

## CS2851 -- Lab 1: Asymptotic Complexity Analysis

Spring 2008

### Outcomes Addressed

- Analyze the time complexity of algorithms

### Procedure

You are required to determine computational time complexity for each of the following mysterious sorting algorithms contained within the *MysteriousSort* class (download class file from class website):

```
public static ArrayList<Integer> sortA(ArrayList<Integer> a);
```

```
public static ArrayList<Integer> sortB(ArrayList<Integer> a);
```

```
public static ArrayList<Integer> sortC(ArrayList<Integer> a);
```

```
public static ArrayList<Integer> sortD(ArrayList<Integer> a);
```

1) Perform the following three *timing* evaluations for *each* algorithm using at least 10 trials of equally spaced sample lengths, i.e.,  $n = 1000, 2000, \dots, 10000$ . (Depending on the speed of your computer and the algorithm you may need to use larger or much smaller numbers, and you may also use more sample points.)

- The integers in the input array are in ascending order.
- The integers in the input array are in descending order.
- The integers in the input array are in random order, you can use `Collections.shuffle()`.

2) From your test program, output your data for each trial as a tab- or comma-delimited text file.

3) Import your data into Excel.

4) Using Excel, plot your data and using the tutorial by G. L. Gray on curve fitting, determine the function that best characterizes the data for each trial.

5) For each characteristic function  $f(n)$ , identify a function  $g(n)$  that satisfies the asymptotic time complexity for  $f(n) \in O(g(n))$  and  $f(n) \in \Omega(g(n))$  for your algorithm. Also determine if there exists a function  $g(n)$  such that  $f(n) \in \theta(g(n))$ ,

### Lab report (due prior to week 3 lab)

Your report should be one pdf file and include:

- Results: You should include a plot with the three characteristic curves for each algorithm being analyzed, along with the curve fitting function for each curve and your asymptotic complexity analysis.
- A discussion of:
  - Methodology
  - Analysis of your results... any surprises?
  - Conclusions based on your results

Zip up your report, along with document source code and log your lab time in the FAST system.

You are required to demo each lab.

Please submit all labs by e-mail as a single Zip file attachment. The zip file name needs to include the class number, lab number, and your name. Your lab report name must also include the class number, lab number, and your name.

When the zip file is uncompressed, all files/subdirectories should be contained within a directory with the same name as the zip file, i.e., class number, lab number, and your name.

If you have any questions, consult your instructor.

Regards,

Jay Urbain