Algorithm Analysis

Assignment 1 Order the following functions by growth rate: N, $\sqrt{N}$, $N^{1.5}$, N^2, Nlog N, N loglogN, $Nlog^2N$, $Nlog(N^2)$, 2/N, 2^N,$2^{N/2}$, 37, N^2logN, N^3. Indicate which functions grow at the same rate.

Assignment 2. Give an analysis of running time of each following code (Big-Oh)

a.
```
Sum = 0;
for (i =1; i<= N; i++)
        Sum += i*i*i;
```

b.
```
Sum = 0;
for (i =1; i<= N; i++)
        for(j=0;j <= N*N; j++)
                Sum ++;
```

c.
```
Sum = 0;
for (i =1; i<= N; i++)
        for(j=0;j <= i; j++)
                Sum ++;
```

d.
```
Sum = 0;
for (i =1; i<= N; i++)
        for(j=0;j <= i*i; j++)
                for(k=0;k <= j; k++)
                        Sum ++;
```

e. Sum = 0;

```
for (i =1; i<= N; i++)
        for(j=0;j <= i*i; j++)
        if ( j%i== 0 )
                for(k=0;jk<=j; k++)
                        Sum ++;
```

f. i=1; s=1;

```
while( s<= N)
{ i++;
 s+=i;
}
```

Assignment 3 What is the running time of the following recursive function (specified as a function of the input value *n*)

a.

```
function(int n) {
        if(n <= 1) return;

        for (int i=1 ; i <= 3 ; i++ )
                function (n − 1).
}
```

b.

```
function (int n) {
        if(n <= 1)  return;
        for(int i = 1; i < n; i + +)
                printf(" ∗ ");
        function ( 0.8n ) ;
}
```

c.

```
int Function (int n) {
        if(n <= 2) return 1;
        else return (Function (floor(sqrt(n))) + 1);
}
```

Assignment 4

a. Write a program to evaluate the function $F(X) = \sum_{i=0}^{N} a_i X^i$. All a_i are the number of an array of N elements which we already knew. After that, calculate your running time?

b. If your running time is $O(N^2)$, please find an algorithm with linear complexity.

Assignment 5

a. Write a program to determine if a positive integer, N, is prime.
b. In terms of N, what is the worst-case running time of your program?