COMPSCI 3MI3 : Assignment 3

Fall 2021

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Solutions submitted as a LaTeXgenerated pdf file are eligible for 1 bonus point, so long as the source file is included with submission.

List of Theorems in Topic 3

Theorem	slide no.
Determinacy of Single Step Evaluation	19
Every Value is in Normal Form	29
If t is in Normal Form, t is a Value	30
Uniqueness of Normal Forms	35
Termination of Evaluation	37

1. (10 points) **Adding Addition**

   Our UAE language is pretty bare bones by any objective standard. Let's fill it out very slightly by adding an addition operator.

   Propose both syntax and small step semantics for an addition operator, which operates on numeric values. Please present your syntax in EBNF, and your semantics as a set of one or more inference rules. The theorems listed above above should still hold, if your proposed term is added to UAE.

2. (15 points) **Determinacy of Single Step Evaluation**

   If a language is determinate, then, for any term t and the evaluation relation $\rightarrow$, the single-step evaluation of t is unique. Another way to say this is:

   $$t \rightarrow t' \wedge t \rightarrow t'' \implies t' = t'' \tag{1}$$

   In topic 4, we demonstrated this result for the Boolean subset of UAE. Prove that this result still holds for UAE when we add our semantics for arithmetic expressions.