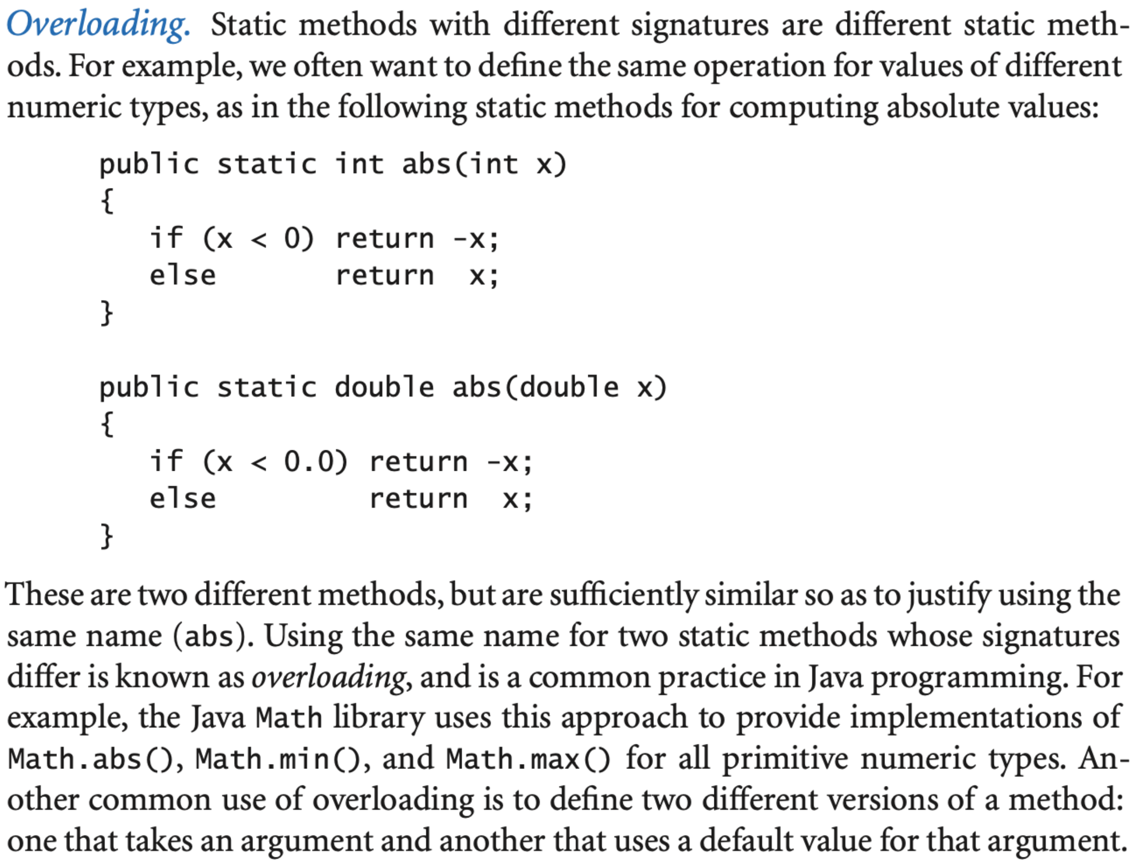
CSC1003 Practice Outline Oct31-Nov4

Programming exercises about Functions. Remember to test your functions within the main() method.

1. Write a static method `max3()` that takes three int arguments and returns the value of the largest one. Add an overloaded function that does the same thing with three double values.

   About overloading:



Overloading. Static methods with different signatures are different static methods. For example, we often want to define the same operation for values of different numeric types, as in the following static methods for computing absolute values:

```
public static int abs(int x)
{
   if (x < 0) return -x;
   else       return  x;
}

public static double abs(double x)
{
   if (x < 0.0) return -x;
   else         return  x;
}
```

These are two different methods, but are sufficiently similar so as to justify using the same name (`abs`). Using the same name for two static methods whose signatures differ is known as *overloading*, and is a common practice in Java programming. For example, the Java `Math` library uses this approach to provide implementations of `Math.abs()`, `Math.min()`, and `Math.max()` for all primitive numeric types. Another common use of overloading is to define two different versions of a method: one that takes an argument and another that uses a default value for that argument.

2. Write a static method `lg()` that takes a double argument n and returns the base-2 logarithm of n. You may use Java's Math library.

   Hint: the API for Java's Math library can be found via the link https://docs.oracle.com/javase/8/docs/api/java/lang/Math.html

3. Write a static method `lg()` that takes an int argument n and returns the largest integer not larger than the base-2 logarithm of n.

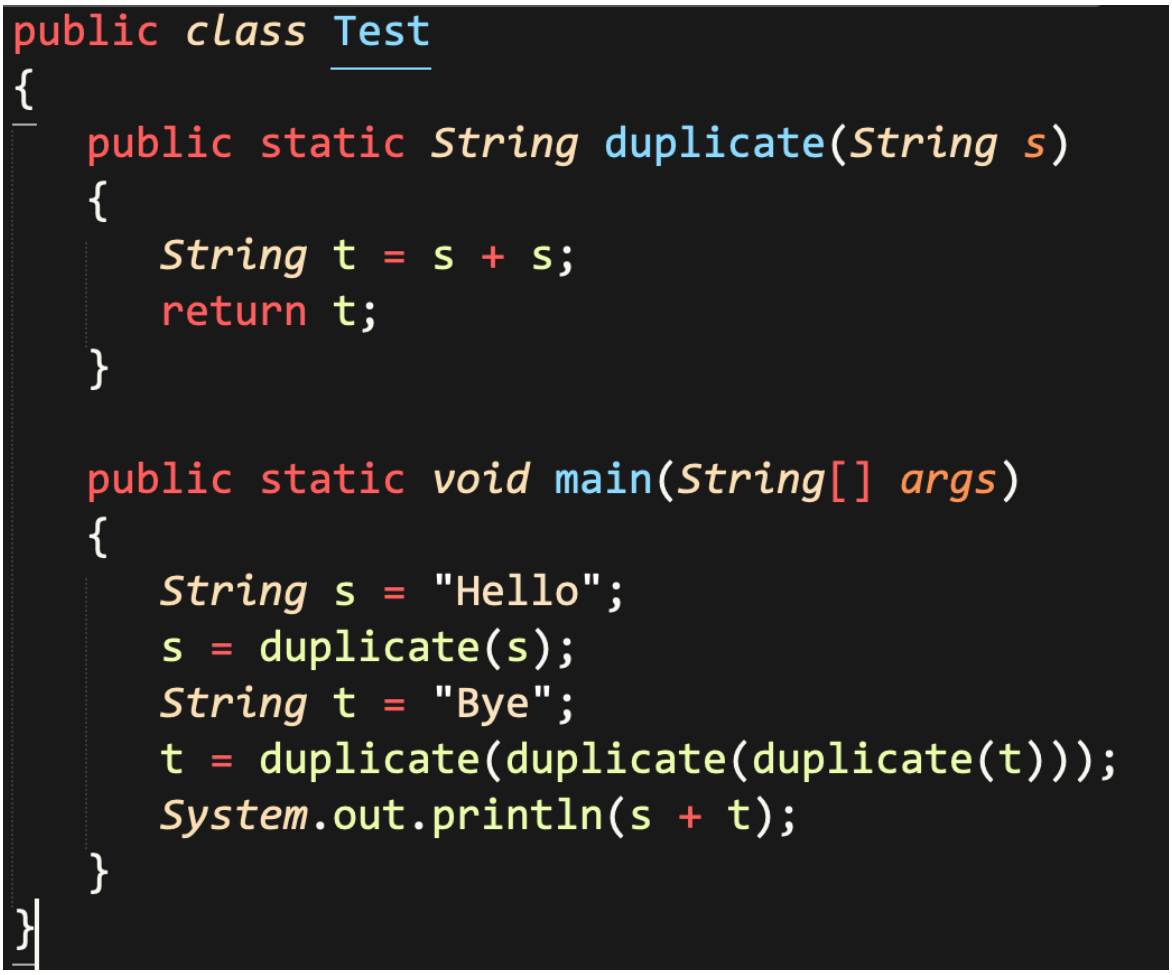
   Hint: Do not use the Math library.

4. Write a static method `any()` that takes a boolean array as its argument and returns true if any of the elements in the array is true, and false otherwise. Write a static method `all()` that takes an array of boolean values as its argument and returns true if all

of the elements in the array are true, and false otherwise.

5. Write a static method `reverse()` that takes an array of integers (int) as its argument and returns a new array with the integers in reverse order. (Do not change the order of the ints in the argument array.)

6. What's the expected output of the following program?



```java
public class Test
{
    public static String duplicate(String s)
    {
        String t = s + s;
        return t;
    }

    public static void main(String[] args)
    {
        String s = "Hello";
        s = duplicate(s);
        String t = "Bye";
        t = duplicate(duplicate(duplicate(t)));
        System.out.println(s + t);
    }
}
```

7. [Optional] *Fourier spikes.* Write a program that takes a command-line argument n and plots the function

$$(\cos(t) + \cos(2t) + \cos(3t) + \cdots + \cos(nt))/n$$

for 500 equally spaced samples of t from -10 to 10 (in radians). Run your program for n = 5 and n = 500.

Note: You will observe that the sum converges to a spike (0 everywhere except a single value). This property is the basis for a proof that *any* smooth function can be expressed as a sum of sinusoids.

Hint: you can use StdDraw to plot the function.