

COTTP3610/6361

# Principles of Programming Languages

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$$\frac{\langle E_1; s \rangle \rightarrow \langle E'_1; s' \rangle}{\langle E_1; E_2; s \rangle \rightarrow \langle E'_1; E_2; s' \rangle}$$

Example

$$\langle 5+3; x:=3, s \rangle \rightarrow \langle 8; x:=3, s \rangle \neq$$

$$\begin{aligned} \langle x:=3; 5+3, s \rangle &\rightarrow \langle \text{skip}; 5+3, s + \{x \mapsto 3\} \rangle \\ &\rightarrow \langle 5+3, s + \{x \mapsto 3\} \rangle \end{aligned}$$

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$$\langle l := 3, \{s \mapsto 0\} \rangle \rightarrow \langle \text{skip}, \{s \mapsto 3\} \rangle$$

assym.1

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$$\langle l := 3; !l, \{l \mapsto 0\} \rangle \rightarrow \langle \text{skip}; !l, \{l \mapsto 3\} \rangle$$

seq 2

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$$\langle \text{skip}; !l, \{l \mapsto 3\} \rangle \rightarrow \langle !l, \{l \mapsto 3\} \rangle$$

seq 1

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$$\langle !l, \{l \mapsto 3\} \rangle \rightarrow \langle 3, \{l \mapsto 3\} \rangle$$

deref

$$\langle l := 3, \{l \mapsto 0\} \rangle \rightarrow \langle \text{skip}, \{l \mapsto 3\} \rangle \quad \text{assign 1}$$

$$\langle l := 3; l := !l, \{l \mapsto 0\} \rangle \rightarrow \langle \text{skip}; l := !l, \{l \mapsto 3\} \rangle \quad \text{seq 2}$$

$$\langle \text{skip}; l := !l, \{l \mapsto 3\} \rangle \rightarrow \langle l := !l, \{l \mapsto 3\} \rangle \quad \text{seq 1}$$

$$\langle !l, \{l \mapsto ?\} \rangle \rightarrow \langle 3, \{l \mapsto 3\} \rangle$$

$$\langle l := !l, \{l \mapsto ?\} \rangle \rightarrow \langle l := 3, \{l \mapsto 3\} \rangle \quad \text{ass 2}$$

$$\langle l := 3, \{l \mapsto ?\} \rangle \rightarrow \langle \text{skip}, \{l \mapsto 3\} \rangle \quad \text{ass 1}$$

$$\langle E_1, s \rangle \rightarrow \langle E_1', s' \rangle$$

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$$\langle \text{if } E_1 \text{ then } E_2 \text{ else } E_3, s \rangle \rightarrow$$

$$\langle \text{if } E_1' \text{ then } E_2 \text{ else } E_3, s' \rangle$$

$$\langle \text{if true then } E_2 \text{ else } E_2, s \rangle \rightarrow \langle E_2, s \rangle$$

$$\langle E_1, s \rangle \rightarrow \langle E_1', s' \rangle$$

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$$\langle \text{while } E_1 \text{ do } E_2, s \rangle \rightarrow \langle \text{while } E_1' \text{ do } E_2, s' \rangle$$

$$\langle \text{while true do } E_2, s \rangle \rightarrow \langle E_2; \text{while } \underline{E_1}, s \rangle$$

$$\langle \text{while false do } E_2, s \rangle \rightarrow \langle \text{skip}, s \rangle$$

$\langle l_2 := 0; \text{while } !l_1 > 1 \text{ do } \dots, s \rangle$

$\rightarrow \langle \text{skip}; \text{while } \dots, s + \{l_2 \mapsto 0\} \rangle$

$\rightarrow \langle \text{while } !l_1 > 1 \text{ do } \dots, s + \{l_2 \mapsto 0\} \rangle$

$\rightarrow \langle \text{if } !l_1 > 1 \text{ then } E_2; \text{while } !l_1 > 1, \dots \text{ else skip, } s + \{l_2 \mapsto 0\} \rangle$