_data(a,n);
    printf("\n for n=%d counts are %d",n,count);


    return 0;
}
void swap(int *a,int *b)
{
    int temp;
    temp=*a;
    *a=*b;
    *b=temp;
}
void heapify(int a[],int n,int i)
{
    count++;
    int largest=i;
    count++;
    int left=2*i+1;
    count++;
    int right=2*i+2;
    count++;
    if(left < n && a[left]>a[largest])
    {
        count++;
        largest=left;
        count++;
    }
    if(right < n && a[right]>a[largest])
    {
        count++;
        largest=right;
        count++;
    }
    if(largest!=i)
    {
        count++;
        swap(&a[i],&a[largest]);
        count++;
        heapify(a,n,largest);
        count++;
    }

}
void build_heap(int a[],int n)
{
    count++;
    int i;
    count++;
    for(i=(n/2)-1;i>=0;i--)
    {
        count++;
        count++;
        heapify(a,n,i);
        count++;
    }
}
void heap_sort(int a[],int n)
{
    int i;
    count++;
    build_heap(a,n);
    count++;
    for(i=n-1;i>=0;i--)
    {
        count++;
        count++;
        swap(&a[0],&a[i]);
        count++;
        heapify(a,i,0);
        count++;
    }

}
void get_data(int a[],int n)
{
    int i;
    for(i=0;i<n;i++)
    {
        scanf("%d",&a[i]);
    }

}
void put_data(int a[],int n)
```

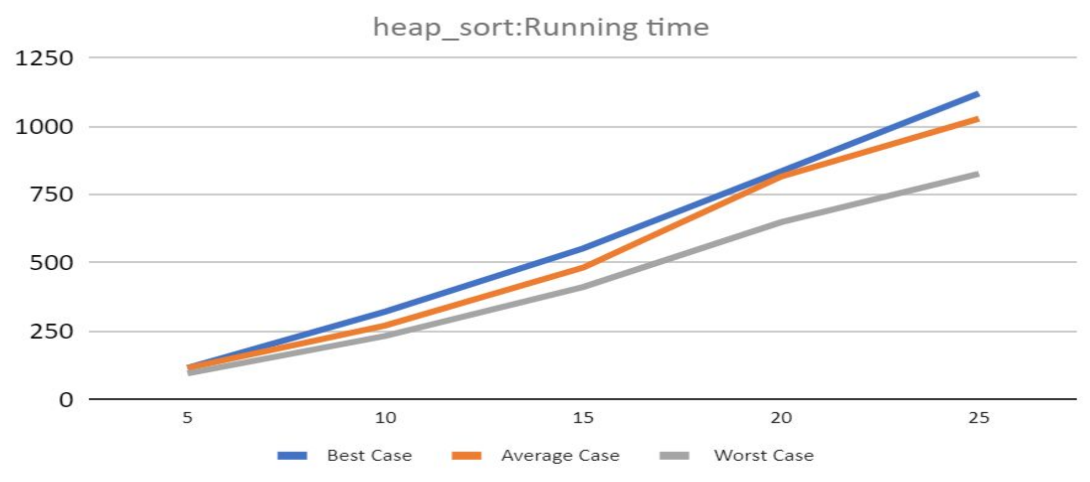
```
{
     int i;
     for(i=0;i<n;i++)
     {
          printf("%d\t",a[i]);
     }

}
```

Output

Input Size	Best Case	Average Case	Worst Case
5	116	116	96
10	322	271	233
15	553	483	412
20	835	816	649
25	1120	1028	826

Graph



Conclusion

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Case	Running Time : Growth of Function mathematically	Running Time : Growth of Function after observing graph
Best Case	O($nlogn$)	O($nlogn$)
Average Case	O($nlogn$)	O($nlogn$)
Worst Case	O($nlogn$)	O($nlogn$)