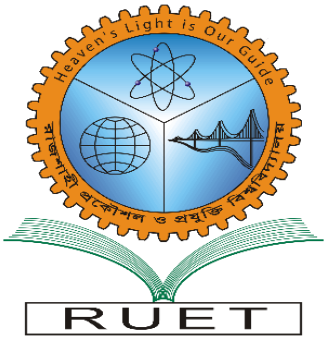

RAJSHAHI UNIVERSITY OF ENGINEERING AND TECHNOLOGY

Course No: CSE 2201

Course Title: Sessional Based on CSE-2201

Submitted to:
Biprodip Pal

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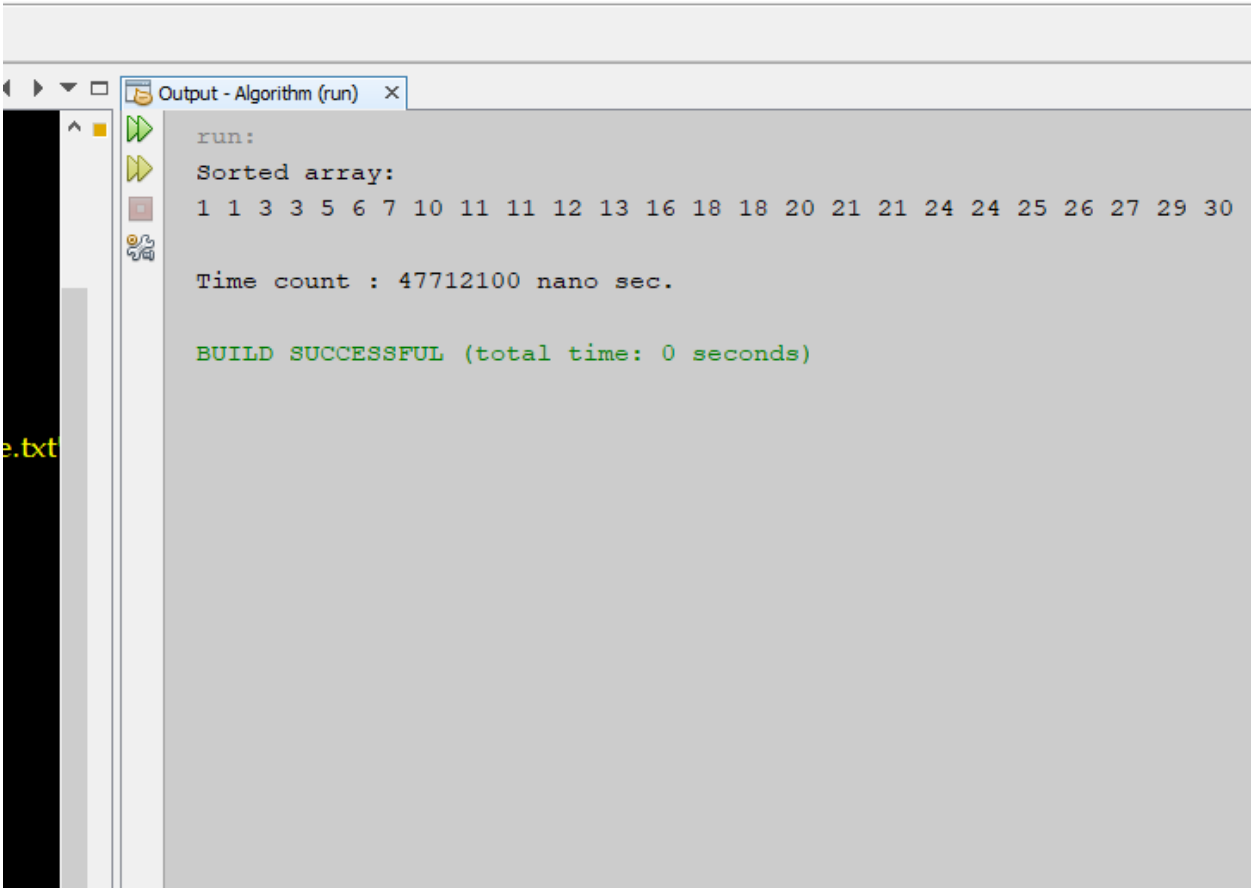
Code(Bubble Sort):

```
package algorithm;

import java.io.File;
import java.util.Scanner;

public class _1803078{

	public static void main(String[] args){
		try{
			File f=new File("input.txt");
			Scanner ob=new Scanner(f);
			int n=ob.nextInt();
			int a[]=new int[n];
			for(int i=0;i<n;i++){
				a[i]=ob.nextInt();
			}
			long t1=System.nanoTime();
			for(int i=0;i<n;i++){
				for(int j=0;j<n-i-1;j++){
					if(a[j]>a[j+1]){
						int temp=a[j];
						a[j]=a[j+1];
						a[j+1]=temp;
					}
				}
			}
			long t2=System.nanoTime();
			System.out.println("Sorted array:");
			for(int i=0;i<a.length;i++){
				System.out.print(a[i]+" ");
			}
			System.out.println("\n");
			System.out.println("Time count : "+(t2-t1)+" nano sec.\n");

		}catch(Exception e){

		}
```

```
        }
}
```

Output:

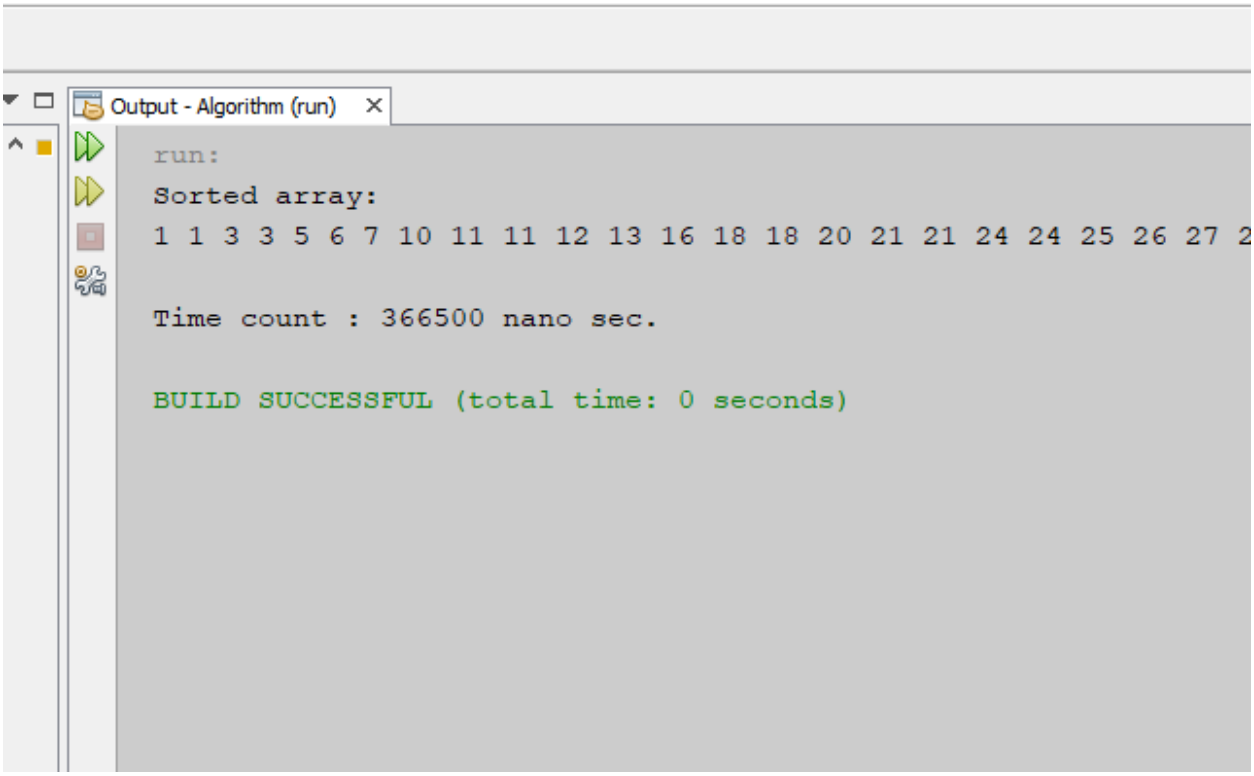

Output - Algorithm (run)
run:
Sorted array:
1 1 3 3 5 6 7 10 11 11 12 13 16 18 18 20 21 21 24 24 25 26 27 29 30
Time count : 47712100 nano sec.
BUILD SUCCESSFUL (total time: 0 seconds)

Code (Counting Sort):

```
package algorithm;

import java.io.File;
import java.util.Scanner;

public class _1803078{

	public static void main(String[] args){
		try{
			File f=new File("input.txt");
			Scanner ob=new Scanner(f);
			int n=ob.nextInt();
			int a[]=new int[n];
			int max=Integer.MIN_VALUE;
			for(int i=0;i<n;i++){
				a[i]=ob.nextInt();
				max=Math.max(max,a[i]);
				//System.out.println(a[i]);
			}

			long t1=System.nanoTime();

			int b[]=new int[max+1];
			for(int i=0;i<a.length;i++){
				b[a[i]]++;
			}
			for(int i=1;i<b.length;i++){
				b[i]=b[i]+b[i-1];
			}

			//for(int i=0;i<b.length;i++){
			//	System.out.println(i+" "+b[i]);
			//}
			int sorted_array[]=new int[b[b.length-1]];
			for(int i=0;i<a.length;i++){
				int pos=b[a[i]];
				sorted_array[pos-1]=a[i];
				b[a[i]]--;
			}
```

```
                        long t2=System.nanoTime();


                        System.out.println("Sorted array:");
                        for(int i=0;i<sorted_array.length;i++){
                                System.out.print(sorted_array[i]+" ");
                        }
                        System.out.println("\n");
                        System.out.println("Time count : "+(t2-t1)+" nano sec.\n");

                }catch(Exception e){
                }
        }
}
```

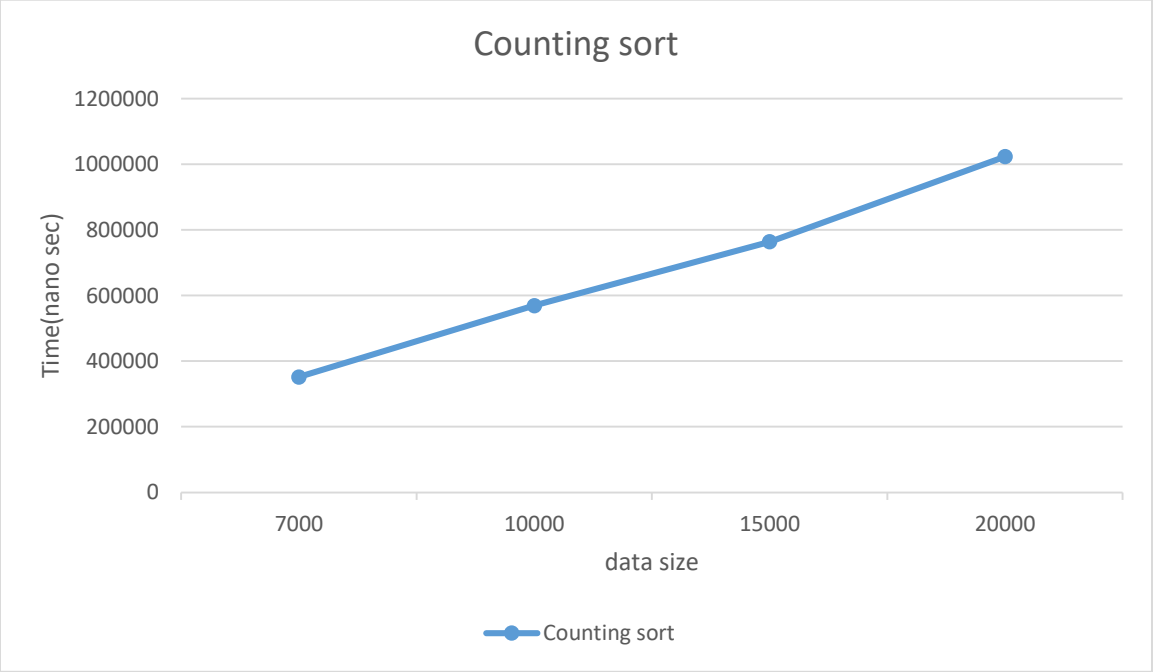
Output:

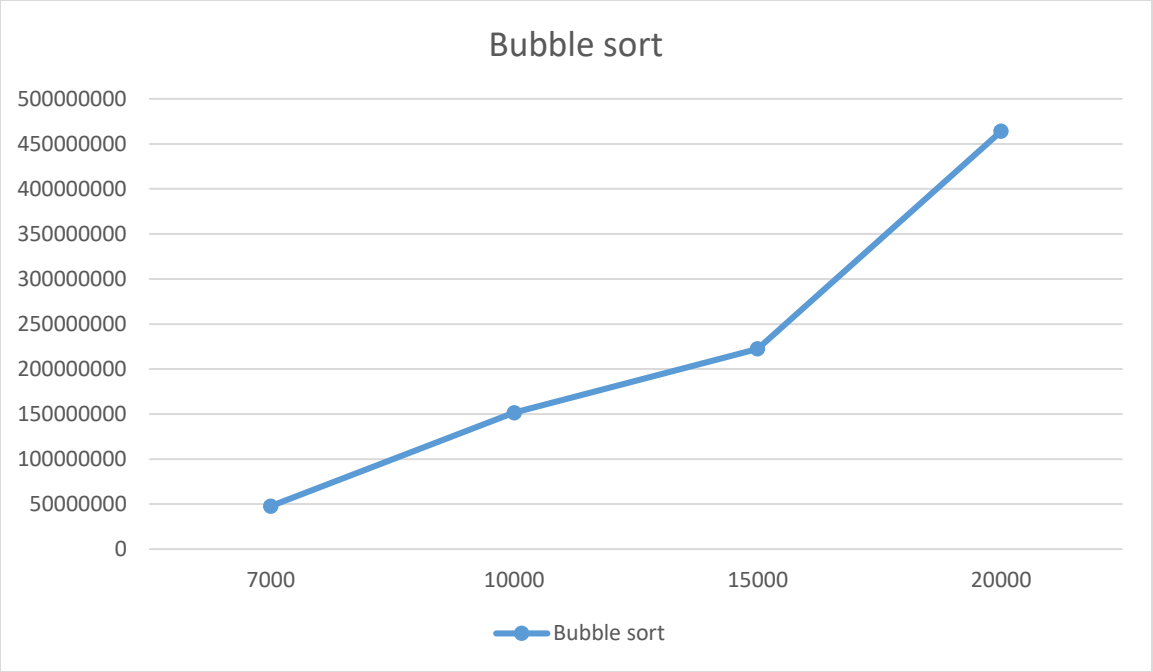


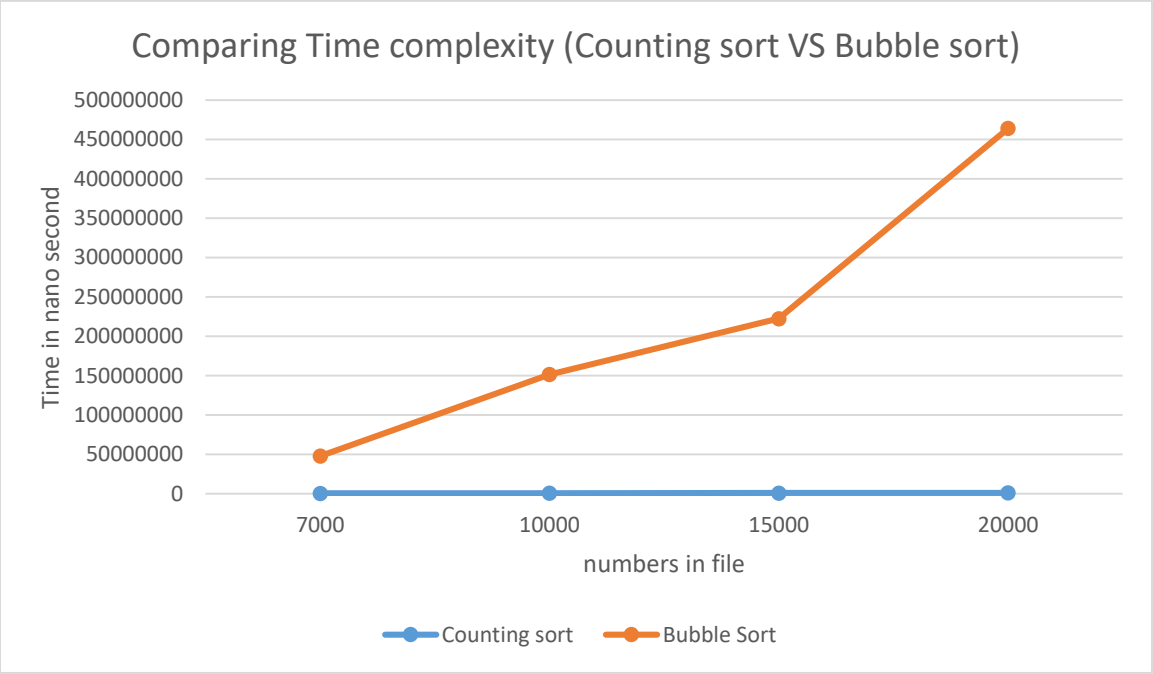
Time Count (Nano second):

Numbers in File (data)	Counting Sort (nano sec.)	Bubble Sort (nano sec.)
7000	366500	47712100
10000	569400	151442500
15000	764200	222330600
20000	1023700	463981500

Performance analysis :




Bubble sort
500000000
450000000
400000000
350000000
300000000
250000000
200000000
150000000
100000000
50000000
0
7000
10000
15000
20000
Bubble sort


Comparing Time complexity (Counting sort VS Bubble sort)
Time in nano second
500000000
450000000
400000000
350000000
300000000
250000000
200000000
150000000
100000000
50000000
0
7000
10000
15000
20000
numbers in file
Counting sort
Bubble Sort

Discussion:

From the performance graph I see that bubble sort taken more and more time rather than counting sort.

when my input data size is 7000 then , counting sort takes 352100 nano sec and bubble sort takes 47732500 nano sec.

similarly ,

when my input data size is 10000 then , counting sort takes 569400 nano sec. and bubble sort takes 151442500 nano sec. etc.

It seems that counting sort works in linear time complexity and bubble sort work Quadratic complexity.

Counting sort is better than bubble sort.