

HW4 – Language Memory Models

CS 554, Fall 2026

Due October 30

1 Problems

This is a written homework with 3 problems, each of which has multiple parts. See <https://www.cs.uic.edu/~mansky/teaching/cs554/fa26/lectures/language-models.pdf> for the definitions of the memory models.

1. Consider the following C program:

```
acquire(a); || acquire(b);  
*x = 5;      || y = *x;  
release(b); || release(a);
```

- (a) Intuitively, do you think this program has a data race? Why or why not?

- (b) Draw an execution graph for the program under the SC-DRF model. Indicate whether it has a data race according to the model's rules.

2. Consider the following C program:

```
*y = 1;           || while(atomic_load(x) != 1) { }  
atomic_store(x, 1); || b = *y;  
*y = 2;
```

(a) Draw an execution of this program under RA+NA that has a data race. Be sure to indicate which two operations race with each other. You may check your answer using CppMem.

(b) How could we change the program to remove this data race?

3. For each of the following programs, draw a RA+RLX+NA execution graph for the outcome where `a` is 5, and indicate whether it has a data race.

4. `*x = 5;`
`atomic_store(y, 1, ra);` $\parallel$ `while(atomic_load(y, ra) != 1) { }`
`a = *x;`

(a) `*x = 5;`
`*y = 1;` $\parallel$ `while(*y != 1) { }`
`a = *x;`

(b) `*x = 5;`
`atomic_store(y, 1, rlx);` $\parallel$ `while(atomic_load(y, rlx) != 1) { }`
`a = *x;`