CSE216
Foundations of Computer Science

Instructor: Zhoulai Fu

State University of New York, Korea

Many slides taken from Cornell's CS3110. Thanks!
https://www.cs.cornell.edu/courses/cs3110/2014fa/lecture_notes.php

Plan

- A review exercise
- Option

A review exercise on lists

Exercise #5, #6

- OCaml standard library has List.rev. Reimplement it.
- Find out whether a list is a palindrome. A palindrome is the same as its own reverse, e.g. [’s’,’m’,’i’,’m’,’s’]

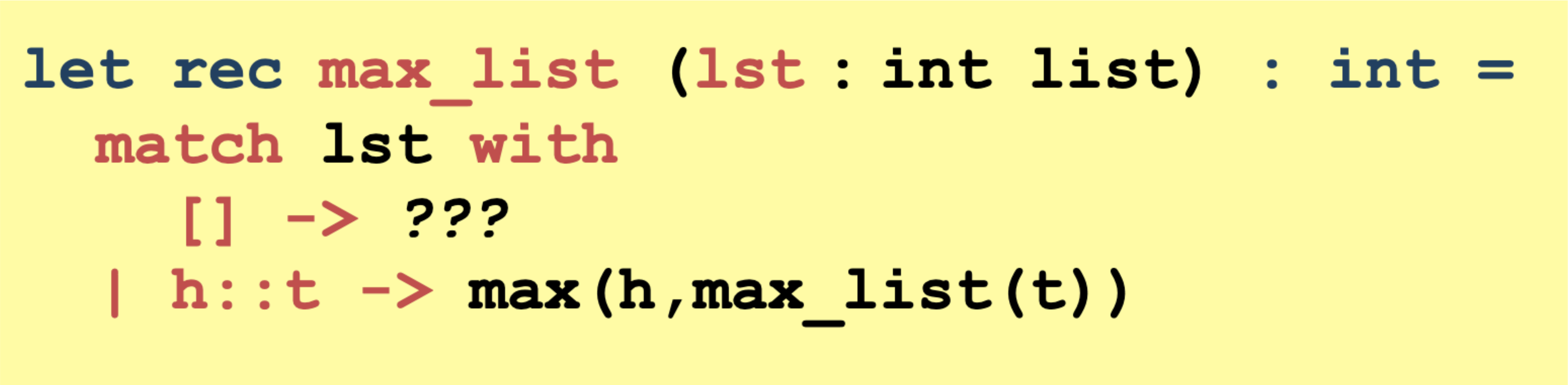
Many good exercises taken from “99 Problems in OCaml”

https://v2.ocaml.org/learn/tutorials/99problems.html

Option

Question

- How would you implement maximum of a list?



```
let rec max_list (lst : int list) : int =
  match lst with
    [] -> ???
  | h::t -> max(h,max_list(t))
```

Ocaml likes to use Option for such a situation

Type *t option*

- A value v has type **t option** if it is either:
  - – the value **None**, or
  - – a value **Some** v, and v has type t
  - type 'a option = None | Some of 'a
- Options can signal there is no useful result to the computation
  - • Example: we loop up a value in a hash table using a key. – If the key is present in the hash table then we return Some v where v is the associated value
  - – If the key is not present, we return None

Constructing an option

- None
- Some 1
- Some “hi”

Accessing an option

```
match e with
     None -> ...
   | Some x -> ...
```

Revisit: What is max of empty list?

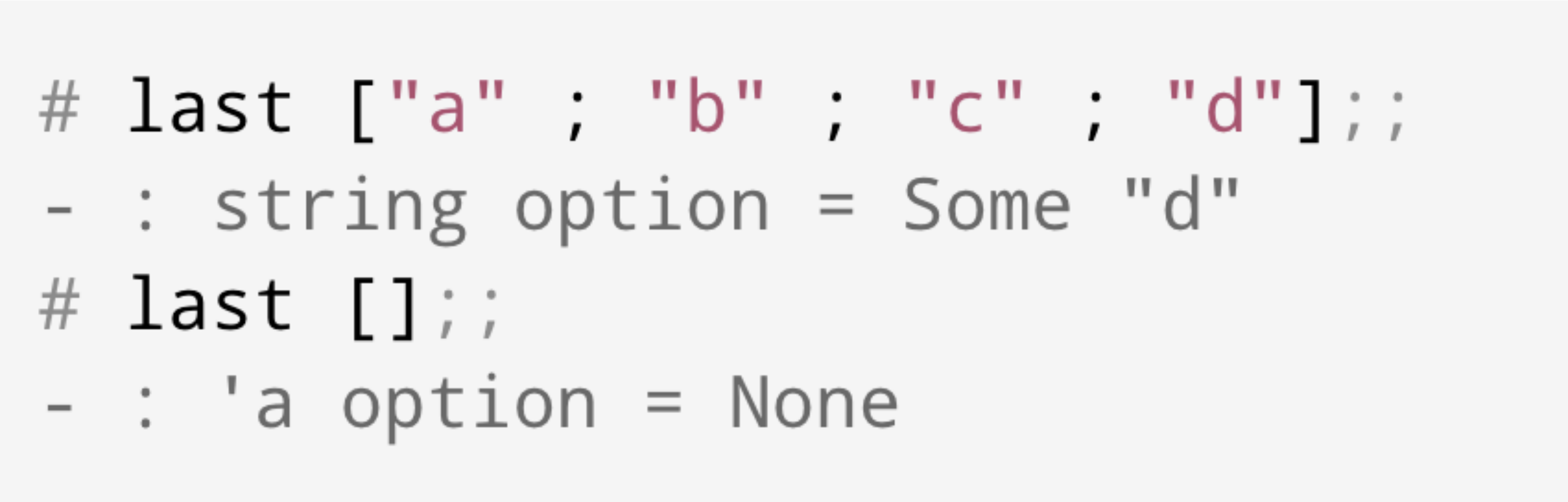
```
let max (x, y) =
  if x>y then x else y

let rec max_list (lst : int list) : int option =
  match lst with
    []    -> None
  | h::t -> match max_list(t) with
              None    -> Some h
            | Some x -> Some (max(h,x))
```

Very stylish!
…no possibility of exceptions
…no chance of programmer ignoring a "null return"

Exercise #1

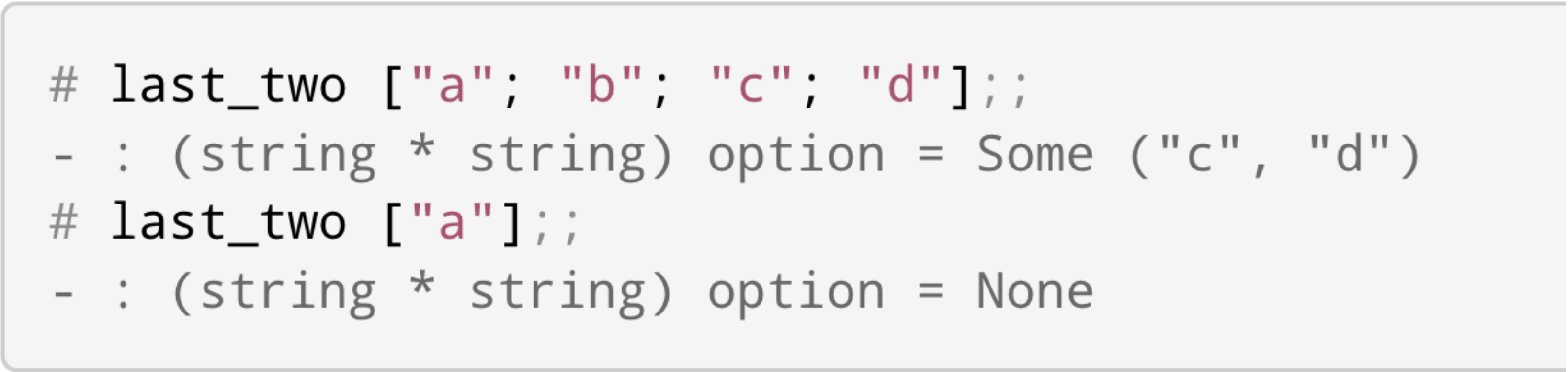
- Write a function **last : 'a list -> 'a option** that returns the last element of a list.



```
# last ["a" ; "b" ; "c" ; "d"];;
- : string option = Some "d"
# last [];;
- : 'a option = None
```

Exercise #2

- Find the last two elements of a list.



```
# last_two ["a"; "b"; "c"; "d"];;
- : (string * string) option = Some ("c", "d")
# last_two ["a"];;
- : (string * string) option = None
```