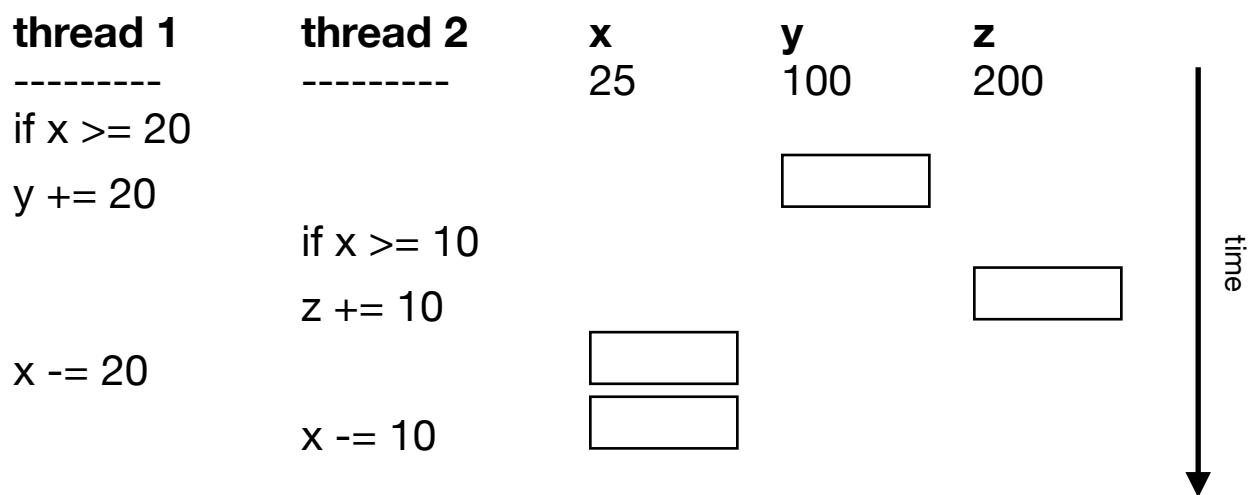


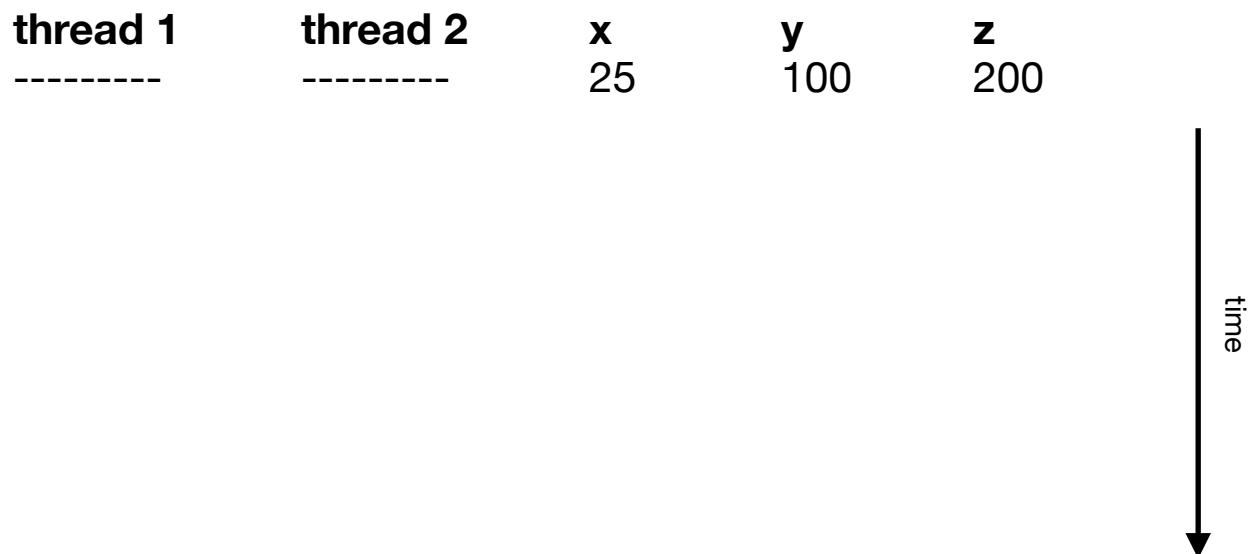
CS 544, Race Condition Worksheet

```
thread 1  
if x >= 20:  
    y += 20  
    x -= 20
```

```
thread 2  
if x >= 10:  
    z += 10  
    x -= 10
```



Problem 1: Fill in the above boxes to indicate the variable changes.



Problem 2: Fill in a timeline above so that x is always ≥ 0 and z ends at 210.

```
thread 1 (T1)
load total
load 1
add
store total
```

```
thread 2 (T2)
load total
load 1
add
store total
```

thread 1

thread 2

total

5

T1 vals T2 vals

time
↓

Problem 3: Choose a bytecode-level interleaving above to finish with total=6.

```
thread 1 (T1)
load total
load 2
add
store total
```

```
thread 2 (T2)
load total
load 3
add
store total
```

Problem 4: Assume any bytecode-level interleaving is possible, and total starts at 0. What is the SMALLEST possible final value for total?