

# Compilation

## Variable

$$\llbracket x \rrbracket_{x::E} = \text{FST}$$

$$\begin{aligned} \llbracket x \rrbracket_{y::E} &= \text{SND} \\ &\quad \llbracket x \rrbracket_E \end{aligned}$$

## Constant

$$\llbracket c \rrbracket_E = \text{LOAD } c$$

## Pair

$$\begin{aligned} \llbracket (e_1, e_2) \rrbracket_E &= \text{DUPL} \\ &\quad \llbracket e_2 \rrbracket_E \\ &\quad \text{SWAP} \\ &\quad \llbracket e_1 \rrbracket_E \\ &\quad \text{CONS} \end{aligned}$$

## Arithmetic Expression

$$\begin{aligned} \llbracket e_1 + e_2 \rrbracket_E &= \text{DUPL} \\ &\quad \llbracket e_2 \rrbracket_E \\ &\quad \text{SWAP} \\ &\quad \llbracket e_1 \rrbracket_E \\ &\quad \text{ADD} \end{aligned}$$

$$\begin{aligned} \llbracket e_1 - e_2 \rrbracket_E &= \text{DUPL} \\ &\quad \llbracket e_2 \rrbracket_E \\ &\quad \text{SWAP} \\ &\quad \llbracket e_1 \rrbracket_E \\ &\quad \text{SUB} \end{aligned}$$

$$\llbracket e_1 \times e_2 \rrbracket_E = \begin{array}{l} \text{DUPL} \\ \llbracket e_2 \rrbracket_E \\ \text{SWAP} \\ \llbracket e_1 \rrbracket_E \\ \text{MUL} \end{array}$$

$$\llbracket e_1 = e_2 \rrbracket_E = \begin{array}{l} \text{DUPL} \\ \llbracket e_2 \rrbracket_E \\ \text{SWAP} \\ \llbracket e_1 \rrbracket_E \\ \text{EQ} \end{array}$$

$$\llbracket e_1 < e_2 \rrbracket_E = \begin{array}{l} \text{DUPL} \\ \llbracket e_2 \rrbracket_E \\ \text{SWAP} \\ \llbracket e_1 \rrbracket_E \\ \text{LT} \end{array}$$

## Function

$$\llbracket \text{fun } x \rightarrow e \rrbracket_E = \begin{array}{l} \text{PUSH } \mathcal{C} \\ \text{SWAP} \\ \text{CONS} \end{array}$$

where  $\mathcal{C}$  is the address of  $\begin{array}{l} \llbracket e \rrbracket_{x::E} \\ \text{RETURN} \end{array}$

## Application

$$\llbracket (e_1 e_2) \rrbracket_E = \begin{array}{l} \text{DUPL} \\ \llbracket e_2 \rrbracket_E \\ \text{SWAP} \\ \llbracket e_1 \rrbracket_E \\ \text{SPLIT} \\ \text{IROT3} \\ \text{CONS} \\ \text{SWAP} \\ \text{CALL} \end{array}$$

## Conditional

$$\llbracket \text{if } e_1 \text{ then } e_2 \text{ else } e_3 \rrbracket_E = \begin{array}{l} \text{DUPL} \\ \llbracket e_1 \rrbracket_E \\ \text{BRANCH } @_2 \ @_3 \\ \text{CALL} \end{array}$$

where  $@_2$  is the address of  $\llbracket e_2 \rrbracket_E$   
RETURN

and  $@_3$  is the address of  $\llbracket e_3 \rrbracket_E$   
RETURN

## Let

$$\llbracket \text{let } x = e_1 \text{ in } e_2 \rrbracket_E = \begin{array}{l} \text{DUPL} \\ \llbracket e_1 \rrbracket_E \\ \text{CONS} \\ \llbracket e_2 \rrbracket_{x::E} \end{array}$$

## Letrec

$$\llbracket \text{letrec } f = e_1 \text{ in } e_2 \rrbracket_E = \begin{array}{l} \text{PUSH NIL} \\ \text{CONS} \\ \llbracket e_1 \rrbracket_{f::E} \\ \text{DUPL} \\ \text{FST} \\ \text{SWAP} \\ \text{SET\_FST} \\ \llbracket e_2 \rrbracket_{f::E} \end{array}$$