MCS-287 Homework 8 (Spring 2014)

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Due May 16, 2014

• Do Exercise 21.1 on page 468.
• Do Exercise 21.2 on page 468.
• Exercise 23.x1: Using the natural semantics for Language One, show how the conclusion
\[
\text{plus(const(4),times(const(3),const(2)))} \rightarrow 10
\]
would be derived. That is, what are the immediately preceding premises from which a rule allows this conclusion to be derived? And for any of those immediately preceding premises that is itself a consequence of applying some rule to earlier premises, what are those? (You can structure this as a tree, as demonstrated in class.)

• Exercise 23.x2: Suppose we replace the natural semantics for Language One with the following nonstandard semantics. Be sure to read it carefully; it does not include a typo:

\[
\begin{align*}
E_1 \rightarrow v_1 & \quad E_2 \rightarrow v_2 \\
\text{plus}(E_1, E_2) \rightarrow v_1 + v_2 \\
E_1 \rightarrow v_1 & \quad E_2 \rightarrow v_2 \\
\text{times}(E_1, E_2) \rightarrow v_1 + v_2 \\
\text{const}(n) \rightarrow 1
\end{align*}
\]

1. Show a derivation, using this nonstandard semantics, of a value for the AST
\[
\text{plus(times(const(4),const(5)),times(const(6),const(7)))}
\]
(You can structure this as a tree, as demonstrated in class.)

2. This nonstandard semantics does not produce the value of an expression in the usual sense of “value.” Give a succinct English description of what property of the expression it does produce.
Exercise 23.x3: Using the natural semantics for Language Two, show how the conclusion

\[
\text{let}(x, \text{const}(3), \text{times}(\text{var}(x), \text{const}(5))), [] \rightarrow 15
\]

would be derived. That is, what are the immediately preceding premises from which a rule allows this conclusion to be derived? And for any of those immediately preceding premises that is itself a consequence of applying some rule to earlier premises, what are those? (You can structure this as a tree, as demonstrated in class.)