0.1 Transition Rules

FiXme Fatal: Ma
for loop, call fun
declerations mås

We use the following names to represent different syntactic categories.

- $n \in \mathbf{Num}$ - Numerals
- v - Values
- $x \in \mathbf{Var}$ - Variables
- $r \in \mathbf{Arrays}$ - Array names
- $a \in Aexp$ - Arithmetic expression
- $b \in Bexp$ - Boolean expression
- e
- env_C
- sto
- env_V
- env_A
- C
- env_E
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[VAR-ASS] $$env_C, \vdash \langle x = e,\ sto\rangle \to sto[l \mapsto v]$$

where $env_C,\ sto \vdash e \to_e v$
and $env_V\ x = l$

[ARR-ASS] $$env_C\ \vdash \langle r[a] = e,\ sto\rangle \to sto[l \mapsto v_2]$$

where $env_C,\ sto \vdash a \to_a v_1$
and $env_C,\ sto \vdash e \to_e v_2$
and $env_A\ r[v_1] = l$

[IF-TRUE] $$\frac{env_C\ \vdash \langle C,\ sto\rangle \to sto'}{env_C\ \langle \mathbf{if}(b)\ \text{begin}\ C\ \text{end},\ sto\rangle \to sto'}$$

if $env_C,\ sto \vdash b \to_b \text{true}$

[IF-FALSE] $$env_C\ \vdash \langle \mathbf{if}(b)\ \text{begin}\ C\ \text{end},\ sto\rangle \to sto$$

if $env_C,\ sto \vdash b \to_b \text{false}$

[IF-ELSE-TRUE] $$\frac{env_C\ \vdash \langle C_1,\ sto\rangle \to sto'}{env_C\ \vdash\ \langle \mathbf{if}(b)\ \text{begin}\ C_1\ \text{end},\ \mathbf{else}\ \text{begin}\ C_2\ \text{end},\ sto\rangle \to sto'}$$

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	if $env_C,\ sto \vdash b \rightarrow_b \text{true}$
[IF-ELSE-FALSE]	$\dfrac{env_C \vdash \langle C_2,\ sto\rangle \rightarrow sto'}{env_C \vdash \langle \textbf{if}(b)\ \text{begin}\ C_1\ \text{end},\ \textbf{else}\ \text{begin}\ C_2\ \text{end},\ sto\rangle \rightarrow sto'}$
	if $env_C,\ sto \vdash b \rightarrow_b \text{false}$
[WHL-TRUE]	$\dfrac{env_C \vdash \langle C,\ sto\rangle \rightarrow sto''\ env_C \vdash \langle \textbf{while}(b)\ \text{begin}\ C\ \text{end},\ sto''\rangle \rightarrow sto'}{env_C \vdash \langle \textbf{while}(b)\ \text{begin}\ C\ \text{end},\ sto\rangle \rightarrow sto'}$
	if $env_C,\ sto \vdash b \rightarrow_b \text{true}$
[WHL-FALSE]	$env_C \vdash \langle \textbf{while}(b)\ \text{begin}\ C\ \text{end},\ sto\rangle \rightarrow sto$
	if $env_C,\ sto \vdash b \rightarrow_b \text{false}$

Table 0.1: Commands

[EQL-TRUE]	$\dfrac{env_E,\ sto \vdash e_1 \rightarrow_e v_1\ \ env_E,\ sto \vdash e_2 \rightarrow_e v_2}{env_E,\ sto \vdash e_1 = e_2 \rightarrow_b \text{true}}$
	if $v_1 = v_2$
[EQL-FALSE]	$\dfrac{env_E,\ sto \vdash e_1 \rightarrow_e v_1\ \ env_E,\ sto \vdash e_2 \rightarrow_e v_2}{env_E,\ sto \vdash e_1 = e_2 \rightarrow_b \text{false}}$
	if $v_1 \neq v_2$
[NEQ-TRUE]	$\dfrac{env_E,\ sto \vdash e_1 \rightarrow_e v_1\ \ env_E,\ sto \vdash e_2 \rightarrow_e v_2}{env_E,\ sto \vdash e_1 ! = e_2 \rightarrow_b \text{true}}$
	if $v_1 \neq v_2$
[NEQ-FALSE]	$\dfrac{env_E,\ sto \vdash e_1 \rightarrow_e v_1\ \ env_E,\ sto \vdash e_2 \rightarrow_e v_2}{env_E,\ sto \vdash e_1 ! = e_2 \rightarrow_b \text{false}}$
	if $v_1 = v_2$
[GRT-TRUE]	$\dfrac{env_E,\ sto \vdash e_1 \rightarrow_e v_1\ \ env_E,\ sto \vdash e_2 \rightarrow_e v_2}{env_E,\ sto \vdash e_1 > e_2 \rightarrow_b \text{true}}$
	if $v_1 > v_2$
[GRT-FALSE]	$\dfrac{env_E,\ sto \vdash e_1 \rightarrow_e v_1\ \ env_E,\ sto \vdash e_2 \rightarrow_e v_2}{env_E,\ sto \vdash e_1 > e_2 \rightarrow_b \text{false}}$
	if $v_1 \leq v_2$
[GEQ-TRUE]	$\dfrac{env_E,\ sto \vdash e_1 \rightarrow_e v_1\ \ env_E,\ sto \vdash e_2 \rightarrow_e v_2}{env_E,\ sto \vdash e_1 >= e_2 \rightarrow_b \text{true}}$

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	if $v_1 \geq v_2$
[GEQ-FALSE]	$\frac{env_E,\ sto \vdash e_1 \rightarrow_e v_1 \quad env_E,\ sto \vdash e_2 \rightarrow_e v_2}{env_E,\ sto \vdash e_1 >= e_2 \rightarrow_b \text{false}}$
	if $v_1 < v_2$
[LES-TRUE]	$\frac{env_E,\ sto \vdash e_1 \rightarrow_e v_1 \quad env_E,\ sto \vdash e_2 \rightarrow_e v_2}{env_E,\ sto \vdash e_1 < e_2 \rightarrow_b \text{true}}$
	if $v_1 < v_2$
[LES-FALSE]	$\frac{env_E,\ sto \vdash e_1 \rightarrow_e v_1 \quad env_E,\ sto \vdash e_2 \rightarrow_e v_2}{env_E,\ sto \vdash e_1 < e_2 \rightarrow_b \text{false}}$
	if $v_1 \geq v_2$
[LEQ-TRUE]	$\frac{env_E,\ sto \vdash e_1 \rightarrow_e v_1 \quad env_E,\ sto \vdash e_2 \rightarrow_e v_2}{env_E,\ sto \vdash e_1 <= e_2 \rightarrow_b \text{true}}$
	if $v_1 \leq v_2$
[GEQ-FALSE]	$\frac{env_E,\ sto \vdash e_1 \rightarrow_e v_1 \quad env_E,\ sto \vdash e_2 \rightarrow_e v_2}{env_E,\ sto \vdash e_1 <= e_2 \rightarrow_b \text{false}}$
	if $v_1 > v_2$
[NOT-TRUE]	$\frac{env_E,\ sto \vdash b \rightarrow_b \text{true}}{env_E,\ sto \vdash !(b) \rightarrow_b \text{false}}$
[NOT-FALSE]	$\frac{env_E,\ sto \vdash b \rightarrow_b \text{false}}{env_E,\ sto \vdash !(b) \rightarrow_b \text{true}}$
[AND-TRUE]	$\frac{env_E,\ sto \vdash b_1 \wedge b_2 \rightarrow_b \text{true}}{env_E,\ sto \vdash b_1 \text{ AND } b_2 \rightarrow_b \text{true}}$
[AND-FALSE]	$\frac{env_E,\ sto \vdash b_1 \vee b_2 \rightarrow_b \text{false}}{env_E,\ sto \vdash b_1 \text{ AND } b_2 \rightarrow_b \text{false}}$
[OR-TRUE]	$\frac{env_E,\ sto \vdash b_1 \vee b_2 \rightarrow_b \text{true}}{env_E,\ sto \vdash b_1 \text{ OR } b_2 \rightarrow_b \text{true}}$
[OR-FALSE]	$\frac{env_E,\ sto \vdash b_1 \wedge b_2 \rightarrow_b \text{false}}{env_E,\ sto \vdash b_1 \text{ OR } b_2 \rightarrow_b \text{false}}$
[PAR]	$\frac{env_E,\ sto \vdash b_1 \rightarrow_b v}{env_E,\ sto \vdash (b_1) \rightarrow_b v}$

Table 0.2: Boolean expressions

[ADD] $$\frac{env_E,\ sto \vdash a_1 \rightarrow_a v_1 \quad env_E,\ sto \vdash a_2 \rightarrow_a v_2}{env_E,\ sto \vdash a_1 + a_2 \rightarrow_a v}$$

where $v = v_1 + v_2$

[SUB] $$\frac{env_E,\ sto \vdash a_1 \rightarrow_a v_1 \quad env_E,\ sto \vdash a_2 \rightarrow_a v_2}{env_E,\ sto \vdash a_1 - a_2 \rightarrow_a v}$$

where $v = v_1 - v_2$

[MUL] $$\frac{env_E,\ sto \vdash a_1 \rightarrow_a v_1 \quad env_E,\ sto \vdash a_2 \rightarrow_a v_2}{env_E,\ sto \vdash a_1 * a_2 \rightarrow_a v}$$

where $v = v_1 * v_2$

[DIV] $$\frac{env_E,\ sto \vdash a_1 \rightarrow_a v_1 \quad env_E,\ sto \vdash a_2 \rightarrow_a v_2}{env_E,\ sto \vdash \frac{a_1}{a_2} \rightarrow_a v}$$

where $v = \frac{v_1}{v_2}$

[PAR] $$\frac{env_E,\ sto \vdash a_1 \rightarrow_a v_1}{env_E,\ sto \vdash (a_1) \rightarrow_a v_1}$$

where $v = \frac{v_1}{v_2}$

[NUM] $$env_E,\ sto \vdash n \rightarrow_a v$$

if $\mathcal{N}[n] = v$
where $\mathcal{N}$ **:** $\mathbf{Num} \rightarrow \mathbb{R}$

[VAR] $$env_V,\ sto \vdash x \rightarrow_a v$$

if $env_V\ x = l\ and\ sto\ l = v$

[ARR] $$env_A,\ sto \vdash r[a_1] \rightarrow_a v_2$$

if $env_A\ r[v_1] = l$ and $sto\ l = v_2$
where $a_1 \rightarrow_a v_1$

Table 0.3: Aritmethic expressions