x	term variable		
f	function declaration?		
cnt	program counter		
n			

$$v \quad ::= \qquad\qquad\qquad\qquad\qquad \text{values}$$
$$\mid \quad \mathbf{c} \qquad\qquad\qquad\qquad \text{constant}$$

$$e \quad ::= \qquad\qquad\qquad\qquad\qquad \text{expressions}$$
$$\mid \quad e_1 \oplus e_2 \qquad\qquad\qquad \text{binary operation}$$
$$\mid \quad x \qquad\qquad\qquad\qquad \text{variable}$$
$$\mid \quad \mathbf{c} \qquad\qquad\qquad\qquad \text{constant}$$
$$\mid \quad f(e_1, .., e_n) \qquad\qquad \text{function application}$$

$$s \quad ::= \qquad\qquad\qquad\qquad\qquad \text{statements}$$
$$\mid \quad \mathbf{skip} \qquad\qquad\qquad\qquad \text{skip}$$
$$\mid \quad s_1; s_2 \qquad\qquad\qquad\qquad \text{sequence}$$
$$\mid \quad \mathbf{def}\ x := e \qquad\qquad\qquad \text{variable declaration}$$
$$\mid \quad x := e \qquad\qquad\qquad\qquad \text{variable assignment}$$
$$\mid \quad \mathbf{for}\ x\ \mathbf{from}\ v_1\ \mathbf{to}\ v_2\ \in\ s \qquad \text{for loop}$$
$$\mid \quad \mathbf{return}\ e \qquad\qquad\qquad \text{return statement}$$

$$fdef \quad ::= \qquad\qquad\qquad\qquad\qquad \text{function definitions}$$
$$\mid \quad fdef\ f(x_1, .., x_n)\ \in\ s$$

$$program \quad ::= \qquad\qquad\qquad\qquad\qquad \text{program}$$
$$\mid \quad fdef_1; fdef_2; \mathbf{expose}\ fdef \qquad \text{list of fdefs}$$

$$fm \quad ::= \qquad\qquad\qquad\qquad\qquad \text{function store}$$
$$\mid \quad \emptyset$$
$$\mid \quad fm, f = s$$

$$m \quad ::= \qquad\qquad\qquad\qquad\qquad \text{memory}$$
$$\mid \quad \emptyset$$
$$\mid \quad m, x = v$$
$$\mid \quad m/x$$

$\boxed{fm\ m\ cnt\ e \longrightarrow cnt'\ e'}$ $\qquad e$ reduces to e'

$$\frac{fm\ m\ cnt\ e_1 \longrightarrow cnt'\ e_1'}{fm\ m\ cnt\ e_1 \oplus e_2 \longrightarrow cnt'\ e_1' \oplus e_2} \quad \text{EXR\_BINOP\_L}$$

$$\frac{fm\ m\ cnt\ e_1 \longrightarrow cnt'\ e_1'}{fm\ m\ cnt\ v \oplus e_2 \longrightarrow cnt'\ v \oplus e_2'} \quad \text{EXR\_BINOP\_R}$$

$$\frac{\begin{array}{c} v_3 \equiv [\![v_1 \oplus]\!] v_2 \\ cnt' = cnt + 1 \end{array}}{fm\ m\ cnt\ v_1 \oplus v_2 \longrightarrow cnt'\ v_3} \quad \text{EXR\_BINOP\_VINCREMENT CNT}$$

$\boxed{fm\ m\ cnt\ s \longrightarrow m'\ cnt'\ s'}$ $\qquad s$ reduces to s'

$$\frac{}{fm\ m\ cnt\ \mathbf{skip}; s \longrightarrow m\ cnt\ s} \quad \text{STR\_SKIP}$$

$$\frac{fm\ m\ cnt\ s_1 \longrightarrow m'\ cnt'\ s_1'}{fm\ m\ cnt\ s_1;s_2 \longrightarrow m'\ cnt'\ s_1';s_2} \quad \text{STR\_SEQ}$$

$$\frac{fm\ m\ cnt\ e \longrightarrow cnt'\ e'}{fm\ m\ cnt\ \mathbf{def}\ x := e \longrightarrow m\ cnt'\ \mathbf{def}\ x := e'} \quad \text{STR\_DEF\_EXPR}$$

$$\frac{\begin{array}{c} cnt' = cnt + 1 \\ m' = m, x = v \end{array}}{fm\ m\ cnt\ \mathbf{def}\ x := v \longrightarrow m'\ cnt'\ \mathbf{skip}} \quad \text{STR\_DEF\_VAL}$$

$$\frac{fm\ m\ cnt\ e \longrightarrow cnt'\ e'}{fm\ m\ cnt\ x := e \longrightarrow m\ cnt'\ x := e'} \quad \text{STR\_ASSIGN\_EXPR}$$

$$\frac{\begin{array}{c} cnt' = cnt + 1 \\ m' = m, x = v \end{array}}{fm\ m\ cnt\ x := v \longrightarrow m'\ cnt'\ \mathbf{skip}} \quad \text{STR\_ASSIGN\_VAL}$$

$$\frac{\begin{array}{c} v_1 < v_2 \\ v_1' = v_1 + 1 \\ x \notin m \\ m' = m, x = v_1 \end{array}}{fm\ m\ cnt\ \mathbf{for}\ x\ \mathbf{from}\ v_2\ \mathbf{to}\ v_2\ \in\ s \longrightarrow m'\ cnt\ s;\mathbf{for}\ x\ \mathbf{from}\ v_1'\ \mathbf{to}\ v_2\ \in\ s} \quad \text{STR\_FOR}$$

$$\frac{\begin{array}{c} v_1 = v_2 \\ m' = m/x \end{array}}{fm\ m\ cnt\ \mathbf{for}\ x\ \mathbf{from}\ v_1\ \mathbf{to}\ v_2\ \in\ s \longrightarrow m'\ cnt\ \mathbf{skip}} \quad \text{STR\_FOR\_ZERO}$$

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Definition rules:         11 good     0 bad
Definition rule clauses:  28 good     0 bad
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