

Homework 2 for CS153 (Fall 2019)

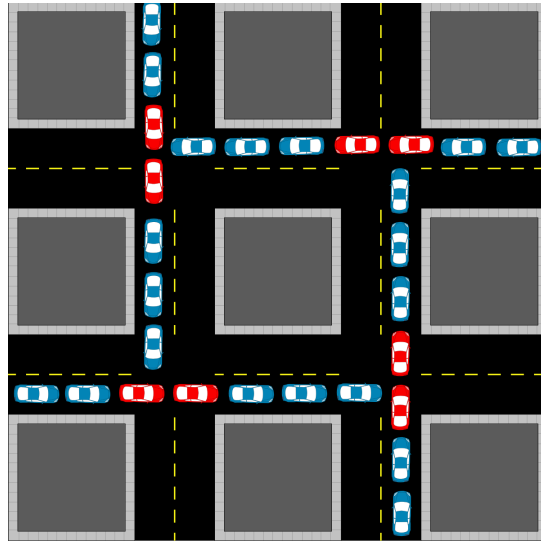
Due: 10/30/2019

Instructions:

- I. Write synchronization code to simulate each of the following scenarios:
 - a. (3 points) A barrier: a group of us go to a restaurant; we wait until the last person arrives before we go in.
 - b. (3 points) A bakery where threads of three types representing three ingredients cake mix, filling and icing arrive. Whenever we have one of each, we make a cake.
 - c. (3 points) The recipe in part b has changed – now we need two portions of cake mix to arrive (in addition to filling and icing) before we can make cake. Update your implementation.

- II. You are writing code for the voting machines for an upcoming election. You use shared counters, one for each candidate to keep track of the votes as they come from the different voting machines. You can think of each machine as a thread: every time it receives a vote, it increments a counter for that candidate.
 - (a) (2 point) Explain what could go wrong with this implementation if we do not use synchronization
 - (b) (2 points) Suggest two ways to use locks to solve this problem without changing the code other than adding the lock operations; which one is more conservative (i.e., more restrictive).
 - (c) (1 point) Consider the following improvement to the implementation suggested by a cs153 veteran: for each thread, maintain a local count of the votes, and then update the global count periodically. Do we still need synchronization?
 - (d) (1 point) Compare the implementation in c to the better of the two implementations in b.

III. (5 points) Traffic in Manhattan goes around a block as shown in the figure below.



Picture

from:

Wikipedia

<https://upload.wikimedia.org/wikipedia/commons/thumb/d/d9/Gridlock.svg/440px-Gridlock.svg.png>

Having studied concurrency, you recognize that even though we call this gridlock, this situation may be a case of deadlock. Use our criteria for deadlock to show whether this is indeed deadlock or not.

If this is deadlock, discuss and compare two solutions to prevent it from happening.