CSC 501 - Assignment #2

version 9.0

Due Thursday 10/13/16 in Sakai

Problems

1. Given the grammar

$$\begin{array}{lcl} \mathrm{Q} & \rightarrow & \mathrm{Q} + \mathrm{D} \,|\, \mathrm{D} \\ \mathrm{D} & \rightarrow & 0 \,|\, 1 \,|\, DD \end{array}$$

   Let **Qexp** and **Dexp** be the sets defined deductively as follows,

$$\begin{array}{lcl} \mathbf{Qexp} & = & \{q \mid \mathrm{Q} \Rightarrow^* q \wedge q \in T^*\} \\ \mathbf{Dexp} & = & \{d \mid \mathrm{D} \Rightarrow^* d \wedge d \in T^*\} \end{array}$$

   give the inductive definitions of these set.

2. Compute the semantic value of $ae \equiv 2 * v$, where $ae \in \mathbf{Aexp}$ with $v \in \mathbf{Loc}$ and $2 \in \mathbf{I}$. Assume the initial state $\sigma_0 \in \Sigma$.

3. Compute the semantic value of $c \equiv x := 3; \mathbf{if}\ x \leq 5\ \mathbf{then}\ x := 0\ \mathbf{else}\ x := 10\ \mathbf{end}$, where $c \in \mathbf{Com}$, $x \in \mathbf{Loc}$, and $0, 3, 5, 10 \in \mathbf{I}$. Assume the initial state σ_0.

4. Let $a_0 \equiv 1 + 1$ and $a_1 \equiv 2 * 2 - 2$, where $a_0, a_1 \in \mathbf{Aexp}$. Prove that $a_0 \sim a_1$.

5. Given the syntax and semantics for the language IMP discussed in class, extend the syntax of this language with the construct '**do** c **while** b **end**' where $c \in \mathbf{Com}$ and $b \in \mathbf{Bexp}$. The informal specification of this command is that c is executed as long as b remains **true**. Provide a set of semantic rules that defines the behavior of this construct formally and demonstrate that your rules work with a simple example.

6. Let $\sigma : \mathbf{Loc} \rightarrow \mathbb{I}$ be some state $\sigma \in \Sigma$, show that $\sigma[2/x] = (\sigma[1/x])[2/x]$ for some $x \in \mathbf{Loc}$. (**Hint:** use extensional equality of functions.[1])

Where not stated explicitly otherwise, show your computations based on the semantic rules covered in class.[2]

[1] http://en.wikipedia.org/wiki/Extensionality

[2] Typewritten work is preferred :)