Assignment 5: Bishop's Bridge

There's construction on the bridge in front of Bishop's (the one that crosses into Lennoxville) and you've been charged with synchronizing the movement of vehicles across it from both directions. This means that you will only be able to let vehicles from one side cross when there are no vehicles from the other side crossing.

You realize that you've just learned about semaphores and that they'd allow you to solve this problem effortlessly! Semaphores are simple counters so using them you can lock and control the number of cars on the bridge along with their direction.

Start off by building a simple Car class like so:

```
abstract class Car {
   private String name;
}
```

Bridge (10)

Make a class called **Bridge** to represent the bridge that the cars will cross. It should have an array of Cars that are currently on it, and two semaphores: one for BishopsBoundCars, and another for LionsBoundCars. Create methods to add and remove cars from the array of cars on the Bridge. These methods should print the type of car being added or removed. Lastly, create a method to print all the cars on the bridge.

Bishop's and Lion's Bound Cars (10)

Create two classes that represent the Cars moving in either direction that implement the Runnable interface and inherit from the Car class. These get initialized with the Bridge that they are crossing.

In their run method they will both do the following in an infinite loop (**while(true)**):

1. Sleep for a random amount of time.
    a. The students driving to the Lion's drive 100 times faster than the ones travelling to Bishop's.
2. If there are no cars on the bridge, or the type of car on the bridge is the opposite type, then wait until this type can proceed with one of the semaphores.
3. Start driving over it.
4. Sleep for a bit.

    a. The students travelling to Bishop's take 4 times longer than the students going to the Lion's.
5. Get off the bridge.
6. If there are no cars left on the bridge, then let the other side go through.

Test your program by creating a bridge with 3 Bishop's bound cars, and 2 Lion's bound cars associated to it. Start all of these cars in new threads and run them forever. Optionally, you could add a timeout to your while loops. Try modifying the number of permits you initialize the semaphores with to see what happens.

Grading Criteria:

Style/submission guidelines: https://gmierzwinski.github.io/bishops/cs321/style_guidelines.html

Comments, Formatting, & Readability	**5 Marks**
Submission Guidelines	**5 Marks**
Bridge	**10 Marks**
Bishop's and Lion's Bound Cars	**10 Marks**
Testing	**5 Marks**
Total	**35 Marks**