Objectives of this assignment:

- to explore time complexity and "real time"
- to "dust off" programming skills

What you need to do:

1. Design and implement a naïve program to sort an array
2. Collect the execution time T(n) as a function of n
3. Plot the functions T(n)/n, T(n)/n^2, and T(n)/n^3 on the same graph.
4. Refer to the analysis of the time complexity your performed for your Module 1 and discuss it light of the graph you plotted above.

Objective:

1. The objective of this programming assignment is to design and implement in Java the naïve sorting program presented in the lecture to sort a list of numbers. We are interested in exploring the relationship between the time complexity and the "real time". For this exploration, you will collect the execution time T(n) as a function of n and plot T(n)/n, T(n)/n^2, and T(n)/n^3 on the same graph. Finally, discuss your results.

Program to implement

```
collectData()
        Generate an array G of HUGE length L (as huge as your language allows) with random values
        for n = 5,000 to L (with step 1,000)
                copy in Array A n first values from Array G

                Start timing // We time the sorting of Array A of length n
                for j = 1 to n-1 //Sort_Array(A)
                        for i = (j + 1) to n
                                if (A[i] < A[j])
                                        // swap A[i] and A[j]
                                        buffer = A[j]
                                        A[j] = A[i]
                                        A[i] = buffer
                Store the value n and the values T(n)/n, T(n)/n^2, and T(n)/n^3 in a file F where
                T(n) is the execution time.
```

Data Analysis

Use any plotting software (e.g., Excel) to plot the values T(n)/n, T(n)/n^2, and T(n)/n^3 in File F as a function of n (on the same graph). File F is the file produced by the program you implemented. Discuss your results based on the plot. (**Hint**: is T(n) closer to K. n, K.n^2, or K. n^3.$\log_2(n)$ where K is a constant?)

Report

- Write a report that will contain, explain, and discuss the plot. The report should not exceed one page.
- In addition, your report must contain the following information:
  - whether the program works or not (this must be just ONE sentence)
  - the directions to compile and execute your program
- Good writing is expected.
- Recall that answers must be well written, documented, justified, and presented to get full credit.

What you need to turn in:

- Electronic copy of your source program
- Electronic copy of the report (including your answers) (standalone). Submit the file as a Microsoft Word or PDF file.

Grading

- Program is worth 30% if it works and provides data to analyze
- Quality of the report is worth 70% distributed as follows: good plots (25%), explanations of plots (10%), discussion and conclusion (35%).