Nama : Ahmad Egy Aranda
NPM : 140810180043

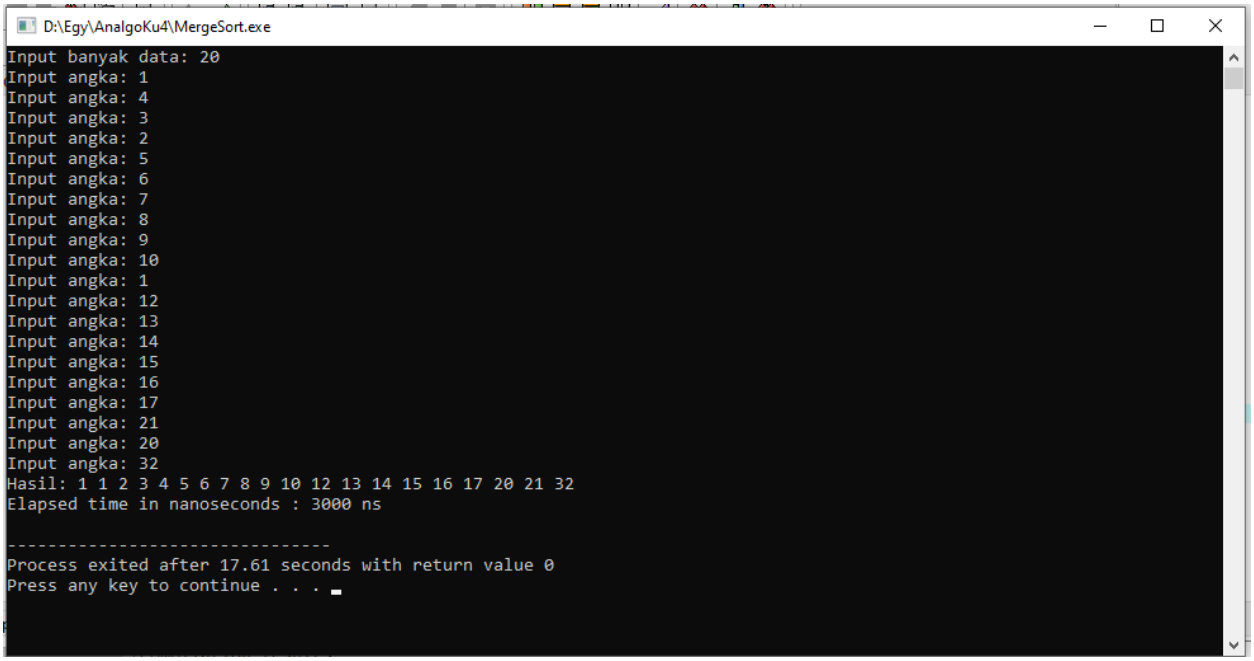
Tugas 4

Studi kasus 1 :

Source Code Merge Sort :

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

void satu(int* in, int p, int q,int r){
   int n1 = q-p+1;
   int n2 = r-q;
   int L[n1+1];
   int R[n2+1];
   for (int i=1; i<=n1; i++){
      L[i-1] = in[(p-1)+i-1];
   }

   for (int j=1; j<=n2; j++){
      R[j-1] = in[(q-1)+j];
   }

   int i=0;
   int j=0;
   L[n1]=2147483647;
   R[n2]=2147483647;

   for (int k=(p-1); k<r; k++){
      if(L[i]<=R[j]){
         in[k]=L[i];
         i = i+1;
      }
      else{
         in[k]=R[j];
         j = j+1;
      }
   }
}

void msort(int* in, int p, int r){
   int q;
```

```
    if(p<r){
        q = (p+r)/2;
        msort(in, p, q);
        msort(in, q+1, r);

        satu(in, p, q, r);
    }
}

void input(int* a, int& n){
    cout << "Input banyak data: "; cin >> n;
    for (int i=0; i<n; i++){
        cout << "Input angka: "; cin >> a[i];
    }
}

int main(){
    int in[100];
    int n;
    input(in,n);
    auto start = chrono::steady_clock::now();
    msort(in,1,n);
    auto end = chrono::steady_clock::now();
    cout << "Hasil: ";
    for(int i=0; i<n; i++){
        cout << in[i] << " ";
    }

    cout<<endl;
    cout << "Elapsed time in nanoseconds : "
                    << chrono::duration_cast<chrono::nanoseconds>(end - start).count()
                    << " ns" << endl;

    return 0;
}
```



Kecepatan computer pada 20 inputan data melalui program ada 3000 ns
Tapi jika menggunakan rumus $O(n \lg n)$. $T(20 \log_{10} 20) = 26$

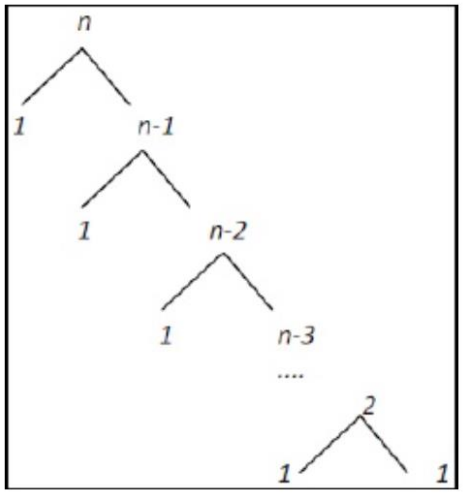
Studi Kasus 2

Pseudocode Selection Sort

```
for i ← n downto 2 do {pass sebanyak n-1 kali}
      imaks ← 1
      for j ← 2 to i do
        if xj > ximaks then
          imaks ← j
        endif
      endfor
      {pertukarkan ximaks dengan xi}
      temp ← xi
      xi ← ximaks
      ximaks ← 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((n^2-3n+2)/2) + cn
= c(n^2/2)-(3n/2)+1 + cn
=O(n^2)

T(n) = cn + cn-c +cn-2c + ... + 2c +cn
= c((n-1)(n-2)/2) + cn
= c((n^2-3n+2)/2) + cn
= c(n^2/2)-(3n/2)+1 + cn
= Ω (n^2)

T(n) = cn^2
= Θ(n^2)

Source Code Selection Sort

```
#include <iostream>
#include<conio.h>

using namespace std;

int data[100],data2[100];
int n;

void tukar(int a, int b)
{
        int t;
        t = data[b];
        data[b] = data[a];
        data[a] = t;
```

```
}
void selection_sort()
{
        int pos,i,j;
        for(i=1;i<=n-1;i++)
        {
           pos = i;
           for(j = i+1;j<=n;j++)
           {
                if(data[j] < data[pos]) pos = j;
              }
      if(pos != i) tukar(pos,i);
   }
}

int main()
{
        cout << "\n=====================================";
        cout<<"\nMasukkan Jumlah Data : ";cin>>n;
        cout << "\n-------------------------------------" << endl;
        for(int i=1;i<=n;i++)
        {
                cout<<"Masukkan data ke-"<<i<<" : ";
                cin>>data[i];
                data2[i]=data[i];
        }

        selection_sort();
        cout << "\n-------------------------------------" << endl;
        cout<<"Data Setelah di Sort : "<<endl;
        for(int i=1; i<=n; i++)
        {
                cout<<" "<<data[i];
        }

        cout << "\n=====================================\n";
        getch();
}
```

Studi Kasus 3

Pseudocode Insertion Sort

```
Algoritma
        for i ← 2 to n do
            insert ← xi
            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 penggabungan = n
Waktu proses pembagian = n

$T(n) = \{\Theta(1)\ T(n-1) + \Theta(n)$

T(n) = cn + cn-c +cn-2c + ... + 2c +cn <= $2cn^2 + cn^2$
= c((n-1)(n-2)/2) + cn<= $2cn^2 + cn^2$
= c((n^2-3n+2)/2) + cn<= $2cn^2 + cn^2$
= c(n^2/2)-c(3n/2)+c+cn <= $2cn^2 + cn^2$
=O(n^2)

T(n) = cn <= cn
= Ω (n)

T(n) = (cn + cn^2)/n
= Θ(n)

Source Code Insertion Sort

```
#include <iostream>
#include <conio.h>

using namespace std;

int data[100],data2[100],n;

void insertion_sort()
{
        int temp,i,j;
        for(i=1;i<=n;i++){
            temp = data[i];
```

```
                j = i -1;
            while(data[j]>temp && j>=0){
                        data[j+1] = data[j];
                    j--;
            }
            data[j+1] = temp;
        }
}
int main()
{
        cout << "\n================================="<<endl;
        cout<<"Masukkan Jumlah Data : "; cin>>n;
        cout<<endl;
        cout << "\n---------------------------------" << endl;
        for(int i=1;i<=n;i++)
        {
          cout<<"Masukkan data ke-"<<i<<" : ";
          cin>>data[i];
          data2[i]=data[i];
        }
        cout << "\n---------------------------------" << endl;
        insertion_sort();
        cout<<"\nData Setelah di Sort : "<<endl;
        for(int i=1; i<=n; i++)
        {
          cout<<data[i]<<" ";
        }
        cout << "\n================================="<<endl;
        getch();
}
```

Studi Kasus 4

$$T(n) = \{\Theta(1)\ T(n-1) + \Theta(n)$$

T(n) = cn + cn-c +cn-2c + ... + 2c +c <= $2cn^2 + cn^2$
= c((n-1)(n-2)/2) + c<= $2cn^2 + cn^2$
= c((n^2-3n+2)/2) + c<= $2cn^2 + cn^2$
= c(n^2/2)-c(3n/2)+2c <= $2cn^2 + cn^2$
=O(n^2)

T(n) = cn + cn-c +cn-2c + ... + 2c +c <= $2cn^2 + cn^2$

$= c((n-1)(n-2)/2) + c <= 2cn^2 + cn^2$
$= c((n^2-3n+2)/2) + c <= 2cn^2 + cn^2$
$= c(n^2/2)-c(3n/2)+2c <= 2cn^2 + cn^2$
$= \Omega(n^2)$

$T(n) = cn^2 + cn^2$
$= \Theta(n^2)$

Source Code Bubble Sort

```
#include <iostream>
#include <conio.h>

using namespace std;


int main(){
	int arr[100],n,temp;
	cout << "\n================================================"<<endl;
	cout<<"Masukkan banyak elemen yang akan diinput : ";cin>>n;
	cout << "\n------------------------------------------------" << endl;

	for(int i=0;i<n;++i){
		cout<<"Masukkan Elemen ke-"<<i+1<<" : ";cin>>arr[i];
	}

	for(int i=1;i<n;i++){
		for(int j=0;j<(n-1);j++){
			if(arr[j]>arr[j+1]){
				temp=arr[j];
				arr[j]=arr[j+1];
				arr[j+1]=temp;
			}
		}
	}
	cout << "------------------------------------------------" << endl;
	cout<<"\nHasil dari Bubble Sort : "<<endl;
	for(int i=0;i<n;i++){
		cout<<" "<<arr[i];
	}
	cout << "\n================================================"<<endl;
}
```