LAPORAN PRAKTIKUM 4

ANALISIS ALGORITMA

Disusun oleh :

Muhammad Zulfikar Ali

140810180064

PROGRAM STUDI S-1 TEKNIK INFORMATIKA

FAKULTAS MATEMATIKA DAN ILMU PENGETAHUAN ALAM

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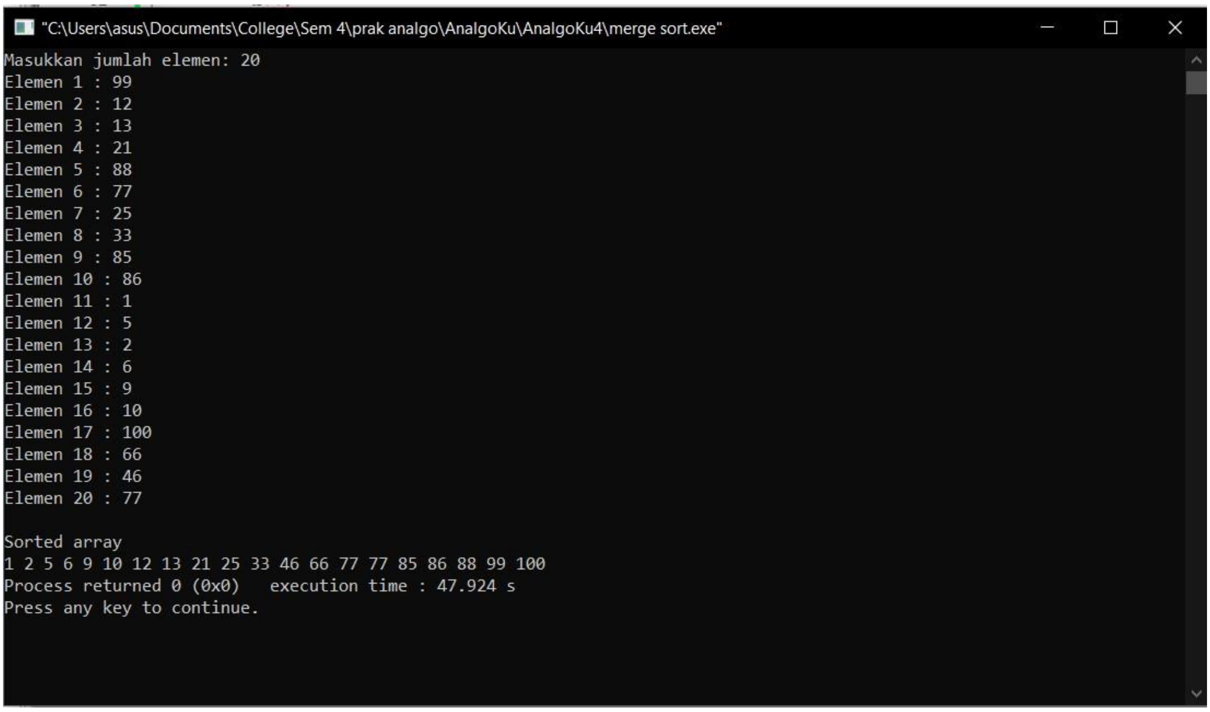
Studi Kasus 1: Merge Sort

1. Source code

```
#include <iostream>
using namespace std;

void merge(int *,int, int , int );
void merge_sort(int *arr, int low, int high)
{
    int mid;
    if (low < high){
        mid=(low+high)/2;
        merge_sort(arr,low,mid);
        merge_sort(arr,mid+1,high);

        merge(arr,low,high,mid);
    }
}

void merge(int *arr, int low, int high, int mid)
{
    int i, j, k, c[50];
    i = low;
    k = low;
    j = mid + 1;
    while (i <= mid && j <= high) {
        if (arr[i] < arr[j]) {
            c[k] = arr[i];
            k++;
            i++;
        }
        else  {
            c[k] = arr[j];
            k++;
            j++;
        }
    }
    while (i <= mid) {
        c[k] = arr[i];
        k++;
        i++;
    }
    while (j <= high) {
        c[k] = arr[j];
        k++;
        j++;
    }
    for (i = low; i < k; i++)  {
        arr[i] = c[i];
    }
}

int main()
{
    int myarray[30], num;

    cout<<"Masukkan jumlah elemen: ";
    cin>>num;

    for (int i = 0; i < num; i++) {
        cout << "Elemen " << i+1 << " : ";
        cin>>myarray[i];
    }

    merge_sort(myarray, 0, num-1);
    cout<<"\nSorted array\n";

    for (int i = 0; i < num; i++){
        cout<<myarray[i]<<" ";
    }
}
```



"C:\Users\asus\Documents\College\Sem 4\prak analgo\AnalgoKu\AnalgoKu4\merge sort.exe"

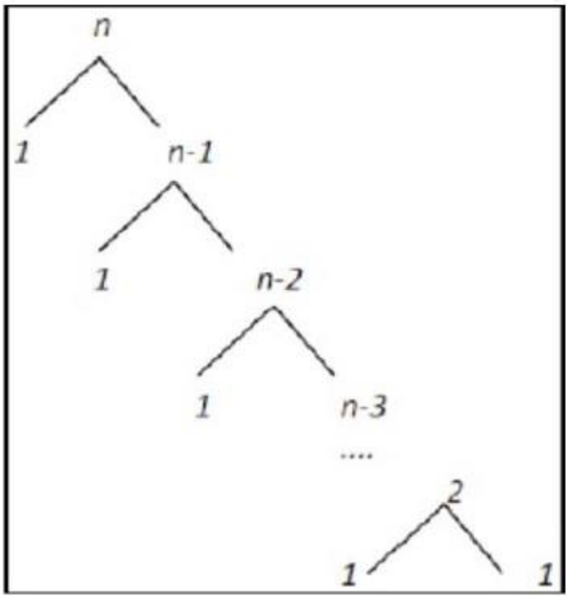
```
Masukkan jumlah elemen: 20
Elemen 1 : 99
Elemen 2 : 12
Elemen 3 : 13
Elemen 4 : 21
Elemen 5 : 88
Elemen 6 : 77
Elemen 7 : 25
Elemen 8 : 33
Elemen 9 : 85
Elemen 10 : 86
Elemen 11 : 1
Elemen 12 : 5
Elemen 13 : 2
Elemen 14 : 6
Elemen 15 : 9
Elemen 16 : 10
Elemen 17 : 100
Elemen 18 : 66
Elemen 19 : 46
Elemen 20 : 77

Sorted array
1 2 5 6 9 10 12 13 21 25 33 46 66 77 77 85 86 88 99 100
Process returned 0 (0x0)   execution time : 47.924 s
Press any key to continue.
```

2. Kompleksitas waktu merge sort = O (n lg n) -> $T(20 \log_{10} 20)$

Studi Kasus 2: Selection Sort

```
T(n) selection sort
for I ← n downto 2 do {pass sebanyak n-1 kali}
    imaks ← 1
    for j ← 2 to I do
        if $x_j > x_{imaks}$ then
            imaks ← j
        endif
endfor
{pertukaran $x_{imaks}$ dengan $x_i$}
temp ← $x_i$
$x_i$ ← $x_{imaks}$
$x_{imaks}$ ← temp
endfor
```

Subproblem = 1
Masalah setiap subproblem = n-1
Waktu proses pembagian = n
Waktu proses penggabungan = n $T(n)=\{\Theta(1)\ T(n-1)+\Theta(n)$

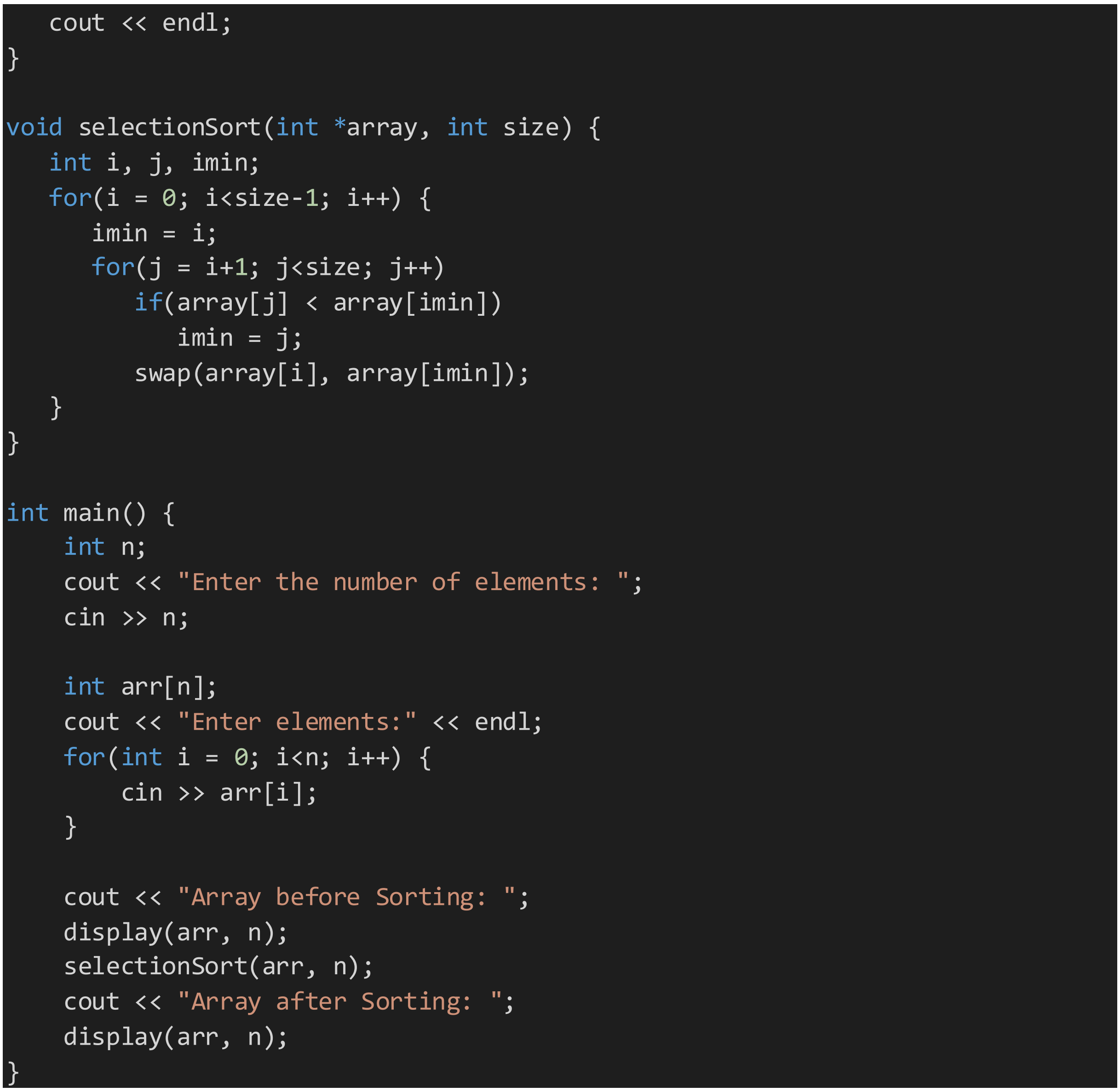


T(n) = cn + cn-c + cn-2c + … + 2c + cn
= c((n-1)(n-2)/2) + cn
= c((n2-3n+2)/2) + cn
= c(n2/2)-(3n/2)+1 +cn
= O(n2)
T(n) = cn + cn-c + cn-2c + … + 2c + cn
= c((n-1)(n-2)/2) + cn
= c((n2-3n+2)/2) + cn
= c(n2/2)-(3n/2)+1 +cn
= Ω (n2)

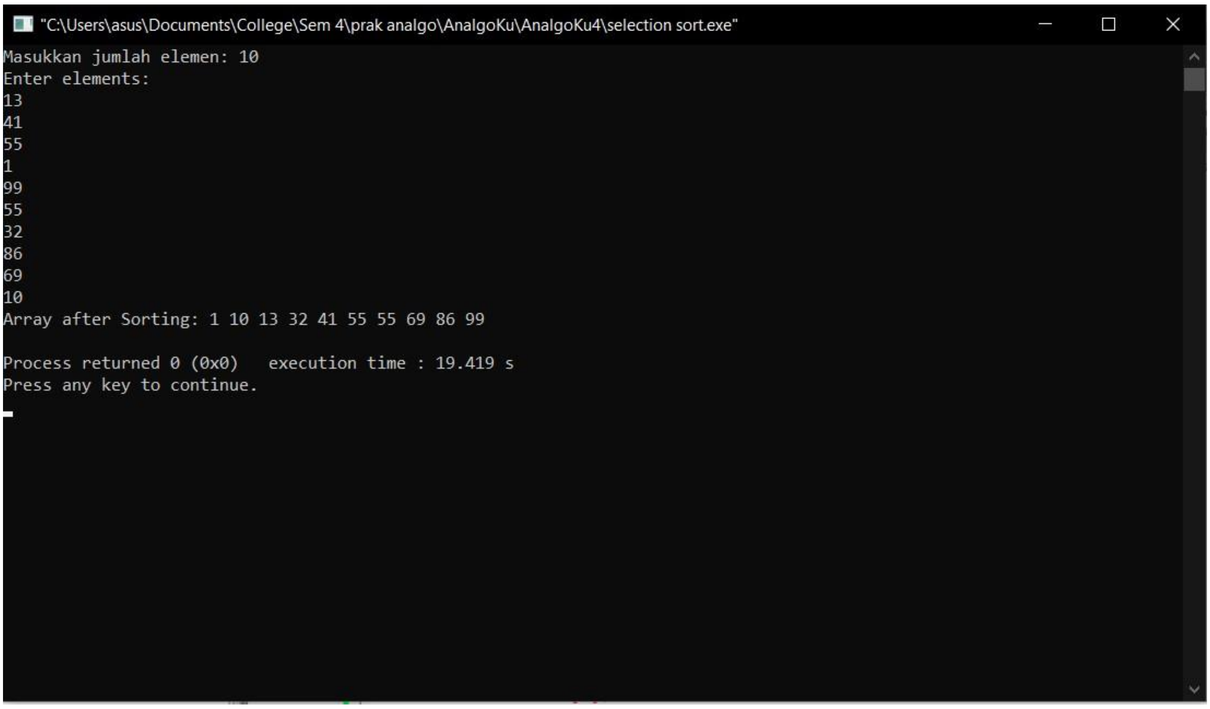
T(n) = cn2
= Θ(n2)

Source code

```
#include<iostream>
using namespace std;

void swapping(int &a, int &b) {
   int temp;
   temp = a;
   a = b;
   b = temp;
}

void display(int *array, int size) {
   for(int i = 0; i<size; i++)
      cout << array[i] << " ";
```



```
   cout << endl;
}

void selectionSort(int *array, int size) {
   int i, j, imin;
   for(i = 0; i<size-1; i++) {
      imin = i;
      for(j = i+1; j<size; j++)
         if(array[j] < array[imin])
            imin = j;
         swap(array[i], array[imin]);
   }
}

int main() {
    int n;
    cout << "Enter the number of elements: ";
    cin >> n;

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

    cout << "Array before Sorting: ";
    display(arr, n);
    selectionSort(arr, n);
    cout << "Array after Sorting: ";
    display(arr, n);
}
```



"C:\Users\asus\Documents\College\Sem 4\prak analgo\AnalgoKu\AnalgoKu4\selection sort.exe"

```
Masukkan jumlah elemen: 10
Enter elements:
13
41
55
1
99
55
32
86
69
10
Array after Sorting: 1 10 13 32 41 55 55 69 86 99

Process returned 0 (0x0)   execution time : 19.419 s
Press any key to continue.
```

Studi Kasus 3: Insertion Sort

Algoritma:

```
for I ← 2 to n do
      insert ← $x_i$
      j ← i
      while (j < i) and (x[j-i] > insert) do
         x[j] ← x[j-1]
         j ← j-1
      endwhile
      x[j] = insert
endfor
```

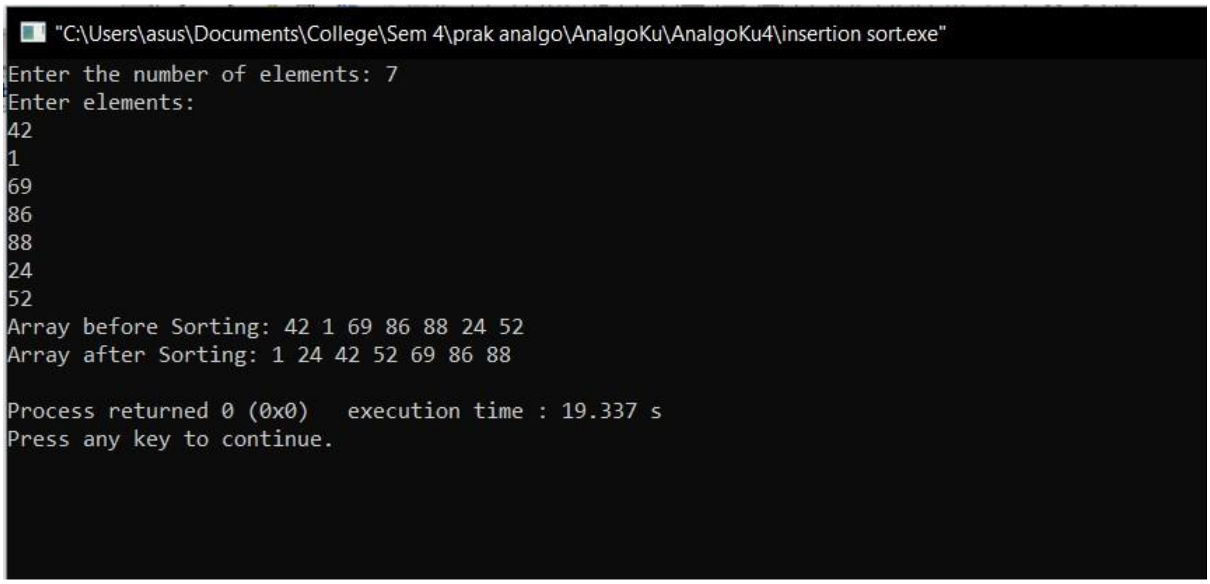
Subproblem = 1
Masalah setiap subproblem = n-1
Waktu proses pembagian = n
Waktu proses penggabungan = n

$T(n)=\{\Theta(1)\,T(n-1)+\Theta(n)$
T(n) = cn + cn-c +cn-2c + ... + 2c +cn <= 2cn2 + cn2
= c((n-1)(n-2)/2) + cn<= 2cn2 + cn2
= c((n2-3n+2)/2) + cn<= 2cn2 + cn2
= c(n2/2)-c(3n/2)+c+cn <= 2cn2 + cn2
=O(n2)

T(n) = cn <= cn
= Ω (n)
T(n) = (cn + cn2)/n
= Θ(n)

Source code

```
#include<iostream>
using namespace std;

void display(int *array, int size) {
   for(int i = 0; i<size; i++)
      cout << array[i] << " ";
   cout << endl;
}

void insertionSort(int *array, int size) {
   int key, j;
   for(int i = 1; i<size; i++) {
      key = array[i];
      j = i;
      while(j > 0 && array[j-1]>key) {
         array[j] = array[j-1];
         j--;
      }
      array[j] = key;
   }
}
int main() {
    int n;
    cout << "Enter the number of elements: ";
    cin >> n;

    int arr[n];
    cout << "Enter elements:" << endl;

    for(int i = 0; i<n; i++) {
        cin >> arr[i];
    }

    cout << "Array before Sorting: ";
    display(arr, n);
    insertionSort(arr, n);
    cout << "Array after Sorting: ";
    display(arr, n);
}
```



"C:\Users\asus\Documents\College\Sem 4\prak analgo\AnalgoKu\AnalgoKu4\insertion sort.exe"

```
Enter the number of elements: 7
Enter elements:
42
1
69
86
88
24
52
Array before Sorting: 42 1 69 86 88 24 52
Array after Sorting: 1 24 42 52 69 86 88

Process returned 0 (0x0)   execution time : 19.337 s
Press any key to continue.
```

Studi Kasus 4: Bubble Sort

Subproblem = 1
Masalah setiap subproblem = n-1
Waktu proses pembagian = n
Waktu proses penggabungan

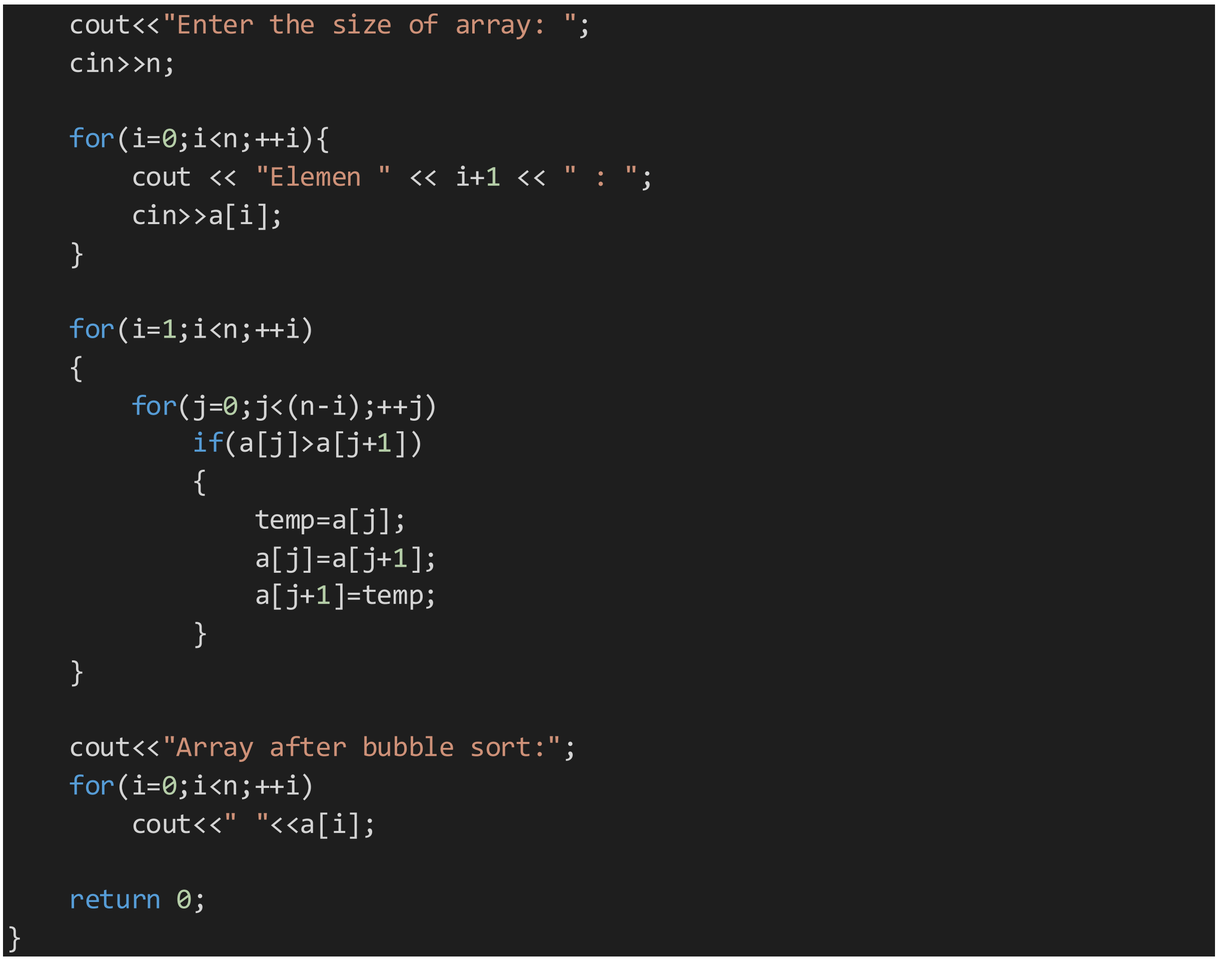
$T(n)=\{\Theta(1)\,T(n-1)+\Theta(n)$
T(n) = cn + cn-c +cn-2c + ... + 2c +c <= 2cn2 + cn2
= c((n-1)(n-2)/2) + c<= 2cn2 + cn2
= c((n2-3n+2)/2) + c<= 2cn2 + cn2
= c(n2/2)-c(3n/2)+2c <= 2cn2 + cn2
=O(n2)

T(n) = cn + cn-c +cn-2c + ... + 2c +c <= 2cn2 + cn2
= c((n-1)(n-2)/2) + c<= 2cn2 + cn2
= c((n2-3n+2)/2) + c<= 2cn2 + cn2
= c(n2/2)-c(3n/2)+2c <= 2cn2 + cn2
= Ω (n2)

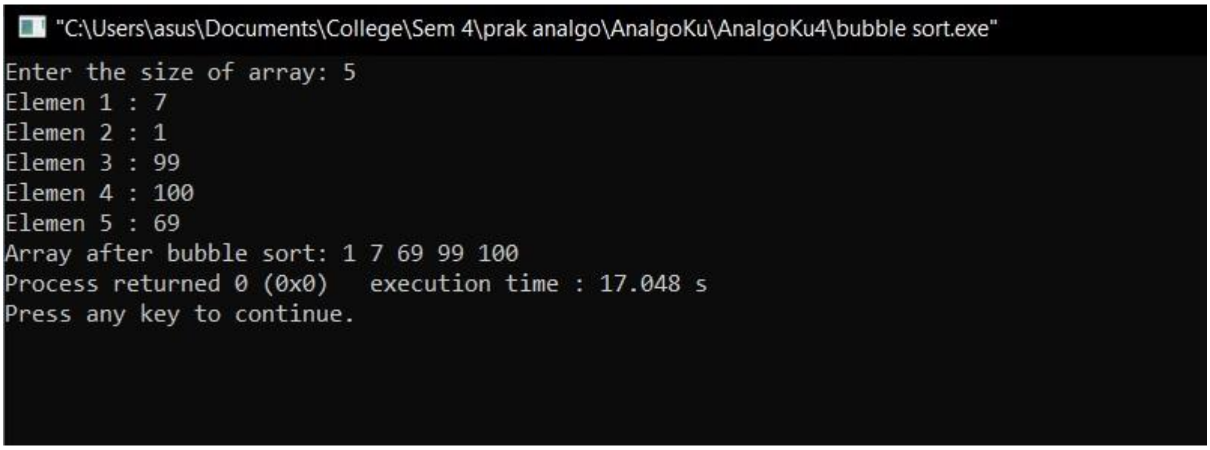
T(n) = cn2 + cn2
= Θ(n2)

Source code

```
#include<iostream>

using namespace std;

int main()
{
    int a[50],n,i,j,temp;
```



```
    cout<<"Enter the size of array: ";
    cin>>n;

    for(i=0;i<n;++i){
        cout << "Elemen " << i+1 << " : ";
        cin>>a[i];
    }

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

    cout<<"Array after bubble sort:";
    for(i=0;i<n;++i)
        cout<<" "<<a[i];

    return 0;
}
```



"C:\Users\asus\Documents\College\Sem 4\prak analgo\AnalgoKu\AnalgoKu4\bubble sort.exe"

```
Enter the size of array: 5
Elemen 1 : 7
Elemen 2 : 1
Elemen 3 : 99
Elemen 4 : 100
Elemen 5 : 69
Array after bubble sort: 1 7 69 99 100
Process returned 0 (0x0)   execution time : 17.048 s
Press any key to continue.
```