CS 284: Homework Assignment 2
Due: March 7, 11:55pm

1 Assignment Policies

Collaboration Policy. Homework will be done individually: each student must hand in their own answers. It is acceptable for students to collaborate in understanding the material but not in solving the problems or programming. Use of the Internet is allowed, but should not include searching for existing solutions.

Under absolutely no circumstances code can be exchanged between students. Excerpts of code presented in class can be used.

Assignments from previous offerings of the course must not be re-used. Violations will be penalized appropriately.

2 Assignment

This assignment asks you to implement a number of methods for a class `Complexity`. These methods should be implemented using for loops, as seen in class (except for the extra-credit one). The Big O time complexity for these methods has to be the one specified in each of the items listed below. All methods are parameterized with `n`. Here is an example of a method that has linear growth rate. That is, the growth rate is $\mathcal{O}(n)$:

```
void public method0(int n) {
   for (i=0; i<n; i++) {
      System.out.println("Iteration "+i);
   }
}
```

The methods you should implement are:

1. `public static void method1(int n)`: a method that has time complexity $\mathcal{O}(n^2)$.
2. `public static void method2(int n)`: a method that has time complexity $\mathcal{O}(n^3)$.
3. `public static void method3(int n)`: a method that has time complexity $\mathcal{O}(\log n)$.
4. Consider the following method where `a` is assumes sorted in ascending order and `x` is a number larger than any number in `a`:

```java
public static boolean bSearch(int[] a, int x) {
  int end = a.length - 1;
  int start = 0;
  while (start <= end) {
    int mid = (end - start) / 2 + start;
    if (a[mid] == x) return true;
    else if (a[mid] > x) end = mid - 1;
    else start = mid + 1;
  }
  return false;
}
```

Suppose the length of `a` is 32. Fill in the table below with the values that `end` and `start` take in every iteration before the while loop exits. The first row has been completed for you. Note: you must add this table as a Java comment in your source code.

Iteration	`start`	`end`
1	0	31

Suppose the length of `a` is 64. Fill in the table below with the values that `end` and `start` take in every iteration before the while loop exits. The first row has been completed for you.

Iteration	`start`	`end`
1	0	63

5. What is the relation between the size `n` of `a` and the number of iterations?
6. What is the time complexity of `bSearch`?
7. `public static void method4(int n)`: a method that has time complexity $\mathcal{O}(n \log n)$.
8. `public static void method5(int n)`: a method that has time complexity $\mathcal{O}(\log \log n)$.
9. (Optional) `public static int method6(int n)`: a method that has time complexity $\mathcal{O}(2^n)$. For this method you should consider using recursion.

3 Submission instructions

Submit a single file named `Complexity.java` through Canvas. No report is required.