21BRS1296 – Anika Kamath

Design and Analysis of Algorithms (Lab)

L37+L38

Experiment No.: 3

Q. Bubble Sort Algorithm with Random Inputs

Code:

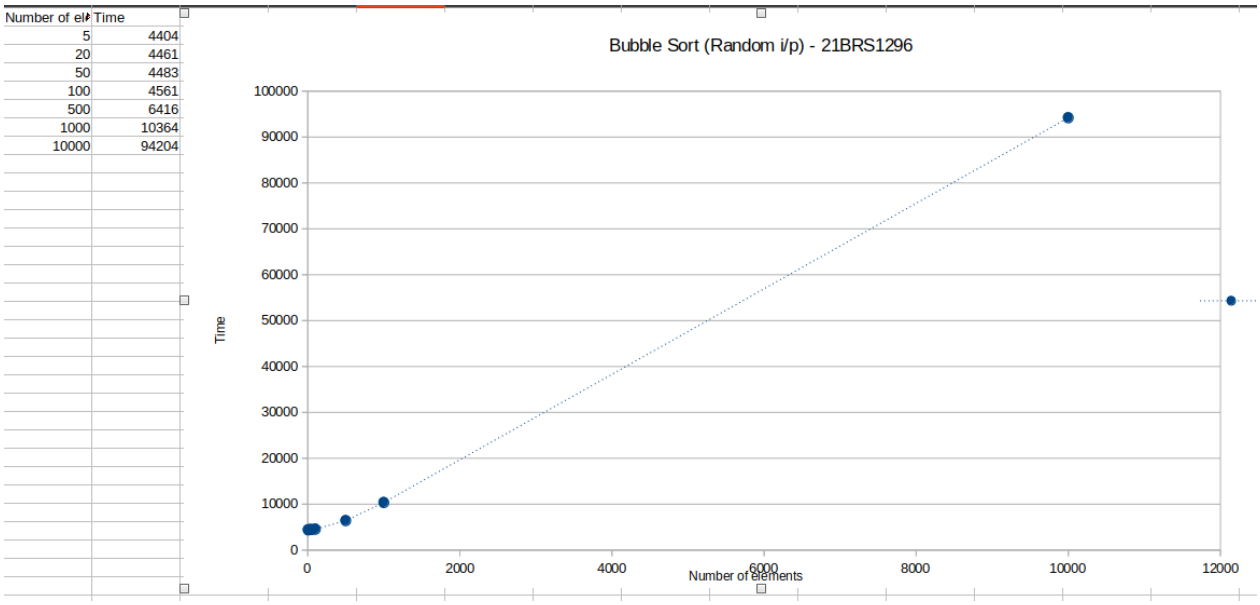
```
#include<iostream>
#include<ctime>

using namespace std;

void bubbleSort(int a[],int n){
    int temp;
    for(int i=0;i<n;++i){
        int flag=0;
     for(int j=0;j<n-i-1;++j){
            if(a[j]>a[j+1]){
                temp=a[j];
                a[j]=a[j+1];
                a[j+1]=temp;

                flag=1;
            }
        }

        if(flag==1){
            break;
        }
    }
```

```
    cout<<"Array sorted using Bubble Sort: "<<endl;
    for(int i=0;i<n;i++){
        cout<<a[i]<<" ";
    }
    cout<<endl;
}

int main(){
int n;
cout<<"Enter number of elements in array: ";
cin>>n;
int a[n];
for(int i=0;i<n;i++){
        /*
        cout<<endl<<"Enter element "<<i+1<<": ";
cin>>a[i];
        */
        int random=rand();

}
bubbleSort(a,n);

    //time
    clock_t tstart=clock();
    double time1=(double)clock()-(tstart)/CLOCKS_PER_SEC;
    cout<<"Time taken to execute: "<<time1<<endl;

return 0;
}
```

Output:

```
student@205A-scope--50:~/Desktop/21BRS1296$ g++ lab3_bubblesort.cpp
student@205A-scope--50:~/Desktop/21BRS1296$ ./a.out
Enter number of elements in array: 20
Array sorted using Bubble Sort:
0 0 20 21959 21959 32765 32765 32765 32765 32765 16777216 197632384 197633054 509354752 907838182 1689832220 168983
2224 1689832272 1689832384 1689832624
Time taken to execute: 4461
student@205A-scope--50:~/Desktop/21BRS1296$ gedit lab3_bubblesort.cpp
^C
student@205A-scope--50:~/Desktop/21BRS1296$ g++ lab3_bubblesort.cpp
student@205A-scope--50:~/Desktop/21BRS1296$ ./a.out
Enter number of elements in array: 50
Array sorted using Bubble Sort:
-1970764196 -1970764192 -1970764160 -1970764144 -1970764132 -1970764032 -1970763792 -1970763792 -1296892317 -129689
2317 -1180971130 -1178382869 -1177568000 -1177557672 -474775040 -474775040 -254041728 -254029472 -254029472 -1 -1 0
 0 0 0 0 0 0 0 0 0 0 50 21882 21882 21882 32665 32665 32665 32665 32765 32765 32765 32765 32765 32765 32765 32765
 16777216
Time taken to execute: 4483
student@205A-scope--50:~/Desktop/21BRS1296$ g++ lab3_bubblesort.cpp
student@205A-scope--50:~/Desktop/21BRS1296$ ./a.out
Enter number of elements in array: 100
Array sorted using Bubble Sort:
-1953492608 -1953491938 -1953480352 -1953480352 -1930793837 -1930793837 -1930793837 -858993460 -858993460 -30880378
2 -308803680 -308803664 -308803664 -308803664 -308803632 -308803524 -308803524 -308803520 -308803520 -308803488 -30
8803472 -308803460 -308803360 -308803120 -308803120 -1 -1 -1 -1 -1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 10 10 10 1
00 100 22073 22073 22073 22073 32529 32529 32529 32529 32529 32529 32529 32529 32529 32529 32767 32767 32767 32767
32767 32767 32767 32767 32767 32767 32767 32767 32767 32767 32767 32767 16777216 214748364 214748364 809803654 8112
09888 812391915 812474237 813206784 813206784 813206784 813211168 813217088 813217112 1206493184 1206493184 2147483
647
Time taken to execute: 4561
```

Graph:



Q. Optimized Bubble Sort Algorithm with Random Inputs

Code:

```
#include<iostream>

#include<ctime>


using namespace std;
```

```
void bubbleSort(int a[],int n){
    int temp;
    for(int i=0;i<n;++i){
        int count=0;

      for(int j=0;j<n-i-1;++j){
            if(a[j]>a[j+1]){
                temp=a[j];
                a[j]=a[j+1];
                a[j+1]=temp;

                count++;
            }
        }
        cout<<"Number of swaps: "<<count<<endl;

        if(count==0){
            break;
        }

    }

    cout<<"Array sorted using Bubble Sort: "<<endl;
    for(int i=0;i<n;i++){
        cout<<a[i]<<" ";
    }
    cout<<endl;
}
```

```
int main(){
int n;
cout<<"Enter number of elements in array: ";
cin>>n;
int a[n];
for(int i=0;i<n;i++){
        /*
        cout<<endl<<"Enter element "<<i+1<<": ";
cin>>a[i];
        */

        int random=rand();

}
bubbleSort(a,n);

    //time
    clock_t tstart=clock();
    double time1=(double)clock()-(tstart)/CLOCKS_PER_SEC;
    cout<<"Time taken to execute: "<<time1<<endl;

return 0;
}
```

Output:

```
student@205A-scope--50:~/Desktop/21BRS1296$ ./a.out
Enter number of elements in array: 10
Number of swaps: 6
Number of swaps: 5
Number of swaps: 4
Number of swaps: 3
Number of swaps: 1
Number of swaps: 1
Number of swaps: 1
Number of swaps: 0
Array sorted using Bubble Sort:
-1935128864 -1935128752 0 10 22082 32766 32766 223931392 1498464057 1876341120
Time taken to execute: 4492
student@205A-scope--50:~/Desktop/21BRS1296$ g++ lab3_bubblesortopt.cpp
student@205A-scope--50:~/Desktop/21BRS1296$ ./a.out
Enter number of elements in array: 5
Number of swaps: 2
Number of swaps: 2
Number of swaps: 1
Number of swaps: 0
Array sorted using Bubble Sort:
-1995147552 -1995147440 22016 32764 1677123968
Time taken to execute: 4404
```

Graph:

Number of el	Time
5	4250
20	4392
50	4420
100	4469
500	4667
1000	4814
10000	8245