CS 544, Locks Worksheet

```
thread 1
lock.acquire()
L.append(3)
x += 1
lock.release()
```

```
thread 2
y += 1
y += 2
lock.acquire()
diff = len(L) - x
lock.release()
```

thread 1	thread 2	x	L	diff	y
---	---	2	[5,4]	None	4
	y += 1				5
lock.aquire()					
	y += 2				7
L.append(3)			[5,4,3]		
	lock.acquire() Not possible				
	diff = len(L) - x			1	
	lock.release()				
x += 1		3			
lock.release() Exception					

time

Problem 1: which statement executions above **are not possible** in a correct locking system? Which statements would cause exceptions? If the locking system behaved correctly, what would be possible values for diff at the end?

0

```
thread 1
if q != 0:          #A
    lock.acquire()  #B
    r = 1/q         #C
    lock.release()  #D
```

```
thread 2
lock.acquire()  #X
q = 0           #Y
lock.release()  #Z
```

Problem 2: assume q is 2 before the threads start running. Write out an interleaving (for example, something like A, B, C, ...) that leads to an ZeroDivisionError.

A XYZ BCD

```
lock = threading.Lock()
x = 1

def task():
     global x
     with lock:
          x = 2


t = threading.Thread(target=task)
a = x
t.start()
with lock:
     b = x
t.join()
c = x
```

a = 1

b = ? 1 if the main thread grabs the lock first, 2 if t grabs first

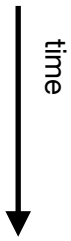
c = 2

Problem 3: how do a, b, and c end? Write "?" if it is impossible to know.

```
thread 1
lockA.acquire()
lockB.acquire()
A += 1
B -= 1
lockA.release()
lockB.release()
```

```
thread 2
lockB.acquire()
lockA.acquire()
B += 2
A -= 2
lockB.release()
lockA.release()
```

thread 1	thread 2	A	B
---	---	30	40
lockA.acquire()			
	lockB.acquire()		
	lockA.acquire()		
lockB.acquire()			



Problem 4: write an interleaving that leads to "deadlock" (both threads blocked).