

## Assignment 10

due 6pm Thursday, November 18, 2021

These problems rely on the latest version of the github lamr repository, so be sure to use a new Gitpod image or update your repository following the instructions in the README.

### Problem 1 (6 points)

Build the Tarski's World models that meet the specifications in `assignment10a.lean`.

### Problem 2 (1 point)

In this problem and the next,  $x$ ,  $y$ , and  $z$  denote variables.

Present a substitution that unifies  $R(f(x), g(x))$  and  $R(f(f(a)), g(f(y)))$ .

### Problem 3 (1 point)

Present a substitution that unifies  $f(x, h(x), y)$  and  $f(g(z), w, z)$ .

### Problem 4 (6 points)

Replace the definitions of of the functions `sortGtConstraints` and `elimVarGtConstraints` in the file `assignment10b.lean` to meet the specifications indicated in that file.

### Problem 5 (3 points)

Present an equational proof of  $f(a) = a$  from  $f^5(a) = a$  and  $f^8(a) = a$ , where  $f^n(a)$  abbreviates  $n$ -fold application  $f(f(\dots f(a)))$ . At each line indicate whether you are applying congruence to a previous line or some combination of symmetry and transitivity. You can chain together as many instances of symmetry and transitivity as you like; just indicate which lines you are using. For example, your proof might begin like this:

1.  $f^5(a) = a$ , given
2.  $f^8(a) = a$ , given
3.  $f^6(a) = f(a)$ , congruence 1
4. ...