OL Concurrent Programming Language

assigment:

$$a: \langle\, x \;:=\; expression \,\rangle$$

while. *For any statement S and boolean expression p:*

$$a\text{:}\ \textbf{while}\ p\ \textbf{do}\ b : S\ \textbf{od}$$

concatenation. *For any two statements S and T:*

$$a: \; S \quad ; \quad b: \; T$$

cobegin. *For n statements $S_1, S_2, ..., S_n$:*

$$a: \ \textbf{cobegin}\ b: \ S_1 \quad \blacksquare \ ... \ \blacksquare \quad c: \ S_n\ \textbf{coend}$$

Axioms

assignment Control Flow Axiom. *For statement S: $\langle\, x := a \,\rangle$*

$$at\ S \rightsquigarrow after\ S.$$

while Control Flow Axiom. *For the statement w:* **while** $\langle\, b \,\rangle$ **do** $s : S$ **od**

$$at\ w \rightsquigarrow (at\ s \ \vee \ after\ w).$$

Rules

concat Control Flow. *For the statement S ; T,*

$$\frac{at\ S \rightsquigarrow after\ S, \qquad at\ T \rightsquigarrow after\ T}{at\ S \rightsquigarrow after\ T}$$

cobegin Control Flow. *For the statement c:* **cobegin** $S \ \blacksquare \ T$ **coend**

$$\frac{at\ S \rightsquigarrow after\ S, \qquad at\ T \rightsquigarrow after\ T}{at\ c \rightsquigarrow after\ c}$$

Single Exit Rule. *For any statement S:*

$$in\ S \supset (\Box\, in\ S \ \vee \ \Diamond\, after\ S)$$

Atomic Statement Rule.*For any atomic statement $\langle S \rangle$:*

$$\frac{\{P\}\ \langle S \rangle\ \{Q\}, \qquad \Box(at\ \langle S \rangle \supset P)}{at\ \langle S \rangle \rightsquigarrow (after\ \langle S \rangle \wedge Q)}$$

General Statement Rule.*For any statement S:*

$$\frac{\{P\}\ S\ \{Q\}, \qquad \Box(in\ S \supset P), \qquad in\ S \rightsquigarrow after\ S}{in\ S \rightsquigarrow (after\ S \wedge Q)}$$

while Test Rule. *For the statement w:* **while** $\langle\, b \,\rangle$ **do** S **od**

$$at\ w \rightsquigarrow ((at\ S \wedge B) \vee (after\ w \wedge \neg B))$$

while Exit Rule. *For the statement w:* **while** $\langle\, b \,\rangle$ **do** S **od**

$$(at\ w \wedge \Box(at\ w \supset B)) \rightsquigarrow at\ S;$$
$$(at\ w \wedge \Box(at\ w \supset \neg B)) \rightsquigarrow after\ w;$$

Suggestions

assigment Safety Axiom

$$\{\text{true}\}\ S : \langle\, x := a \,\rangle\ \{x = a\}$$

LTL Rules

TL1-10: