Test 1: CPS 004G

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Name: __________________________________________

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Honor code acknowledgment (signature) ____________________________

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PROBLEM 1:  (The Closer You Get (15 points))

In this problem all methods are in a class DNAstuff so code in one method can call the other methods discussed.

There are many ways of determining how similar two strands of DNA are to each other. In this problem you’re provided with a method snpMeasure that measures similarity of two strands using SNP data and returns a number between 0 and 1 where 1 means the strands are identical and 0 means that the two strands are very far apart. The code isn’t shown completely, but you can call this method from other methods in the class DNAstuff.

```java
/**
 * Returns a value indicating how close a and b are to each other
 * when measured using a normalized SNP-metric. The value returned
 * is between 0 and 1, with 0 meaning not close at all and 1 meaning
 * identical.
 * @param a is a strand of dna
 * @param b is a strand of dna
 * @return value in range [0..1] indicating how close a is to b where 1 indicates identical
 */
public double snpMeasure(String a, String b){
    if (a.equals(b)){
        return 1.0;
    }
    // code not shown here, returns snp-metric between 0 and 1
}
```

(you don’t write code on this page)
Part A (10 points)
The method leastSimilar is intended to return the String in an array of DNA strands that is least-similar to a specified Strand. For example, to find the element of an array named strands least similar to "AGGTTCCA" the call below would be used (where the code is in the class DNAstuff and the array strands is filled with Strings representing DNA.)

```
String least = leastSimilar(strands,"AGGTTCCA");
```

You’re to complete the body of leastSimilar that’s started for you by filling in code appropriately in two places.

```java
/**
 * Returns the String from array strands that is the least similar
 * compared to parameter dna when measured using snpMeasure, i.e., the element
 * returned is from strands and is the least similar to dna.
 * @param strands is an array of dna strands
 * @param dna is compared to elements from strands
 * @return which String from strands is least similar to dna
 */
public String leastSimilar(String[] strands, String dna){
    double min = 0; // fill in a value here
    String minString = "";
    for(String s : strands){
        double measure = snpMeasure(s,dna);
        // fill in code here to set value of minString
        // and other variables as appropriate
    }
    return minString;
}
```
**Part B (5 points)**

Write the method `minMeasure` that should effectively compare every pair of DNA strands in an array and return the `snpMeasure` value that is the lowest for all pairs. In your code you can call `leastSimilar` from **Part A**, assuming it works as specified. You can also call `snpMeasure`.

The idea is to return a double that is the closest to zero (least similar using `snpMeasure`) for all pairs of strands. Note that the call below, for example, will assign to `far` the String from `strands` that is least-similar to `s`. In the code you write you should consider making calls like the call below (though not necessarily identical to it), though you don’t have to.

```java
String far = leastSimilar(strands, s);
```

Write the method below.

```java
/**
 * Return the minimum snpMeasure value for all pairs of DNA strings in strands.
 * @param strands is array of DNA strands
 * @return minimum snpMeasure value for all pairs of strings in strand
 */
public double minMeasure(String[] strands){
```
PROBLEM 2:  \((\text{Max CG (10 points)})\)

Do the CGratio max APT problem on the 4G website. Turn in the java code using Eclipse. Be sure to include a README in which you indicate how many hours you worked. You should not speak with anyone about this. When you turn in your code you're indicating that you did not work with anyone. You may consult books, notes, and online materials.