[addInt] $$\frac{n_1 \rhd \mathit{int32}(\_) \quad n_2 \rhd \mathit{int32}(\_)}{\langle\, \mathsf{add}(n_1\ n_2), \sigma \,\rangle \to \langle\, \mathit{add}(n_1\ n_2), \sigma \,\rangle}$$

[addReal] $$\frac{n_1 \rhd \mathit{real64}(\_) \quad n_2 \rhd \mathit{real64}(\_)}{\langle\, \mathsf{add}(n_1\ n_2), \sigma \,\rangle \to \langle\, \mathit{add}(n_1\ n_2), \sigma \,\rangle}$$

[addRightInt] $$\frac{n \rhd \mathit{int32}(\_) \quad \langle\, E_2, \sigma \,\rangle \to \langle\, I_2, \sigma' \,\rangle}{\langle\, \mathsf{add}(n\ E_2), \sigma \,\rangle \to \langle\, \mathsf{add}(n\ I_2), \sigma' \,\rangle}$$

[addRightReal] $$\frac{n \rhd \mathit{real64}(\_) \quad \langle\, E_2, \sigma \,\rangle \to \langle\, I_2, \sigma' \,\rangle}{\langle\, \mathsf{add}(n\ E_2), \sigma \,\rangle \to \langle\, \mathsf{add}(n\ I_2), \sigma' \,\rangle}$$

[addLeft] $$\frac{\langle\, E_1, \sigma \,\rangle \to \langle\, I_1, \sigma' \,\rangle}{\langle\, \mathsf{add}(E_1\ E_2), \sigma \,\rangle \to \langle\, \mathsf{add}(I_1\ E_2), \sigma' \,\rangle}$$

[rotate] $$\frac{Z \rhd \mathit{int32}(\_) \quad x \rhd \mathit{real64}(\_) \quad y \rhd \mathit{real64}(\_) \quad z \rhd \mathit{real64}(\_)}{\langle\, \mathsf{rotate}(Z\ x\ y\ z), \sigma \,\rangle \to \langle\, \mathit{user}(\mathit{string}(\texttt{rotate})\ Z\ x\ y\ z), \sigma \,\rangle}$$

[rotateResolve] $$\frac{\langle\, E_1, \sigma \,\rangle \to \langle\, V_1, \sigma \,\rangle \quad \langle\, E_2, \sigma \,\rangle \to \langle\, V_2, \sigma \,\rangle \quad \langle\, E_3, \sigma \,\rangle \to \langle\, V_3, \sigma \,\rangle \quad \langle\, E_4, \sigma \,\rangle \to \langle\, V_4, \sigma \,\rangle}{\langle\, \mathsf{rotate}(E_1\ E_2\ E_3\ E_4), \sigma \,\rangle \to \langle\, \mathsf{rotate}(V_1\ V_2\ V_3\ V_4), \sigma \,\rangle}$$

[variable] $$\frac{\mathit{get}(\sigma\ R) \rhd Z}{\langle\, \mathsf{deref}(R), \sigma \,\rangle \to \langle\, Z, \sigma \,\rangle}$$

[scale] $$\frac{Z \rhd \mathit{int32}(\_) \quad x \rhd \mathit{real64}(\_) \quad y \rhd \mathit{real64}(\_) \quad z \rhd \mathit{real64}(\_)}{\langle\, \mathsf{scale}(Z\ x\ y\ z), \sigma \,\rangle \to \langle\, \mathit{user}(\mathit{string}(\texttt{scale})\ Z\ x\ y\ z), \sigma \,\rangle}$$

[scaleResolve] $$\frac{\langle\, E_1, \sigma \,\rangle \to \langle\, V_1, \sigma \,\rangle \quad \langle\, E_2, \sigma \,\rangle \to \langle\, V_2, \sigma \,\rangle \quad \langle\, E_3, \sigma \,\rangle \to \langle\, V_3, \sigma \,\rangle \quad \langle\, E_4, \sigma \,\rangle \to \langle\, V_4, \sigma \,\rangle}{\langle\, \mathsf{scale}(E_1\ E_2\ E_3\ E_4), \sigma \,\rangle \to \langle\, \mathsf{scale}(V_1\ V_2\ V_3\ V_4), \sigma \,\rangle}$$

[compoundAssignInt] $$\frac{n \rhd \mathit{int32}(\_)}{\langle\, \mathsf{compassign}(X\ n), \sigma \,\rangle \to \langle\, \mathit{done}, \mathit{put}(\sigma\ X\ \mathit{add}(\mathit{get}(\sigma\ X)\ n)) \,\rangle}$$

[compoundAssignReal] $$\frac{n \rhd \mathit{real64}(\_)}{\langle\, \mathsf{compassign}(X\ n), \sigma \,\rangle \to \langle\, \mathit{done}, \mathit{put}(\sigma\ X\ \mathit{add}(\mathit{get}(\sigma\ X)\ n)) \,\rangle}$$

[compoundAssignResolve] $$\frac{\langle\, E, \sigma \,\rangle \to \langle\, I, \sigma' \,\rangle}{\langle\, \mathsf{compassign}(X\ E), \sigma \,\rangle \to \langle\, \mathsf{compassign}(X\ I), \sigma' \,\rangle}$$

[mulInt] $$\frac{n_1 \rhd \mathit{int32}(\_) \quad n_2 \rhd \mathit{int32}(\_)}{\langle\, \mathsf{mul}(n_1\ n_2), \sigma \,\rangle \to \langle\, \mathit{mul}(n_1\ n_2), \sigma \,\rangle}$$

[mulReal] $$\frac{n_1 \rhd \mathit{real64}(\_) \quad n_2 \rhd \mathit{real64}(\_)}{\langle\, \mathsf{mul}(n_1\ n_2), \sigma \,\rangle \to \langle\, \mathit{mul}(n_1\ n_2), \sigma \,\rangle}$$

[mulRightInt] $$\frac{n \rhd \mathit{int32}(\_) \quad \langle\, E_2, \sigma \,\rangle \to \langle\, I_2, \sigma' \,\rangle}{\langle\, \mathsf{mul}(n\ E_2), \sigma \,\rangle \to \langle\, \mathsf{mul}(n\ I_2), \sigma' \,\rangle}$$

[mulRightReal] $$\frac{n \rhd \mathit{real64}(\_) \quad \langle\, E_2, \sigma \,\rangle \to \langle\, I_2, \sigma' \,\rangle}{\langle\, \mathsf{mul}(n\ E_2), \sigma \,\rangle \to \langle\, \mathsf{mul}(n\ I_2), \sigma' \,\rangle}$$

[mulLeft] $$\frac{\langle\, E_1, \sigma \,\rangle \rightarrow \langle\, I_1, \sigma' \,\rangle}{\langle\, \mathsf{mul}(E_1\ E_2), \sigma \,\rangle \rightarrow \langle\, \mathsf{mul}(I_1\ E_2), \sigma' \,\rangle}$$

[init] $$\frac{w \rhd \mathit{int32}(\_) \quad h \rhd \mathit{int32}(\_)}{\langle\, \mathsf{init}(w\ h), \sigma \,\rangle \rightarrow \langle\, \mathit{user}(\mathit{string}(\texttt{init})\ w\ h), \sigma \,\rangle}$$

[paint] $$\langle\, \mathsf{paint}, \sigma \,\rangle \rightarrow \langle\, \mathit{user}(\mathit{string}(\texttt{paint})), \sigma \,\rangle$$

[eqInt] $$\frac{n_1 \rhd \mathit{int32}(\_) \quad n_2 \rhd \mathit{int32}(\_)}{\langle\, \mathsf{eq}(n_1\ n_2), \sigma \,\rangle \rightarrow \langle\, \mathit{eq}(n_1\ n_2), \sigma \,\rangle}$$

[eqReal] $$\frac{n_1 \rhd \mathit{real64}(\_) \quad n_2 \rhd \mathit{real64}(\_)}{\langle\, \mathsf{eq}(n_1\ n_2), \sigma \,\rangle \rightarrow \langle\, \mathit{eq}(n_1\ n_2), \sigma \,\rangle}$$

[eqRightInt] $$\frac{n \rhd \mathit{int32}(\_) \quad \langle\, E_2, \sigma \,\rangle \rightarrow \langle\, I_2, \sigma' \,\rangle}{\langle\, \mathsf{eq}(n\ E_2), \sigma \,\rangle \rightarrow \langle\, \mathsf{eq}(n\ I_2), \sigma' \,\rangle}$$

[eqRightReal] $$\frac{n \rhd \mathit{real64}(\_) \quad \langle\, E_2, \sigma \,\rangle \rightarrow \langle\, I_2, \sigma' \,\rangle}{\langle\, \mathsf{eq}(n\ E_2), \sigma \,\rangle \rightarrow \langle\, \mathsf{eq}(n\ I_2), \sigma' \,\rangle}$$

[eqLeft] $$\frac{\langle\, E_1, \sigma \,\rangle \rightarrow \langle\, I_1, \sigma' \,\rangle}{\langle\, \mathsf{eq}(E_1\ E_2), \sigma \,\rangle \rightarrow \langle\, \mathsf{eq}(I_1\ E_2), \sigma' \,\rangle}$$

[divInt] $$\frac{n_1 \rhd \mathit{int32}(\_) \quad n_2 \rhd \mathit{int32}(\_)}{\langle\, \mathsf{div}(n_1\ n_2), \sigma \,\rangle \rightarrow \langle\, \mathit{div}(n_1\ n_2), \sigma \,\rangle}$$

[divReal] $$\frac{n_1 \rhd \mathit{real64}(\_) \quad n_2 \rhd \mathit{real64}(\_)}{\langle\, \mathsf{div}(n_1\ n_2), \sigma \,\rangle \rightarrow \langle\, \mathit{div}(n_1\ n_2), \sigma \,\rangle}$$

[divRightInt] $$\frac{n \rhd \mathit{int32}(\_) \quad \langle\, E_2, \sigma \,\rangle \rightarrow \langle\, I_2, \sigma' \,\rangle}{\langle\, \mathsf{div}(n\ E_2), \sigma \,\rangle \rightarrow \langle\, \mathsf{div}(n\ I_2), \sigma' \,\rangle}$$

[divRightReal] $$\frac{n \rhd \mathit{real64}(\_) \quad \langle\, E_2, \sigma \,\rangle \rightarrow \langle\, I_2, \sigma' \,\rangle}{\langle\, \mathsf{div}(n\ E_2), \sigma \,\rangle \rightarrow \langle\, \mathsf{div}(n\ I_2), \sigma' \,\rangle}$$

[divLeft] $$\frac{\langle\, E_1, \sigma \,\rangle \rightarrow \langle\, I_1, \sigma' \,\rangle}{\langle\, \mathsf{div}(E_1\ E_2), \sigma \,\rangle \rightarrow \langle\, \mathsf{div}(I_1\ E_2), \sigma' \,\rangle}$$

[printlnSingleStr] $$\frac{s \rhd \mathit{string}(\_)}{\langle\, \mathsf{println}(s), \sigma \,\rangle \rightarrow \langle\, \mathsf{seq}(\mathit{user}(\mathit{string}(\texttt{print})\ s)\ \mathit{user}(\mathit{string}(\texttt{printNewLineChar}))), \sigma \,\rangle}$$

[printlnSingleInt] $$\frac{n \rhd \mathit{int32}(\_)}{\langle\, \mathsf{println}(n), \sigma \,\rangle \rightarrow \langle\, \mathsf{seq}(\mathit{user}(\mathit{string}(\texttt{print})\ n)\ \mathit{user}(\mathit{string}(\texttt{printNewLineChar}))), \sigma \,\rangle}$$

[printlnSingleReal] $$\frac{n \rhd \mathit{real64}(\_)}{\langle\, \mathsf{println}(n), \sigma \,\rangle \rightarrow \langle\, \mathsf{seq}(\mathit{user}(\mathit{string}(\texttt{print})\ n)\ \mathit{user}(\mathit{string}(\texttt{printNewLineChar}))), \sigma \,\rangle}$$

[printlnSingleBool] $$\frac{b \rhd \mathit{bool}(\_)}{\langle\, \mathsf{println}(b), \sigma \,\rangle \rightarrow \langle\, \mathsf{seq}(\mathit{user}(\mathit{string}(\texttt{print})\ b)\ \mathit{user}(\mathit{string}(\texttt{printNewLineChar}))), \sigma \,\rangle}$$

[printlnMultiStr] $$\frac{s \rhd \mathit{string}(\_)}{\langle\, \mathsf{println}(s\ E), \sigma \,\rangle \rightarrow \langle\, \mathsf{seq}(\mathit{user}(\mathit{string}(\texttt{print})\ s)\ E), \sigma \,\rangle}$$

[printlnMultiInt] $$\frac{n \rhd \mathit{int32}(\_)}{\langle\, \mathsf{println}(n\ E), \sigma \,\rangle \rightarrow \langle\, \mathsf{seq}(\mathit{user}(\mathit{string}(\texttt{print})\ n)\ E), \sigma \,\rangle}$$

[printlnMultiReal] $$\frac{n \rhd \mathit{real64}(\_)}{\langle\, \mathsf{println}(n\ E), \sigma \,\rangle \rightarrow \langle\, \mathsf{seq}(\mathit{user}(\mathit{string}(\texttt{print})\ n)\ E), \sigma \,\rangle}$$

[printlnMultiBool] $$\frac{b \rhd \mathit{bool}(\_)}{\langle\, \mathsf{println}(b\ E), \sigma \,\rangle \rightarrow \langle\, \mathsf{seq}(\mathit{user}(\mathit{string}(\texttt{print})\ b)\ E), \sigma \,\rangle}$$

[printlnResolve] $$\frac{\langle\, E_1, \sigma \,\rangle \rightarrow \langle\, I_1, \sigma' \,\rangle}{\langle\, \mathsf{println}(E_1\ E_2), \sigma \,\rangle \rightarrow \langle\, \mathsf{println}(I_1\ E_2), \sigma' \,\rangle}$$

[printlnResolve] $$\frac{\langle\, E, \sigma \,\rangle \rightarrow \langle\, I, \sigma' \,\rangle}{\langle\, \mathsf{println}(E), \sigma \,\rangle \rightarrow \langle\, \mathsf{println}(I), \sigma' \,\rangle}$$

[modInt] $$\frac{n_1 \rhd \mathit{int32}(\_) \quad n_2 \rhd \mathit{int32}(\_)}{\langle\, \mathsf{mod}(n_1\ n_2), \sigma \,\rangle \rightarrow \langle\, \mathit{mod}(n_1\ n_2), \sigma \,\rangle}$$

[modRightInt] $$\frac{n \rhd \mathit{int32}(\_) \quad \langle\, E_2, \sigma \,\rangle \rightarrow \langle\, I_2, \sigma' \,\rangle}{\langle\, \mathsf{mod}(n\ E_2), \sigma \,\rangle \rightarrow \langle\, \mathsf{mod}(n\ I_2), \sigma' \,\rangle}$$

[modLeft] $$\frac{\langle\, E_1, \sigma \,\rangle \rightarrow \langle\, I_1, \sigma' \,\rangle}{\langle\, \mathsf{mod}(E_1\ E_2), \sigma \,\rangle \rightarrow \langle\, \mathsf{mod}(I_1\ E_2), \sigma' \,\rangle}$$

[neInt] $$\frac{n_1 \rhd \mathit{int32}(\_) \quad n_2 \rhd \mathit{int32}(\_)}{\langle\, \mathsf{ne}(n_1\ n_2), \sigma \,\rangle \rightarrow \langle\, \mathit{ne}(n_1\ n_2), \sigma \,\rangle}$$

[neReal] $$\frac{n_1 \rhd \mathit{real64}(\_) \quad n_2 \rhd \mathit{real64}(\_)}{\langle\, \mathsf{ne}(n_1\ n_2), \sigma \,\rangle \rightarrow \langle\, \mathit{ne}(n_1\ n_2), \sigma \,\rangle}$$

[neRightInt] $$\frac{n \rhd \mathit{int32}(\_) \quad \langle\, E_2, \sigma \,\rangle \rightarrow \langle\, I_2, \sigma' \,\rangle}{\langle\, \mathsf{ne}(n\ E_2), \sigma \,\rangle \rightarrow \langle\, \mathsf{ne}(n\ I_2), \sigma' \,\rangle}$$

[neRightReal] $$\frac{n \rhd \mathit{real64}(\_) \quad \langle\, E_2, \sigma \,\rangle \rightarrow \langle\, I_2, \sigma' \,\rangle}{\langle\, \mathsf{ne}(n\ E_2), \sigma \,\rangle \rightarrow \langle\, \mathsf{ne}(n\ I_2), \sigma' \,\rangle}$$

[neLeft] $$\frac{\langle\, E_1, \sigma \,\rangle \rightarrow \langle\, I_1, \sigma' \,\rangle}{\langle\, \mathsf{ne}(E_1\ E_2), \sigma \,\rangle \rightarrow \langle\, \mathsf{ne}(I_1\ E_2), \sigma' \,\rangle}$$

[negInt] $$\frac{n \rhd \mathit{int32}(\_)}{\langle\, \mathsf{neg}(n), \sigma \,\rangle \rightarrow \langle\, \mathit{neg}(n), \sigma \,\rangle}$$

[negReal] $$\frac{n \rhd \mathit{real64}(\_)}{\langle\, \mathsf{neg}(n), \sigma \,\rangle \rightarrow \langle\, \mathit{neg}(n), \sigma \,\rangle}$$

[negResolve] $$\frac{\langle\, E, \sigma \,\rangle \rightarrow \langle\, I, \sigma' \,\rangle}{\langle\, \mathsf{neg}(E), \sigma \,\rangle \rightarrow \langle\, \mathit{neg}(I), \sigma' \,\rangle}$$

[printlnElemStr] $$\frac{s \rhd \mathit{string}(\_)}{\langle\, \mathsf{printlnElem}(s\ \ E), \sigma \,\rangle \rightarrow \langle\, \mathsf{seq}(\mathit{user}(\mathit{string}(\texttt{print})\ \ \mathit{string}(\ \ ))\ \mathsf{seq}(\mathit{user}(\mathit{string}(\texttt{print})\ \ s)\ \ E)), \sigma \,\rangle}$$

[printlnElemInt] $$\frac{n \rhd \mathit{int32}(\_)}{\langle\, \mathsf{printlnElem}(n\ \ E), \sigma \,\rangle \rightarrow \langle\, \mathsf{seq}(\mathit{user}(\mathit{string}(\texttt{print})\ \ \mathit{string}(\ \ ))\ \mathsf{seq}(\mathit{user}(\mathit{string}(\texttt{print})\ \ n)\ \ E)), \sigma \,\rangle}$$

[printlnElemReal] $$\frac{n \rhd \mathit{real64}(\_)}{\langle\, \mathsf{printlnElem}(n\ \ E), \sigma \,\rangle \rightarrow \langle\, \mathsf{seq}(\mathit{user}(\mathit{string}(\texttt{print})\ \ \mathit{string}(\ \ ))\ \mathsf{seq}(\mathit{user}(\mathit{string}(\texttt{print})\ \ n)\ \ E)), \sigma \,\rangle}$$

[printlnElemBool] $$\frac{b \rhd \mathit{bool}(\_)}{\langle\, \mathsf{printlnElem}(b\ \ E), \sigma \,\rangle \rightarrow \langle\, \mathsf{seq}(\mathit{user}(\mathit{string}(\texttt{print})\ \ \mathit{string}(\ \ ))\ \mathsf{seq}(\mathit{user}(\mathit{string}(\texttt{print})\ \ b)\ \ E)), \sigma \,\rangle}$$

[printlnElemLast]
$$\frac{s \rhd \mathit{string}(\_)}{\langle\, \mathsf{printlnElem}(s), \sigma \,\rangle \rightarrow \langle\, \mathsf{seq}(\mathsf{seq}(\mathit{user}(\mathit{string}(\texttt{print})\ \ \mathit{string}(\ \ ))\ \mathit{user}(\mathit{string}(\texttt{print})\ \ s))\ \mathit{user}(\mathit{string}(\texttt{printNewLineChar}))), \sigma \,\rangle}$$

[printlnElemLastInt]
$$\frac{n \rhd \mathit{int32}(\_)}{\langle\, \mathsf{printlnElem}(n), \sigma \,\rangle \rightarrow \langle\, \mathsf{seq}(\mathsf{seq}(\mathit{user}(\mathit{string}(\texttt{print})\ \ \mathit{string}(\ \ ))\ \mathit{user}(\mathit{string}(\texttt{print})\ \ n))\ \mathit{user}(\mathit{string}(\texttt{printNewLineChar}))), \sigma \,\rangle}$$

[printlnElemLastReal]
$$\frac{n \rhd \mathit{real64}(\_)}{\langle\, \mathsf{printlnElem}(n), \sigma \,\rangle \rightarrow \langle\, \mathsf{seq}(\mathsf{seq}(\mathit{user}(\mathit{string}(\texttt{print})\ \ \mathit{string}(\ \ ))\ \mathit{user}(\mathit{string}(\texttt{print})\ \ n))\ \mathit{user}(\mathit{string}(\texttt{printNewLineChar}))), \sigma \,\rangle}$$

[printlnElemLastBool]
$$\frac{b \rhd \mathit{bool}(\_)}{\langle\, \mathsf{printlnElem}(b), \sigma \,\rangle \rightarrow \langle\, \mathsf{seq}(\mathsf{seq}(\mathit{user}(\mathit{string}(\texttt{print})\ \ \mathit{string}(\ \ ))\ \mathit{user}(\mathit{string}(\texttt{print})\ \ b))\ \mathit{user}(\mathit{string}(\texttt{printNewLineChar}))), \sigma \,\rangle}$$

[printlnElemLastResolve] $$\frac{\langle\, E, \sigma \,\rangle \rightarrow \langle\, I, \sigma' \,\rangle}{\langle\, \mathsf{printlnElem}(E), \sigma \,\rangle \rightarrow \langle\, \mathsf{printlnElem}(I), \sigma' \,\rangle}$$

[printlnElemResolve] $$\frac{\langle\, E_1, \sigma \,\rangle \rightarrow \langle\, I_1, \sigma' \,\rangle}{\langle\, \mathsf{printlnElem}(E_1\ \ E_2), \sigma \,\rangle \rightarrow \langle\, \mathsf{printlnElem}(I_1\ \ E_2), \sigma' \,\rangle}$$

[gtInt] $$\frac{n_1 \rhd \mathit{int32}(\_) \quad n_2 \rhd \mathit{int32}(\_)}{\langle\, \mathsf{gt}(n_1\ \ n_2), \sigma \,\rangle \rightarrow \langle\, \mathit{gt}(n_1\ \ n_2), \sigma \,\rangle}$$

[gtReal] $$\frac{n_1 \rhd \mathit{real64}(\_) \quad n_2 \rhd \mathit{real64}(\_)}{\langle\, \mathsf{gt}(n_1\ \ n_2), \sigma \,\rangle \rightarrow \langle\, \mathit{gt}(n_1\ \ n_2), \sigma \,\rangle}$$

[gtRightInt] $$\frac{n \rhd \mathit{int32}(\_) \quad \langle\, E_2, \sigma \,\rangle \rightarrow \langle\, I_2, \sigma' \,\rangle}{\langle\, \mathsf{gt}(n\ \ E_2), \sigma \,\rangle \rightarrow \langle\, \mathsf{gt}(n\ \ I_2), \sigma' \,\rangle}$$

[gtRightReal] $$\frac{n \rhd \mathit{real64}(\_) \quad \langle\, E_2, \sigma \,\rangle \rightarrow \langle\, I_2, \sigma' \,\rangle}{\langle\, \mathsf{gt}(n\ \ E_2), \sigma \,\rangle \rightarrow \langle\, \mathsf{gt}(n\ \ I_2), \sigma' \,\rangle}$$

[gtLeft] $$\frac{\langle\, E_1, \sigma \,\rangle \rightarrow \langle\, I_1, \sigma' \,\rangle}{\langle\, \mathsf{gt}(E_1\ \ E_2), \sigma \,\rangle \rightarrow \langle\, \mathsf{gt}(I_1\ \ E_2), \sigma' \,\rangle}$$

[expInt] $$\frac{n_1 \rhd \mathit{int32}(\_) \quad n_2 \rhd \mathit{int32}(\_)}{\langle\, \mathsf{exp}(n_1\ n_2), \sigma \,\rangle \rightarrow \langle\, \mathit{exp}(n_1\ n_2), \sigma \,\rangle}$$

[expReal] $$\frac{n_1 \rhd \mathit{real64}(\_) \quad n_2 \rhd \mathit{real64}(\_)}{\langle\, \mathsf{exp}(n_1\ n_2), \sigma \,\rangle \rightarrow \langle\, \mathit{exp}(n_1\ n_2), \sigma \,\rangle}$$

[powResolve] $$\frac{\langle\, E_1, \sigma \,\rangle \rightarrow \langle\, I_1, \sigma' \,\rangle \quad \langle\, E_2, \sigma \,\rangle \rightarrow \langle\, I_2, \sigma' \,\rangle}{\langle\, \mathsf{exp}(E_1\ E_2), \sigma \,\rangle \rightarrow \langle\, \mathit{exp}(I_1\ I_2), \sigma' \,\rangle}$$

[int2real] $$\frac{n \rhd \mathit{int32}(\_)}{\langle\, \mathsf{int2real}(n), \sigma \,\rangle \rightarrow \langle\, \mathit{user}(\mathit{string}(\texttt{int2real})\ n), \sigma \,\rangle}$$

[int2realResolve] $$\frac{\langle\, E, \sigma \,\rangle \rightarrow \langle\, I, \sigma' \,\rangle}{\langle\, \mathsf{int2real}(E), \sigma \,\rangle \rightarrow \langle\, \mathit{user}(\mathit{string}(\texttt{int2real})\ I), \sigma' \,\rangle}$$

[geInt] $$\frac{n_1 \rhd \mathit{int32}(\_) \quad n_2 \rhd \mathit{int32}(\_)}{\langle\, \mathsf{ge}(n_1\ n_2), \sigma \,\rangle \rightarrow \langle\, \mathit{ge}(n_1\ n_2), \sigma \,\rangle}$$

[geReal] $$\frac{n_1 \rhd \mathit{real64}(\_) \quad n_2 \rhd \mathit{real64}(\_)}{\langle\, \mathsf{ge}(n_1\ n_2), \sigma \,\rangle \rightarrow \langle\, \mathit{ge}(n_1\ n_2), \sigma \,\rangle}$$

[geRightInt] $$\frac{n \rhd \mathit{int32}(\_) \quad \langle\, E_2, \sigma \,\rangle \rightarrow \langle\, I_2, \sigma' \,\rangle}{\langle\, \mathsf{ge}(n\ E_2), \sigma \,\rangle \rightarrow \langle\, \mathsf{ge}(n\ I_2), \sigma' \,\rangle}$$

[geRightReal] $$\frac{n \rhd \mathit{real64}(\_) \quad \langle\, E_2, \sigma \,\rangle \rightarrow \langle\, I_2, \sigma' \,\rangle}{\langle\, \mathsf{ge}(n\ E_2), \sigma \,\rangle \rightarrow \langle\, \mathsf{ge}(n\ I_2), \sigma' \,\rangle}$$

[geLeft] $$\frac{\langle\, E_1, \sigma \,\rangle \rightarrow \langle\, I_1, \sigma' \,\rangle}{\langle\, \mathsf{ge}(E_1\ E_2), \sigma \,\rangle \rightarrow \langle\, \mathsf{ge}(I_1\ E_2), \sigma' \,\rangle}$$

[real2int] $$\frac{n \rhd \mathit{real64}(\_)}{\langle\, \mathsf{real2int}(n), \sigma \,\rangle \rightarrow \langle\, \mathit{user}(\mathit{string}(\texttt{real2int})\ n), \sigma \,\rangle}$$

[real2intResolve] $$\frac{\langle\, E, \sigma \,\rangle \rightarrow \langle\, I, \sigma' \,\rangle}{\langle\, \mathsf{real2int}(E), \sigma \,\rangle \rightarrow \langle\, \mathit{user}(\mathit{string}(\texttt{real2int})\ I), \sigma' \,\rangle}$$

[sequenceDone] $$\langle\, \mathsf{seq}(\mathit{done}\ C), \sigma \,\rangle \rightarrow \langle\, C, \sigma \,\rangle$$

[sequence] $$\frac{\langle\, C_1, \sigma \,\rangle \rightarrow \langle\, C_1{}', \sigma' \,\rangle}{\langle\, \mathsf{seq}(C_1\ C_2), \sigma \,\rangle \rightarrow \langle\, \mathsf{seq}(C_1{}'\ C_2), \sigma' \,\rangle}$$

[box] $$\frac{x \rhd \mathit{real64}(\_) \quad y \rhd \mathit{real64}(\_) \quad z \rhd \mathit{real64}(\_)}{\langle\, \mathsf{box}(x\ y\ z), \sigma \,\rangle \rightarrow \langle\, \mathit{user}(\mathit{string}(\mathsf{box})\ x\ y\ z), \sigma \,\rangle}$$

[break] $$\langle\, \mathsf{break}, \sigma \,\rangle \rightarrow \langle\, \mathit{done}, \sigma \,\rangle$$

[ltInt] $$\frac{n_1 \rhd \mathit{int32}(\_) \quad n_2 \rhd \mathit{int32}(\_)}{\langle\, \mathsf{lt}(n_1\ n_2), \sigma \,\rangle \rightarrow \langle\, \mathit{lt}(n_1\ n_2), \sigma \,\rangle}$$

[ltReal] $\dfrac{n_1 \rhd \mathit{real64}(\_) \quad n_2 \rhd \mathit{real64}(\_)}{\langle\, \mathsf{lt}(n_1\ n_2), \sigma \,\rangle \to \langle\, \mathit{lt}(n_1\ n_2), \sigma \,\rangle}$

[ltRightInt] $\dfrac{n \rhd \mathit{int32}(\_) \quad \langle\, E_2, \sigma \,\rangle \to \langle\, I_2, \sigma' \,\rangle}{\langle\, \mathsf{lt}(n\ E_2), \sigma \,\rangle \to \langle\, \mathsf{lt}(n\ I_2), \sigma' \,\rangle}$

[ltRightReal] $\dfrac{n \rhd \mathit{real64}(\_) \quad \langle\, E_2, \sigma \,\rangle \to \langle\, I_2, \sigma' \,\rangle}{\langle\, \mathsf{lt}(n\ E_2), \sigma \,\rangle \to \langle\, \mathsf{lt}(n\ I_2), \sigma' \,\rangle}$

[ltLeft] $\dfrac{\langle\, E_1, \sigma \,\rangle \to \langle\, I_1, \sigma' \,\rangle}{\langle\, \mathsf{lt}(E_1\ E_2), \sigma \,\rangle \to \langle\, \mathsf{lt}(I_1\ E_2), \sigma' \,\rangle}$

[cube] $\dfrac{e \rhd \mathit{real64}(\_)}{\langle\, \mathsf{cube}(e), \sigma \,\rangle \to \langle\, \mathit{user}(\mathit{string}(\mathsf{cube})\ e), \sigma \,\rangle}$

[cubeResolve] $\dfrac{\langle\, E, \sigma \,\rangle \to \langle\, I, \sigma' \,\rangle}{\langle\, \mathsf{cube}(E), \sigma \,\rangle \to \langle\, \mathsf{cube}(I), \sigma' \,\rangle}$

[ifTrue] $\langle\, \mathsf{if}(\mathit{bool}(\mathsf{True})\ C_1\ C_2), \sigma \,\rangle \to \langle\, C_1, \sigma \,\rangle$

[ifTrue] $\langle\, \mathsf{if}(\mathit{bool}(\mathsf{True})\ C), \sigma \,\rangle \to \langle\, C, \sigma \,\rangle$

[ifFalse] $\langle\, \mathsf{if}(\mathit{bool}(\mathsf{False})\ C_1\ C_2), \sigma \,\rangle \to \langle\, C_2, \sigma \,\rangle$

[ifFalse] $\langle\, \mathsf{if}(\mathit{bool}(\mathsf{False})\ C), \sigma \,\rangle \to \langle\, \mathit{done}, \sigma \,\rangle$

[ifResolve] $\dfrac{\langle\, E, \sigma \,\rangle \to \langle\, E', \sigma' \,\rangle}{\langle\, \mathsf{if}(E\ C_1\ C_2), \sigma \,\rangle \to \langle\, \mathsf{if}(E'\ C_1\ C_2), \sigma' \,\rangle}$

[ifResolve] $\dfrac{\langle\, E, \sigma \,\rangle \to \langle\, E', \sigma' \,\rangle}{\langle\, \mathsf{if}(E\ C), \sigma \,\rangle \to \langle\, \mathsf{if}(E'\ C\ \mathit{done}), \sigma' \,\rangle}$

[leInt] $\dfrac{n_1 \rhd \mathit{int32}(\_) \quad n_2 \rhd \mathit{int32}(\_)}{\langle\, \mathsf{le}(n_1\ n_2), \sigma \,\rangle \to \langle\, \mathit{le}(n_1\ n_2), \sigma \,\rangle}$

[leReal] $\dfrac{n_1 \rhd \mathit{real64}(\_) \quad n_2 \rhd \mathit{real64}(\_)}{\langle\, \mathsf{le}(n_1\ n_2), \sigma \,\rangle \to \langle\, \mathit{le}(n_1\ n_2), \sigma \,\rangle}$

[leRightInt] $\dfrac{n \rhd \mathit{int32}(\_) \quad \langle\, E_2, \sigma \,\rangle \to \langle\, I_2, \sigma' \,\rangle}{\langle\, \mathsf{le}(n\ E_2), \sigma \,\rangle \to \langle\, \mathsf{le}(n\ I_2), \sigma' \,\rangle}$

[leRightReal] $\dfrac{n \rhd \mathit{real64}(\_) \quad \langle\, E_2, \sigma \,\rangle \to \langle\, I_2, \sigma' \,\rangle}{\langle\, \mathsf{le}(n\ E_2), \sigma \,\rangle \to \langle\, \mathsf{le}(n\ I_2), \sigma' \,\rangle}$

[leLeft] $\dfrac{\langle\, E_1, \sigma \,\rangle \to \langle\, I_1, \sigma' \,\rangle}{\langle\, \mathsf{le}(E_1\ E_2), \sigma \,\rangle \to \langle\, \mathsf{le}(I_1\ E_2), \sigma' \,\rangle}$

[sphere] $$\frac{r \rhd \mathit{real64}(\_)}{\langle\, \mathsf{sphere}(r), \sigma \,\rangle \rightarrow \langle\, \mathit{user}(\mathit{string}(\texttt{sphere})\ r), \sigma \,\rangle}$$

[cylinder] $$\frac{r \rhd \mathit{real64}(\_) \quad h \rhd \mathit{real64}(\_)}{\langle\, \mathsf{cylinder}(r\ h), \sigma \,\rangle \rightarrow \langle\, \mathit{user}(\mathit{string}(\texttt{cylinder})\ r\ h), \sigma \,\rangle}$$

[while] $$\langle\, \mathsf{while}(E\ C), \sigma \,\rangle \rightarrow \langle\, \mathsf{if}(E\ \mathsf{seq}(C\ \mathsf{while}(E\ C))\ \mathit{done}), \sigma \,\rangle$$

[not] $$\frac{n \rhd \mathit{bool}(\_)}{\langle\, \mathsf{not}(n), \sigma \,\rangle \rightarrow \langle\, \mathit{not}(n), \sigma \,\rangle}$$

[notResolve] $$\frac{\langle\, E, \sigma \,\rangle \rightarrow \langle\, I, \sigma' \,\rangle}{\langle\, \mathsf{not}(E), \sigma \,\rangle \rightarrow \langle\, \mathit{not}(I), \sigma' \,\rangle}$$

[for] $$\langle\, \mathsf{for}(E_1\ E_2\ E_3\ C), \sigma \,\rangle \rightarrow \langle\, \mathsf{seq}(E_1\ \mathsf{while}(E_2\ \mathsf{seq}(C\ E_3))), \sigma \,\rangle$$

[cone] $$\frac{r \rhd \mathit{real64}(\_) \quad h \rhd \mathit{real64}(\_)}{\langle\, \mathsf{cone}(r\ h), \sigma \,\rangle \rightarrow \langle\, \mathit{user}(\mathit{string}(\texttt{cone})\ r\ h), \sigma \,\rangle}$$

[and] $$\frac{n_1 \rhd \mathit{bool}(\_) \quad n_2 \rhd \mathit{bool}(\_)}{\langle\, \mathsf{and}(n_1\ n_2), \sigma \,\rangle \rightarrow \langle\, \mathit{and}(n_1\ n_2), \sigma \,\rangle}$$

[andResolve] $$\frac{\langle\, E_1, \sigma \,\rangle \rightarrow \langle\, I_1, \sigma' \,\rangle \quad \langle\, E_2, \sigma \,\rangle \rightarrow \langle\, I_2, \sigma' \,\rangle}{\langle\, \mathsf{and}(E_1\ E_2), \sigma \,\rangle \rightarrow \langle\, \mathit{and}(I_1\ I_2), \sigma' \,\rangle}$$

[torus] $$\frac{r \rhd \mathit{real64}(\_) \quad R \rhd \mathit{real64}(\_)}{\langle\, \mathsf{torus}(r\ R), \sigma \,\rangle \rightarrow \langle\, \mathit{user}(\mathit{string}(\texttt{torus})\ r\ R), \sigma \,\rangle}$$

[or] $$\frac{n_1 \rhd \mathit{bool}(\_) \quad n_2 \rhd \mathit{bool}(\_)}{\langle\, \mathsf{or}(n_1\ n_2), \sigma \,\rangle \rightarrow \langle\, \mathit{or}(n_1\ n_2), \sigma \,\rangle}$$

[orResolve] $$\frac{\langle\, E_1, \sigma \,\rangle \rightarrow \langle\, I_1, \sigma' \,\rangle \quad \langle\, E_2, \sigma \,\rangle \rightarrow \langle\, I_2, \sigma' \,\rangle}{\langle\, \mathsf{or}(E_1\ E_2), \sigma \,\rangle \rightarrow \langle\, \mathit{or}(I_1\ I_2), \sigma' \,\rangle}$$

[tetrahedron] $$\frac{e \rhd \mathit{real64}(\_)}{\langle\, \mathsf{tetrahedron}(e), \sigma \,\rangle \rightarrow \langle\, \mathit{user}(\mathit{string}(\texttt{tetrahedron})\ e), \sigma \,\rangle}$$

[xor] $$\frac{n_1 \rhd \mathit{bool}(\_) \quad n_2 \rhd \mathit{bool}(\_)}{\langle\, \mathsf{xor}(n_1\ n_2), \sigma \,\rangle \rightarrow \langle\, \mathit{xor}(n_1\ n_2), \sigma \,\rangle}$$

[xorResolve] $$\frac{\langle\, E_1, \sigma \,\rangle \rightarrow \langle\, I_1, \sigma' \,\rangle \quad \langle\, E_2, \sigma \,\rangle \rightarrow \langle\, I_2, \sigma' \,\rangle}{\langle\, \mathsf{xor}(E_1\ E_2), \sigma \,\rangle \rightarrow \langle\, \mathit{xor}(I_1\ I_2), \sigma' \,\rangle}$$

[pyramid] $$\frac{e \rhd \mathit{real64}(\_) \quad h \rhd \mathit{real64}(\_)}{\langle\, \mathsf{pyramid}(e\ h), \sigma \,\rangle \rightarrow \langle\, \mathit{user}(\mathit{string}(\texttt{pyramid})\ e\ h), \sigma \,\rangle}$$

[assignInt] $$\frac{n \rhd \mathit{int32}(\_)}{\langle\, \mathsf{assign}(X\ n), \sigma \,\rangle \rightarrow \langle\, \mathit{done}, \mathit{put}(\sigma\ X\ n) \,\rangle}$$

[assignReal] $$\frac{n \rhd \mathit{real64}(\_)}{\langle\, \mathsf{assign}(X\ \ n), \sigma \,\rangle \rightarrow \langle\, \mathit{done}, \mathit{put}(\sigma\ \ X\ \ n) \,\rangle}$$

[assignStr] $$\frac{s \rhd \mathit{string}(\_)}{\langle\, \mathsf{assign}(X\ \ s), \sigma \,\rangle \rightarrow \langle\, \mathit{done}, \mathit{put}(\sigma\ \ X\ \ s) \,\rangle}$$

[assignBool] $$\frac{b \rhd \mathit{bool}(\_)}{\langle\, \mathsf{assign}(X\ \ b), \sigma \,\rangle \rightarrow \langle\, \mathit{done}, \mathit{put}(\sigma\ \ X\ \ b) \,\rangle}$$

[assignResolve] $$\frac{\langle\, E, \sigma \,\rangle \rightarrow \langle\, I, \sigma' \,\rangle}{\langle\, \mathsf{assign}(X\ \ E), \sigma \,\rangle \rightarrow \langle\, \mathsf{assign}(X\ \ I), \sigma' \,\rangle}$$

[subInt] $$\frac{n_1 \rhd \mathit{int32}(\_) \quad n_2 \rhd \mathit{int32}(\_)}{\langle\, \mathsf{sub}(n_1\ \ n_2), \sigma \,\rangle \rightarrow \langle\, \mathit{sub}(n_1\ \ n_2), \sigma \,\rangle}$$

[subReal] $$\frac{n_1 \rhd \mathit{real64}(\_) \quad n_2 \rhd \mathit{real64}(\_)}{\langle\, \mathsf{sub}(n_1\ \ n_2), \sigma \,\rangle \rightarrow \langle\, \mathit{sub}(n_1\ \ n_2), \sigma \,\rangle}$$

[subRightInt] $$\frac{n \rhd \mathit{int32}(\_) \quad \langle\, E_2, \sigma \,\rangle \rightarrow \langle\, I_2, \sigma' \,\rangle}{\langle\, \mathsf{sub}(n\ \ E_2), \sigma \,\rangle \rightarrow \langle\, \mathsf{sub}(n\ \ I_2), \sigma' \,\rangle}$$

[subRightReal] $$\frac{n \rhd \mathit{real64}(\_) \quad \langle\, E_2, \sigma \,\rangle \rightarrow \langle\, I_2, \sigma' \,\rangle}{\langle\, \mathsf{sub}(n\ \ E_2), \sigma \,\rangle \rightarrow \langle\, \mathsf{sub}(n\ \ I_2), \sigma' \,\rangle}$$

[subLeft] $$\frac{\langle\, E_1, \sigma \,\rangle \rightarrow \langle\, I_1, \sigma' \,\rangle}{\langle\, \mathsf{sub}(E_1\ \ E_2), \sigma \,\rangle \rightarrow \langle\, \mathsf{sub}(I_1\ \ E_2), \sigma' \,\rangle}$$

[translate] $$\frac{Z \rhd \mathit{int32}(\_) \quad x \rhd \mathit{real64}(\_) \quad y \rhd \mathit{real64}(\_) \quad z \rhd \mathit{real64}(\_)}{\langle\, \mathsf{translate}(Z\ \ x\ \ y\ \ z), \sigma \,\rangle \rightarrow \langle\, \mathit{user}(\mathit{string}(\texttt{translate})\ \ Z\ \ x\ \ y\ \ z), \sigma \,\rangle}$$

[translateResolve] $$\frac{\langle\, E_1, \sigma \,\rangle \rightarrow \langle\, V_1, \sigma \,\rangle \quad \langle\, E_2, \sigma \,\rangle \rightarrow \langle\, V_2, \sigma \,\rangle \quad \langle\, E_3, \sigma \,\rangle \rightarrow \langle\, V_3, \sigma \,\rangle \quad \langle\, E_4, \sigma \,\rangle \rightarrow \langle\, V_4, \sigma \,\rangle}{\langle\, \mathsf{translate}(E_1\ \ E_2\ \ E_3\ \ E_4), \sigma \,\rangle \rightarrow \langle\, \mathsf{translate}(V_1\ \ V_2\ \ V_3\ \ V_4), \sigma \,\rangle}$$
