

# CS101 Homework 5

**Due: Friday, November 11, 1PM (sharp).**

**Collaboration:** You are allowed and encouraged to work together and collaborate with others. However, your submission must be your own; you must write up your homework without referring to material developed with other groups.

You may use the WWW for reference material. You may use the material you found to develop your understanding, but your submission must be your own.

Summary: you may use any and all resources at your disposal, but your submission must be your own work.

1. Suppose the the SLam language is augmented with booleans — namely, with the type `bool`, constants `truek` and `falsek` and expression `(if e1 then e2 else e3)r`. Write the typing and operational semantics rules (in context of the full language — with references and concurrency, as presented on page 7 of the paper) that need to be added in order to support booleans. Make sure that the rules you write are the same that one would get if booleans were defined using the union type constructor, as described on page 3 of the SLam paper.

2. Write a proof of the `spawn` case of the subject reduction theorem for SLam (Theorem 3,1 on page 8).

3. Suppose we want to extend the stack inspection language with booleans. Write the necessary operational semantics rules that need to be added to the language (refer to the “Security-Indexed Reduction Rules” table in Section 2.2, page 3 of the stack inspection paper for the list of the existing rules). Make sure that you have handled cases when one of the expressions fail. Also make sure that the rules you write are deterministic — any expression should be matched by at most one rule.