CS302 - Programming Assignment 1

Due: Mon, Sep. 25. Must be uploaded to Canvas before the beginning of class.

Please read the sections of the syllabus on programming assignments and honor code before starting this homework. I would also recommend reading the rubric for programming grading, so that you know how we will be grading this assignment.

1. [**30 points**] Create a Java class called `Multiplication`. It should contain the following two methods:

   - `public static String karatsuba(String n1, String n2)`
   - `public static String school(String n1, String n2)`

   Both methods take in two Strings of base-10 numbers (which are not necessarily the same length) and return a String containing their product. Using Strings instead of ints or longs allows you to multiply very large numbers. You may convert the characters of the strings into ints to do the multiplication, but you should only multiply two ints if they are both less than 10.

   `school` should use the grade school formula for multiplication, and `karatsuba` should use the Karatsuba divide and conquer algorithm.

   Your main method should prompt the user for two numbers, and should return the product of those two numbers using both methods, along with the time in milliseconds it took to do each calculation.

   Put a multiline comment at the beginning of your class. It should contain:

   - Your name
   - ”Programming Assignment 1”
   - The name of anyone you worked with
   - Sample output from your program
   - Answer to the following questions:
     - Approximately how large must n be before your karatsuba method is reliably faster than your school method for multiplying two n-digit numbers?
     - How long did you work on this Programming Assignment?

   Sample Output:

   ```
   First number?
   1948723597345140913854873258762342
   Second number?
   124871219481237572524723482372
   The output using the school algorithm is:
   ```

```
243339492032351923147854304472969918560398748074099956974435224
and it took 7 milliseconds
The output using the karatsuba algorithm is:
243339492032351923147854304472969918560398748074099956974435224
and it took 6 milliseconds
```