The objective of this lab is to:

1. Practice complexity analysis.

ALERT!

1. This is an individual lab, you are strictly **NOT** allowed to discuss your solution with fellow colleagues, even not allowed asking how is he/she is doing, it may result in negative marking. You can **ONLY** discuss with your TAs or with me.
2. **Anyone caught in act of plagiarism would be awarded an "F" grade in this Lab.**

Task 01: [20 Marks]

Derive the time function for each of the following code snippets:

1.

```
int a = 0, b = 0;
for (i = 0; i < n; i++)
{
      a = a + i;
}

for (j = 0; j < n; j++)
{
      b = b + j;
}
```

2.

```
int a = 0;
for (i = 0; i < n; i++)
{
      for (j = n; j > 0; j--)
      {
            a = a + i + j;
      }
}
```

3.

```
int sum = 0;
for (int i = 1; i < n; i *= 2)
{
      for (int j = 0; j < n; j++)
      {
            sum++;
      }
}
```

4.

```
int a = 0, i = n;
while (i > 0)
{
      a += i;
      i /= 2;
}
```

5.
```
for (int i = n; i > 0; i--)
{
     for (int j = 1; j < n; j = j * 2)
     {
          cout << i;
     }
}
```

Task 02: [15 Minutes]

Find the time complexity in terms of big-Oh notation for following code snippets:

1.
```
int i, j, k = 0;
for (i = n / 2; i <= n; i++)
  {
     for (j = 2; j <= n; j = j * 3)
         {
           k = k + n / 2;
     }
}
```

2.
```
int count = 0;
for (int i = n / 2; i <= n; i++)
     for (int j = 1; j <= n; j = 2 * j)
          for (int k = 1; k <= n; k = k * 2)
               count++;
```

3.
```
  int count = 0;
for (int i = n; i > 0; i /= 2)
{
     for (int j = 0; j < i; j++)
     {
          count++;
     }
}
```

Task 03: [10 Minutes]

Write the best case and worst case time complexities of each of the following functions.

1.
```
void function(int n)
{
     if (n == 1)
          return;
     for (int i = 1; i <= n; i++)
     {
          for (int j = 1; j <= n; j++)
```

```
                {
                        cout << "*";
                        break;
                }
        }
}
```

2.

```
void function(int n)
{
        if (n % 2 == 0)
        {
                for (int i = 0; i < n; i *= 2)
                {
                        cout << i << endl;
                }
        }
        else
        {
                for (int i = 0; i < n; i++)
                {
                        for (int j = 0; j < i; j++)
                        {
                                cout << i + j << endl;
                        }
                }
        }

}
```

Task 04: [15 Minutes]

Find the time function of following program.

```
int main()
{
      int num;
      char ch;
      cout << "Enter a number: ";
      cin >> num;
      cout << "If you wish to check whether the input number is ";
      cout << "prime or not? enter 1";
      cout << "enter 2 to see fibonacci series till the input number.";
      cin >> ch;

      if (ch == '1')
      {
            if (isPrime(num) == true)
                  cout << num << " is a Prime number" << endl;
            else
```

```
                cout << num << " is not a Prime number" << endl;
        }
        if (ch == '2')
        {
                printFibonacci(num);
        }
        return 0;
}

void printFibonacci(int n)
{
        int fib1 = 0;
        int fib2 = 1;

        for(int i = 2; i <= n; i = i + 1)
        {
                int temp = fib1 + fib2;
                fib1 = fib2;
                fib2 = temp;
                cout << temp << endl;
        }
}

bool isPrime(int n)
{
        for (int i = 2; i <= sqrt(n); i++)
        {
                if (n % i == 0)
                {
                        return false;
                }
        }
        return true;
}
```