

# Exceptions

FbX

"Side-effect"  
Control operator

$e ::= \dots \mid \text{Raise } e \mid \#l e \mid \text{Try } e \text{ With } \#l x \rightarrow e$   
 $v ::= \dots \mid \#l v \mid \text{Raised } v$   
no concrete syntax  
 $l ::= (\text{identifier})$

Exception  $\frac{e \Rightarrow v}{\#l e \Rightarrow \#l v}$

#A 5

Raise  $\frac{e \Rightarrow \#l v}{\text{Raise } e \Rightarrow \text{Raised } (\#l v)}$

$\text{Raise } (\#A 5) \Rightarrow \text{Raised } (\#A 5)$   
 $1 + \text{Raise } (\#A 5) \Rightarrow \text{Raised } (\#A 5)$   
 $\text{Raise } (\#A 5) + \text{True} \Rightarrow \text{Raised } (\#A 5)$

Raise + Left  $\frac{e_1 \Rightarrow \text{Raised } v}{e_1 + e_2 \Rightarrow \text{Raised } v}$

Raise + Right  $\frac{e_1 \Rightarrow v_1 \quad v_1 \text{ not of form } \text{Raised } v' \quad e_2 \Rightarrow \text{Raised } v_2}{e_1 + e_2 \Rightarrow \text{Raised } v_2}$

Raise Let 1  $\frac{e_1 \Rightarrow \text{Raised } v}{\text{Let } x = e_1 \text{ In } e_2 \Rightarrow \text{Raised } v}$

AND MANY MORE

Try Success  $\frac{e \Rightarrow v \quad v \text{ not of form } \text{Raised } v'}{\text{Try } e \text{ With } \#l x \rightarrow e' \Rightarrow v}$

Try Fail  $\frac{e \Rightarrow \text{Raised } (\#l v) \quad e'[v/x] \Rightarrow v'}{\text{Try } e \text{ With } \#l x \rightarrow e' \Rightarrow v'}$

Raise Try  $\frac{e \Rightarrow \text{Raised } \#l' v \quad l \neq l'}{\text{Try } e \text{ With } \#l x \rightarrow e' \Rightarrow \text{Raised } (\#l' v)}$

FBS

$$\langle S, e \rangle \Rightarrow \langle S, v \rangle$$

$$\langle \{c_0 \mapsto 2, c_1 \mapsto 4\}, !c_0 + !c_1 \rangle \Rightarrow$$

$$e ::= \dots \mid \text{Ref } e \mid !e \mid e := e$$

$$v ::= \dots \mid c$$

$c ::=$  (infinite set of names)

$$\langle \{c_0 \mapsto 0\}, \text{Let } b = \text{Ref } 4 \text{ In Let } c = c_0 := 2 \text{ In } !c_0 + !b \rangle \Rightarrow$$

$e_1$

Let  $a = \text{Ref } 0$  In  
 Let  $b = \text{Ref } 4$  In  
 Let  $c = a := 2$  In  
 $!a + !b$

$$\langle \emptyset, \text{Ref } 0 \rangle \Rightarrow \langle \{c_0 \mapsto 0\}, c_0 \rangle$$

$$\langle \emptyset, e_1 \rangle \Rightarrow$$

$$e ::= \dots \mid e_1 e_2$$

Sequence

$$\frac{\langle S_1, e_1 \rangle \Rightarrow \langle S_2, v_1 \rangle \quad \langle S_2, e_2 \rangle \Rightarrow \langle S_3, v_2 \rangle}{\langle S_1, e_1 e_2 \rangle \Rightarrow \langle S_3, v_2 \rangle}$$

Let  $a = \text{Ref } 0$  In

$a := 4$   
 $!a + 1$