CS101.3 Homework 2: IMP++ continued

Due: Friday, Jan 30, 3PM

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.

As in previous homework, IMP++ is an extension of the IMP language presented in class and textbook with the ++ operators. Namely, the `Aexp` definition is augmented as follows:

$$a \ ::= \ n \mid X \mid a_1 + a_2 \mid a_1 - a_2 \mid a_1 * a_2 \mid X\texttt{++} \mid \texttt{++}X$$

The intended meaning of the ++ operators is the standard one — X++ increments the value in location X and evaluates to the old value, and ++X increments the value in location X and evaluate to the new (incremented) value.

To address side-effects, the denotational semantics of arithmetical expressions of IMP++ would have the form A : `Aexp` $\rightarrow$ $2^{\Sigma * \Sigma * \mathbb{Z}}$. It would correspond to large-step operational semantics in the following way:

$$A[\![c]\!] = \{\langle \sigma, \sigma', n\rangle \mid \langle \sigma, c\rangle \ \rightarrow \ \langle \sigma', n, \}\rangle \ .$$

Write an inductive definition of denotational semantics for arithmetical expressions of IMP++:

1. Write the n, X, X++ and ++X parts of the inductive definition.

2. Write the $a_1 \, op \, a_2$ part of the inductive definition of denotational semantics that corresponds to deterministic operational semantics.

3. Write the $a_1 \, op \, a_2$ part of the inductive definition of denotational semantics that corresponds to nondeterministic operational semantics.