1 Literals

$$\overline{\Gamma \vdash n : \text{number}} \quad \overline{\Gamma \vdash true : \text{bool}} \quad \overline{\Gamma \vdash false : \text{bool}} \quad \overline{\Gamma \vdash unit : \text{unit}}$$

2 Compound data

- List

$$\frac{\Gamma \vdash E_1 : t \quad \Gamma \vdash E_2 : t \quad ... \quad \Gamma \vdash E_n : t}{\Gamma \vdash [E_1; E_2; ...; E_n] : \text{list}(t)}$$

- Tuple

$$\frac{\Gamma \vdash E_1 : t_1 \quad \Gamma \vdash E_2 : t_2 \quad ... \quad \Gamma \vdash E_n : t_n}{\Gamma \vdash (E_1, E_2, ..., E_n) : \text{tuple}(t_1, t_2, ..., t_n)}$$

3 Operations

- Unary operators

$$\frac{\Gamma \vdash E : \text{number}}{\Gamma \vdash -E : \text{number}} \quad \frac{\Gamma \vdash E : \text{bool}}{\Gamma \vdash not\ E : \text{bool}}$$

- Binary operators

$$\frac{\Gamma \vdash E_1 : t_1 \quad \Gamma \vdash E_2 : t_2}{\Gamma \vdash p[E_1, E_2] : t}$$

p	t_1	t_2	t
$+$	number	number	number
$-$	number	number	number
$*$	number	number	number
$/$	number	number	number
$**$	number	number	number
$=$	number	number	bool
$=$	bool	bool	bool
$<>$	number	number	bool
$<>$	bool	bool	bool
$<$	number	number	bool
$>$	number	number	bool
$<=$	number	number	bool
$>=$	number	number	bool
$\|\|$	bool	bool	bool
$\&\&$	bool	bool	bool
$::$	t'	list(t')	list(t')
$@$	list(t')	list(t')	list(t')

4 Binding

$$\frac{\Gamma[x \leftarrow t]\Gamma' \quad \Gamma \vdash E_1 : t \quad \Gamma' \vdash E_2 : t'}{\Gamma \vdash (\text{let } x : t = E_1).E_2 : t'}$$

5 Block

$$\frac{\Gamma \vdash E_2 : t}{\Gamma \vdash E_1.E_2 : t}$$

6 Control flow

- Conditional

$$\frac{\Gamma \vdash E_0 : \text{bool} \quad \Gamma \vdash E_1 : t \quad \Gamma \vdash E_2 : t}{\Gamma \vdash \text{if } E_0 \text{ then } E_1 \text{ else } E_2 : t} \qquad \frac{\Gamma \vdash E_0 : \text{bool} \quad \Gamma \vdash E_1 : \text{unit}}{\Gamma \vdash \text{if } E_0 \text{ then } E_1 : \text{unit}}$$

- While loop

$$\frac{\Gamma \vdash E_1 : \text{bool} \quad \Gamma \vdash E_2 : t}{\Gamma \vdash \text{while } E_1 \text{ do } E_2 : t}$$

- For to/downto loop

$$\frac{\Gamma \vdash E_1 : \text{number} \quad \Gamma \vdash E_2 : \text{number} \quad \Gamma[x \leftarrow \text{number}]\Gamma' \quad \Gamma' \vdash E_3 : t}{\Gamma' \vdash \text{for } x = E_1 \text{ to } E_2 \text{ do } E_3 : t}$$

$$\frac{\Gamma \vdash E_1 : \text{number} \quad \Gamma \vdash E_2 : \text{number} \quad \Gamma[x \leftarrow \text{number}]\Gamma' \quad \Gamma' \vdash E_3 : t}{\Gamma' \vdash \text{for } x = E_1 \text{ downto } E_2 \text{ do } E_3 : t}$$

- For in loop

$$\frac{\Gamma \vdash E_1 : \text{list}(t_1) \quad \Gamma[x \leftarrow t_1]\Gamma' \quad \Gamma' \vdash E_2 : t_2}{\Gamma' \vdash \text{for } x \text{ in } E_1 \text{ do } E_2 : t_2}$$

$$\frac{\Gamma \vdash E_1 : \text{number} \quad \Gamma \vdash E_2 : \text{number} \quad \Gamma[x \leftarrow \text{number}]\Gamma' \quad \Gamma' \vdash E_3 : t}{\Gamma' \vdash \text{for } x \text{ in } E_1..E_2 \text{ do } E_3 : t}$$

$$\frac{\Gamma \vdash E_1 : \text{number} \quad \Gamma \vdash E_2 : \text{number} \quad \Gamma \vdash E_3 : \text{number} \quad \Gamma[x \leftarrow \text{number}]\Gamma' \quad \Gamma' \vdash E_4 : t}{\Gamma' \vdash \text{for } x \text{ in } E_1..E_2..E_3 \text{ do } E_4 : t}$$

7   Functions

- Function declaration

$$\frac{\Gamma[x_1 \leftarrow t_1, ..., x_n \leftarrow t_n]\Gamma' \quad \Gamma' \vdash E : t}{\Gamma' \vdash (x_1 : t_1)...(x_n : t_n) : t = E \quad : \quad \text{fun}(t_1, ..., t_n) : t}$$

- Application

$$\frac{\Gamma \vdash E_1 : t_1 \quad ... \quad \Gamma \vdash E_n : t_n \quad \Gamma \vdash E : \text{fun}(t_1, ..., t_n) : t}{\Gamma \vdash E\, E_1 ... E_n : t}$$

- Lambda expressions

$$\frac{\Gamma[x_1 \leftarrow t_1, ..., x_n \leftarrow t_n]\Gamma' \quad \Gamma' \vdash E : t}{\Gamma' \vdash (x_1 : t_1)...(x_n : t_n) \rightarrow E \quad : \quad \text{fun}(t_1, ..., t_n) : t}$$