

# OCaml Static Semantics Cheat Sheet

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## 1 Notation

Recall that  $e : t$  means that  $e$  has type  $t$ . We'll use  $t$  (as well as variants like  $t_1, t_2, t'$ , etc.) to mean arbitrary types. We'll write rules like this:

$$\frac{\text{Premise \#1} \quad \text{Premise \#2} \quad \dots}{\text{Conclusion}}$$

to mean that if the premises (everything above the line) hold, then the conclusion holds. We'll write this with nothing above the line if the conclusion is always true. We'll write  $x : t \Rightarrow e : t'$  to mean that  $e$  has type  $t'$  assuming  $x$  is a variable of type  $t$ .

## 2 Values

### 2.1 Base Values

Types	Examples
Integers	$1 : \text{int}, 2 : \text{int}, \dots$
Floats	$1.0 : \text{float}, 2. : \text{float}, 3.14 : \text{float}, \dots$
Booleans	$\text{true} : \text{bool}, \text{false} : \text{bool}$
Strings	$\text{"Hello"} : \text{string}$
Characters	$\text{'a'} : \text{char}$
Unit	$() : \text{unit}$

### 2.2 Tuples

$$\frac{v_1 : t_1 \quad v_2 : t_2 \quad \dots \quad v_n : t_n}{(v_1, v_2, \dots, v_n) : t_1 * t_2 * \dots * t_n}$$

### 2.3 Anonymous Functions

$$\frac{x : t \Rightarrow e : t'}{\text{fun } x \text{ -> } e : t \text{ -> } t'}$$

## 3 Operators

### 3.1 Integer Operators

$$\frac{e_1 : \text{int} \quad e_2 : \text{int}}{e_1 + e_2 : \text{int}} \quad \frac{e_1 : \text{int} \quad e_2 : \text{int}}{e_1 - e_2 : \text{int}} \quad \frac{e_1 : \text{int} \quad e_2 : \text{int}}{e_1 * e_2 : \text{int}} \quad \frac{e_1 : \text{int} \quad e_2 : \text{int}}{e_1 / e_2 : \text{int}}$$

### 3.2 Float Operators

$$\frac{e_1 : \text{int} \quad e_2 : \text{int}}{e_1 +. e_2 : \text{int}}$$

$$\frac{e_1 : \text{int} \quad e_2 : \text{int}}{e_1 -. e_2 : \text{int}}$$

$$\frac{e_1 : \text{int} \quad e_2 : \text{int}}{e_1 *. e_2 : \text{int}}$$

$$\frac{e_1 : \text{int} \quad e_2 : \text{int}}{e_1 /. e_2 : \text{int}}$$

### 3.3 String Concatenation

$$\frac{e_1 : \text{string} \quad e_2 : \text{string}}{e_1 \wedge e_2 : \text{string}}$$

## 4 Other Expressions

### 4.1 If

$$\frac{e_1 : \text{bool} \quad e_2 : t \quad e_3 : t}{\text{if } e_1 \text{ then } e_2 \text{ else } e_3 : t}$$

### 4.2 Let

$$\frac{x : t \Rightarrow e_2 : t' \quad e_1 : t}{\text{let } x = e_1 \text{ in } e_2 : t'}$$

### 4.3 Function Application

$$\frac{e_1 : t \rightarrow t' \quad e_2 : t}{e_1 e_2 : t'}$$

### 4.4 Type Annotations

$$\frac{e : t}{(e : t) : t}$$