Ken and Cris P3

The strategy for our bridge crossing algorithm is was to have all threads/cars wait on a conditional variable that would signal them when it's their turn to go. This allowed us to abstract the logic for releasing cars into the updateGoNum() function. This gave us a single point to change between different algorithms for letting cars cross the bridge. We can switch between greedy, FCFS and other algorithms simply by changing updateGoNum().

The implementation for our strategy was achieved by using multiple global variables. The most notable of which are vQue and sQue which are both arrays. The vQue is a queue containing information about each vehicle. sQue contained the status for each vehicle. updateGoNum would examine both arrays to determine which vehicle should be allowed to go next. After setting GlobalGoNum pthread_cond_broadcast(&goNumTracker) is called to alert all active threads to check if it is their turn to go. After which if is not their turn to go they wait for the next broadcast.

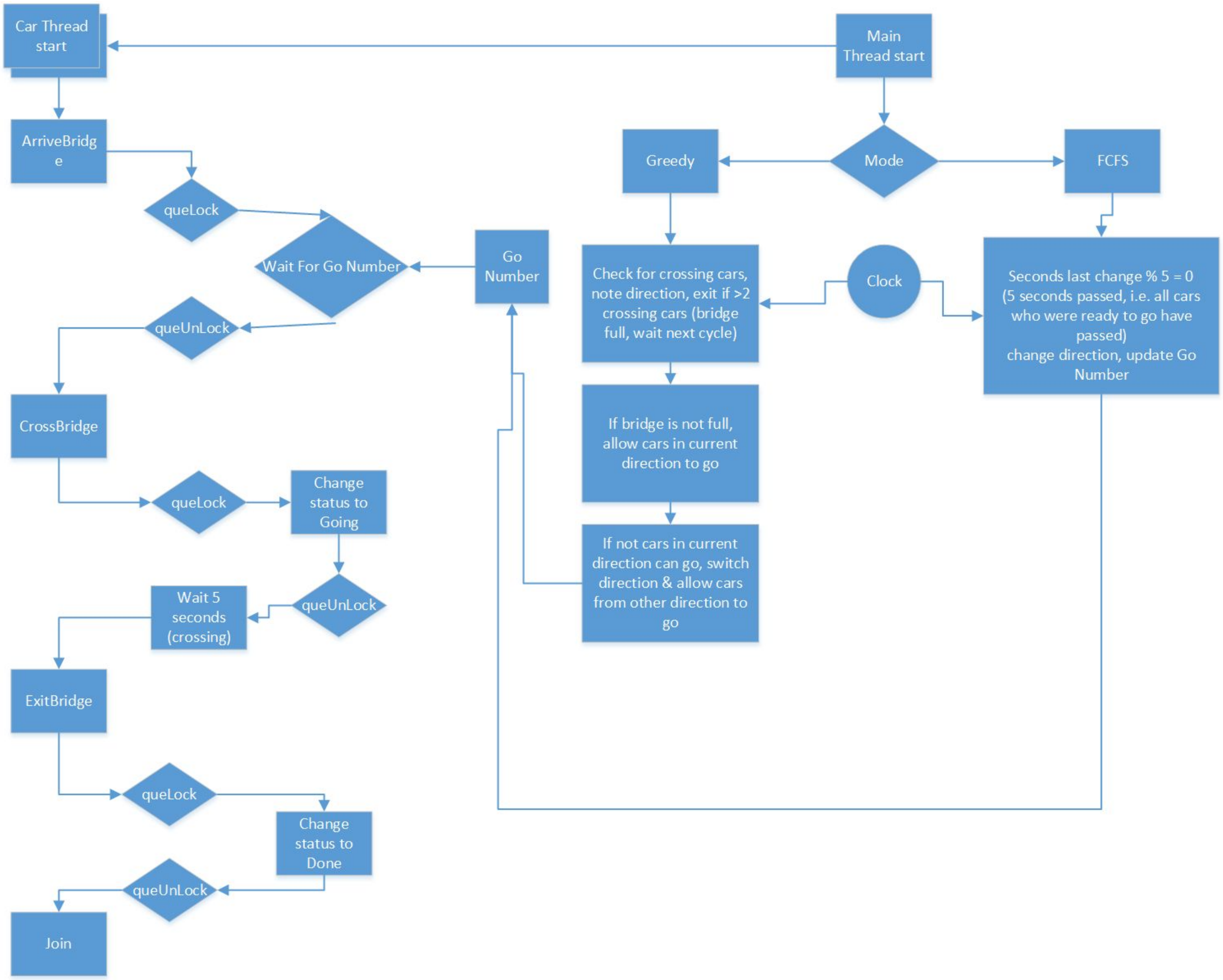
Mutexes were used to lock the access to the GlobalGoNum, vQue and sQue. That way these could not be changed while various threads/vehicles were looking at them and being assigned there GoNum and updating their states.

Greedy Algorithm Overview:

1. Loop through all cars to see if any cars are crossing and if so save their direction. Also check to see if more than two cars are crossing. If so, exit function.
2. Loop through all cars again if car is waiting and there is no assigned direction or the car's direction is the same as existing cars set that waiting car's id to the GolbalGoNumber and broadcast update.

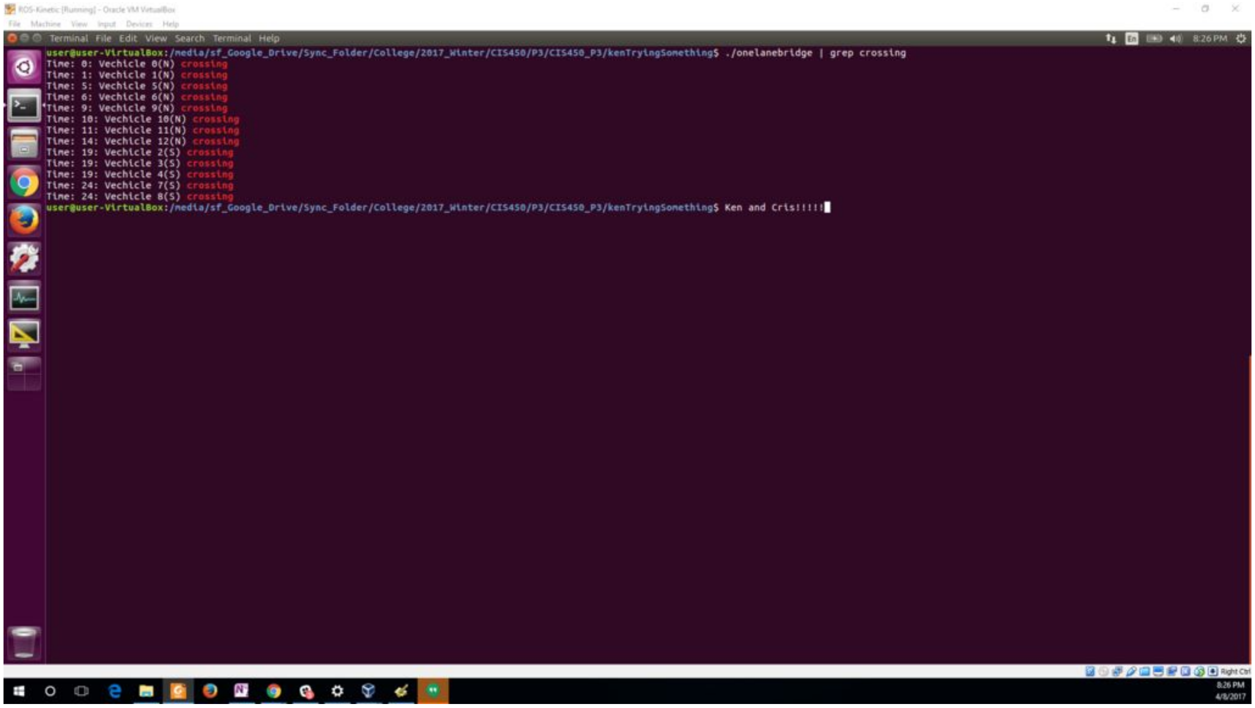
FCFS Algorithm Overview:

1. Loop through all cars to see if any cars are crossing and if so save their direction. Also check to see if more than two cars are crossing. If so, exit function.
2. Loop through all cars again if car is waiting and the direction is different than that of the already assigned direction exit the function. If there is no assigned direction or the car's direction is the same as existing cars set that waiting car's id to the GolbalGoNumber and broadcast update.

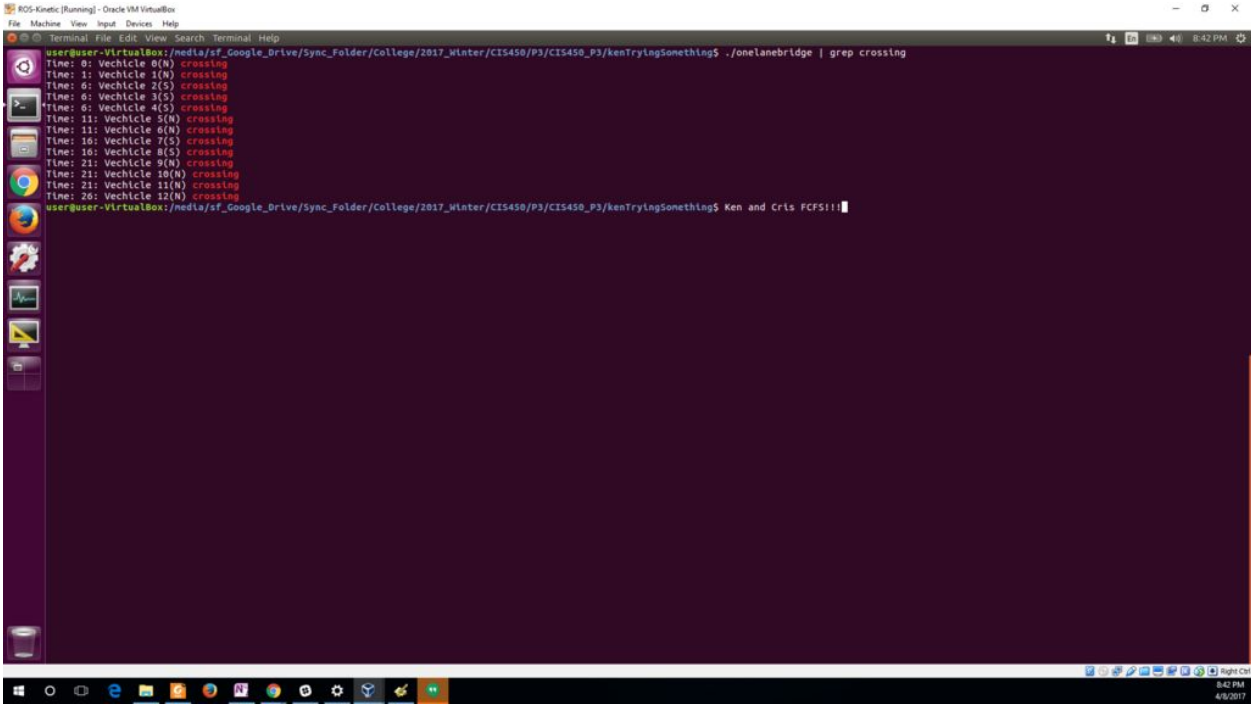

Car Thread start
Main Thread start
ArriveBridge
queLock
Mode
Greedy
FCFS
Wait For Go Number
Go Number
Check for crossing cars, note direction, exit if >2 crossing cars (bridge full, wait next cycle)
Clock
Seconds last change % 5 = 0 (5 seconds passed, i.e. all cars who were ready to go have passed) change direction, update Go Number
queUnLock
CrossBridge
If bridge is not full, allow cars in current direction to go
queLock
Change status to Going
If not cars in current direction can go, switch direction & allow cars from other direction to go
Wait 5 seconds (crossing)
queUnLock
ExitBridge
queLock
Change status to Done
queUnLock
Join

Timing was computed/estimated using a for loop of just under 1 second to increment a counter. This was not ideal but was the simplest and easiest solution for this problem and did not affect demonstrating the use of semaphores/mutexes.

The output matches the expected outputs for both the Greedy Crossing and FCFS Crossing:


ROS-Kinetic [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Terminal File Edit View Search Terminal Help
8:26 PM
8:26 PM
4/8/2017

```
user@user-VirtualBox:/media/sf_Google_Drive/Sync_Folder/College/2017_Winter/CIS450/P3/CIS450_P3/kenTryingSomething$ ./onelanebridge | grep crossing
Time: 0: Vechicle 0(N) crossing
Time: 1: Vechicle 1(N) crossing
Time: 5: Vechicle 5(N) crossing
Time: 6: Vechicle 6(N) crossing
Time: 9: Vechicle 9(N) crossing
Time: 10: Vechicle 10(N) crossing
Time: 11: Vechicle 11(N) crossing
Time: 14: Vechicle 12(N) crossing
Time: 19: Vechicle 2(S) crossing
Time: 19: Vechicle 3(S) crossing
Time: 19: Vechicle 4(S) crossing
Time: 24: Vechicle 7(S) crossing
Time: 24: Vechicle 8(S) crossing
user@user-VirtualBox:/media/sf_Google_Drive/Sync_Folder/College/2017_Winter/CIS450/P3/CIS450_P3/kenTryingSomething$ Ken and Cris!!!!!
```


ROS-Kinetic [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Terminal File Edit View Search Terminal Help
8:42 PM
8:42 PM
4/8/2017

```
user@user-VirtualBox:/media/sf_Google_Drive/Sync_Folder/College/2017_Winter/CIS450/P3/CIS450_P3/kenTryingSomething$ ./onelanebridge | grep crossing
Time: 0: Vechicle 0(N) crossing
Time: 1: Vechicle 1(N) crossing
Time: 6: Vechicle 2(S) crossing
Time: 6: Vechicle 3(S) crossing
Time: 6: Vechicle 4(S) crossing
Time: 11: Vechicle 5(N) crossing
Time: 11: Vechicle 6(N) crossing
Time: 16: Vechicle 7(S) crossing
Time: 16: Vechicle 8(S) crossing
Time: 21: Vechicle 9(N) crossing
Time: 21: Vechicle 10(N) crossing
Time: 21: Vechicle 11(N) crossing
Time: 26: Vechicle 12(N) crossing
user@user-VirtualBox:/media/sf_Google_Drive/Sync_Folder/College/2017_Winter/CIS450/P3/CIS450_P3/kenTryingSomething$ Ken and Cris FCFS!!!
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Table of Teamwork	
Cris accomplishments	Ken accomplishments
Main coding of 1st attempt	Main coding of 2nd attempt
Made flowcharts	Wrote text for report
Revised/Profread report	Made Table of Teamwork

Code: https://github.com/kyesh/CIS450_P3/tree/master/kenTryingSomething