

# Homework # 2

## due September 20

### 1 Reading

Please read Chapter 3 through the end of 3.3 in your textbook.

### 2 Natural Numbers

Using the following definition of “greater than”

judgment `gt: n > n`

```
----- gt-one
s n > n
```

```
n1 > n2
----- gt-more
s n1 > n2
```

Prove the following theorems in SASyLF:

1. For any  $n$ , we have  $(sn) > 0$ .
2. If  $sn_1 > sn_2$  then  $n_1 > n_2$ .
3. “Greater than” is transitive.
4. If  $n > n$  then we have a contradiction.

Put your SaSyLF text in a file `gt.slf` in your AFS directory.

### 3 Terms

Define the boolean term language (`true`, `false` and `if`) and define equality over the terms and then prove the following theorems:

1. If `if t0 then t1 else t2 == if t'0 then t'1 else t'2`, then `t0 == t'0`.
2. If `t0 == t'0`, `t1 == t'1`, and `t2 == t'2` then `if t0 then t1 else t2 == if t'0 then t'1 else t'2`.

### 4 Graduate Students

For each of the following proof systems, explain whether they support the “law of excluded middle” and why or why not:

1. Twelf
2. Coq
3. Isabelle

Write your answers on paper.

### 5 Submission

The SASyLF proofs should be placed in the files `gt.slf` and `term.slf` in the `homework2` directory of your AFS volume.