Instruction Graph Dynamics

Andrew Benson

1 Terminated

We let I be a *bool* list, representing the input used to satisfy a Condition *cnd*, and we let O be an a list, representing the ordered (but reversed) list of actions that are executed.

$(n,\ vs,\ I,\ O)$ `terminated` means that the state with vertex represented by n in vertices vs with remaining input I and current output O is in a finished state for the program execution context.

$$\frac{\mathbf{V}(n,\ \mathbf{end}) \in vs}{(n,\ vs,\ I,\ O)\ \texttt{terminated}}$$

2 Stuck

We let I be a *bool* list, representing the input used to satisfy a Condition *cnd*, and we let O be an a list, representing the ordered (but reversed) list of actions that are executed.

$(n,\ vs,\ I,\ O)$ `stuck` means that the state with vertex represented by n in vertices vs with remaining input I and current output O cannot proceed, as it requires more input to continue.

$$\frac{\mathbf{V}(n,\ \mathbf{do}\ a\ \mathbf{until}\ cnd\ \mathbf{then}\ n') \in vs}{(n,\ vs,\ [\,],\ O)\ \texttt{stuck}}$$

$$\frac{\mathbf{V}(n,\ \mathbf{if}\ cnd\ \mathbf{then}\ n'\ \mathbf{else}\ n'') \in vs}{(n,\ vs,\ [\,],\ O)\ \texttt{stuck}}$$

3 Steps

We let I be a *bool* list, representing the input used to satisfy a Condition *cnd*, and we let O be an a list, representing the ordered (but reversed) list of actions that are executed.

$(n,\ vs,\ I,\ O) \longmapsto (n',\ vs,\ I',\ O')$ means that the state with vertex represented by n in vertices vs with remaining input I and current output O continues to the state with vertex represented by n' in vertices vs with remaining input I' and current output O'.

$$\frac{\mathbf{V}(n,\ \mathbf{do}\ a\ \mathbf{then}\ n') \in vs}{(n,\ vs,\ I,\ O) \longmapsto (n',\ vs,\ I,\ a :: O)}$$

$$\frac{\mathbf{V}(n,\ \mathbf{do}\ a\ \mathbf{until}\ cnd\ \mathbf{then}\ n') \in vs}{(n,\ vs,\ true :: I,\ O) \longmapsto (n',\ vs,\ I,\ a :: O)}$$

$$\frac{\mathbf{V}(n,\ \mathbf{do}\ a\ \mathbf{until}\ cnd\ \mathbf{then}\ n') \in vs}{(n,\ vs,\ false :: I,\ O) \longmapsto (n,\ vs,\ I,\ a :: O)}$$

$$\frac{\mathbf{V}(n,\ \mathbf{if}\ cnd\ \mathbf{then}\ n'\ \mathbf{else}\ n'') \in vs}{(n,\ vs,\ true :: I,\ O) \longmapsto (n',\ vs,\ I,\ O)}$$

$$\frac{\mathbf{V}(n,\ \mathbf{if}\ cnd\ \mathbf{then}\ n'\ \mathbf{else}\ n'') \in vs}{(n,\ vs,\ false :: I,\ O) \longmapsto (n'',\ vs,\ I,\ O)}$$

$$\frac{\mathbf{V}(n,\ \mathbf{goto}\ n') \in vs}{(n,\ vs,\ I,\ O) \longmapsto (n',\ vs,\ I,\ O)}$$