Assignment 8

*Note: When you turn in an assignment to be graded in this class, you are making the claim that you neither gave nor received assistance on the work you turned in (except, of course, assistance from the instructor or teaching assistants).*

Write the following Java programs and upload the FoodBank and RaceTrack files to Canvas when the assignment is complete. Please note that the use of the stop and suspend methods are **prohibited** for both programs.

[40 points] Create a Java program that uses monitors to control access to a FoodBank object. You will create a FoodBank class that has a food amount and methods to give and take food. You will create two Thread classes for this program that will either put food into the food bank or take food from the food bank. Food cannot be taken if there is no food available to take. This is not a true producer/consumer problem. You only have one condition, which is to wait if there is no food available to take. Both giving and taking food must involve locking the FoodBank object and unlocking it when done. The FoodBank object must never enter an invalid state (a negative amount of food) The methods in FoodBank to take and give food must print out exactly what is happening with each action in the method, i.e. “Waiting to get food”, “Taking 10 items of food, the balance is now 20 items”. **NOTE:** No other methods can print to the console.

A class FoodBank

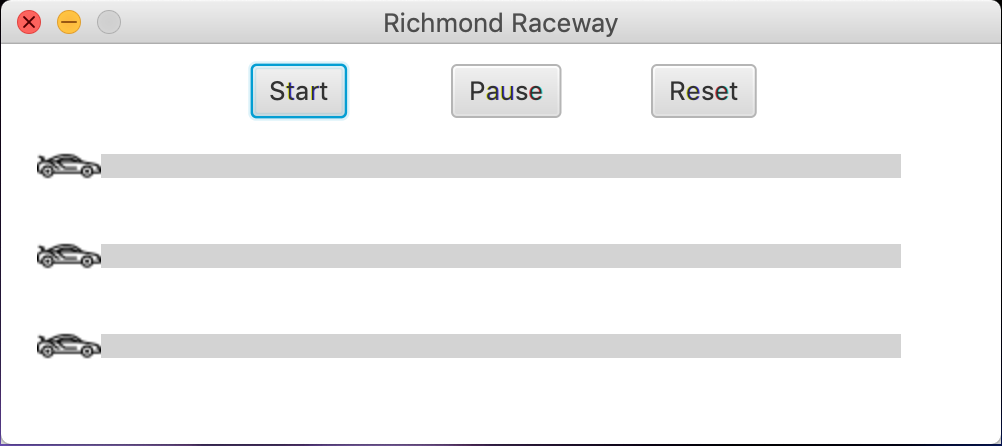
FoodBank will have a single instance variable named food of type int. FoodBank will define a default constructor which initializes food to zero. FoodBank will have two methods: giveFood and takeFood. Both methods will have a single parameter of type int. giveFood will add the value of the parameter to the food instance variable, takeFood will subtract the value.

A class FoodProducer

FoodProducer will have a single instance variable named bank of type FoodBank. FoodProducer will have a parameterized constructor with a single parameter of type FoodBank. The parameterized constructor will initialize the value of bank to the single parameter. FoodProducer will extend the Thread class and override Thread’s run method. FoodProducer’s run method will loop infinitely. On each loop iteration run will generate a random number from 1-100 and add that much food to the bank instance variable. After adding food, the thread will sleep for 100 milliseconds.

A class FoodConsumer  
 FoodConsumer is identical to FoodProducer except that the random number generated in run will be removed from the FoodBank object.

A class FoodBankPatrons  
 FoodBankPatrons will have a main method in which a FoodBank, FoodProcuder, and FoodConsumer object are created. The FoodProcuder and FoodConsumer must share the same FoodBank object. Once created, the main method starts these threads.

[60 points] Create a Java program which will use multiple threads to simulate a race between cars. The program should look like: 

Create a class RaceTrack which uses JavaFX\* (subclasses the [Application](https://docs.oracle.com/javase/8/javafx/api/javafx/application/Application.html) class) and overrides its start method to do the required drawing. Each car must be advanced by a separate [Thread](https://docs.oracle.com/javase/7/docs/api/java/lang/Thread.html). On each thread iteration, each car should advance a random 0-10 pixels forward. Once advanced, a thread should sleep for 50 miliseconds. The threads will execute until a car reaches the end of the track. Once this occurs, an [Alert](https://docs.oracle.com/javase/8/javafx/api/javafx/scene/control/Alert.html) should be spawned alerting the user of the winner and all cars stop. The primaryStage will be 500px by 200px and is not be resizable.

Please make the filepath for the car image a constant defined at the beginning of your RactTrack.java file so I can easily modify it for grading. (Or leave a comment indicating that the image path is a working web URL instead)

HINT: Updating the GUI from a non-GUI thread is considered bad practice as it leads to race conditions and UI errors. If you need to update a GUI component from a non-GUI thread, please use the runLater method defined in the [Platform](https://docs.oracle.com/javase/8/javafx/api/javafx/application/Platform.html) class. Don’t be dissuaded by the “future time” a runnable object passed to runLater will be executed. We can expect that any runnable object passed to runLater will be executed quickly enough for the purposes of this project.

\*Java 8 comes with JavaFX and should work out of the box. For all later Java versions, you must install JavaFX. Instructions can be found [here](https://openjfx.io/openjfx-docs/). Please note that the provided URL has instructions for installing JavaFX both on a system and for specific IDE’s, including Intelji. It is recommended you follow the tutorial for the specific IDE you are using

Grading Rubric for FoodBank:

|  |  |
| --- | --- |
| Category | Points |
| Classes defined correctly | 20 |
| Correctly uses Java object monitors to enforce mutual exclusion | 10 |
| FoodBank state remains valid even with multiple Consumer threads active | 10 |
| Total | 40 |

Grading Rubric for RaceTrack:

|  |  |
| --- | --- |
| Category | Points |
| GUI Implemented correctly | 15 |
| Each car is run by a separate thread | 15 |
| Start button works as described | 10 |
| Winner is random and stops race from continuing | 10 |
| Pause button works as described | 5 |
| Reset button works as described | 5 |
| Total | 60 |