

Introduction to Functional Programming in *OCaml*

Roberto Di Cosmo, Yann Régis-Gianas, Ralf Treinen

Week 1 - Sequence 1: More Data Types



Floating-point arithmetic

- ▶ Type: `float`
- ▶ Values: Must be written with a decimal point (5.2), or exponential (5e3, 6e-9), or both.
- ▶ Operations: `+. , -. , *. , /.`
- ▶ Functions: `sqrt, sin, cos, ceil, floor, ...`

Floating-point Pitfalls

- ▶ Floating-point constants must indicate that they are not integers: use decimal dot or exponent
- ▶ Floating-point operations must be written with a dot (+. etc.)

Floating-point Examples I

```
3.0 +. 0.01;;
```

```
# - : float = 3.01
```

```
2e-4 *. 0.1;;
```

```
# - : float = 2e-05
```

```
2 + 3.0;;
```

```
# Characters 5-8:
```

```
2 + 3.0;;
```

```
^^^
```

```
Error: This expression has type float  
      but an expression was expected of type int
```

Floating-point Examples II

```
4 *. 56;;
```

```
# Characters 1-2:
```

```
4 *. 56;;  
^
```

```
Error: This expression has type int  
      but an expression was expected of type float
```

Conversions between types

- ▶ Basic types are *disjoint*: no value belongs to two different basic types
- ▶ No implicit conversion between types
- ▶ Explicit conversion operations
- ▶ Background: implicit conversion would not go well with type inference

Conversion Floating-point \leftrightarrow Integer

- ▶ Conversion functions in both directions :

`float_of_int : int \rightarrow float`

`int_of_float : float \rightarrow int`

- ▶ Function application:

write the name of the function, followed by the argument

- ▶ Parentheses only when necessary to indicate structure
- ▶ More on functions later

Characters

- ▶ Type: `char`
- ▶ Values: 256 characters, numbered from 0 to 255
- ▶ can be written like `'a'`, `'\087'`, etc (see the manual)
- ▶ Conversion functions :
 `Char.chr : int → char`
 `Char.code : char → int`
- ▶ More on modules later

Character Examples I

```
Char.code 'A';;
```

```
# - : int = 65
```

```
Char.code '\122';;
```

```
# - : int = 122
```

```
Char.chr 65;;
```

```
# - : char = 'A'
```

```
Char.chr (Char.code 'B');
```

```
# - : char = 'B'
```

Strings

- ▶ Type: `string`
- ▶ Values: Character strings, written like `"Hello, World!"`
- ▶ Operator `^` for string concatenation
- ▶ Many functions, like
 - `String.length : string → int`
 - `int_of_string : string → int`
 - `float_of_string : string → float`

Character and String Pitfalls

- ▶ Strings, Characters, Integers, Booleans, Floats are all disjoint
- ▶ You must use explicit conversion functions
- ▶ Positions in strings are numbered from 0 to its length minus 1
- ▶ In earlier versions of *OCaml*, strings used to be modifiable

String Examples I

```
"abc" ^ "def";;
```

```
# - : string = "abcdef"
```

```
String.length "12345";;
```

```
# - : int = 5
```

```
int_of_string "12345";;
```

```
# - : int = 12345
```

```
string_of_int 12345;;
```

```
# - : string = "12345"
```

```
String.get "abcdef" 1;;
```

```
# - : char = 'b'
```

To Know More

The OCaml Manual:

- ▶ The core library
 - ▶ Module Pervasives :
 - ▶ Floating Point Arithmetic
- ▶ The standard library
 - ▶ Module Char
 - ▶ Module String