PAUL G. ALLEN SCHOOL OF COMPUTER SCIENCE & ENGINEERING

CSE 341 Section 5

HW2 Debrief, Currying, Modules

Agenda

- HW2 Debrief
- Currying
- Modules
- Q&A

Homework 2 Recap

- If-then-else vs. case expression
  - If-then-else is prefered:

```
match x with
   0 => “zero”
| _ =>  “not-zero”
```

  - Case statement is preferred:

```
if null xs
then “empty”
else if null (tl xs)
        then “one elt”
        else “more than one elt”
```

Homework 2 Recap

- Wildcards
  - Use wildcards when we don’t use the value in the pattern

```
match arith with
  Const x => Const 1 (* we don’t use x! *)
| Mult(x, y)  =>  Const x (* we don’t use y! *)

match arith with
  Const _ => Const 1
| Mult(x,_)  =>  Const x
```

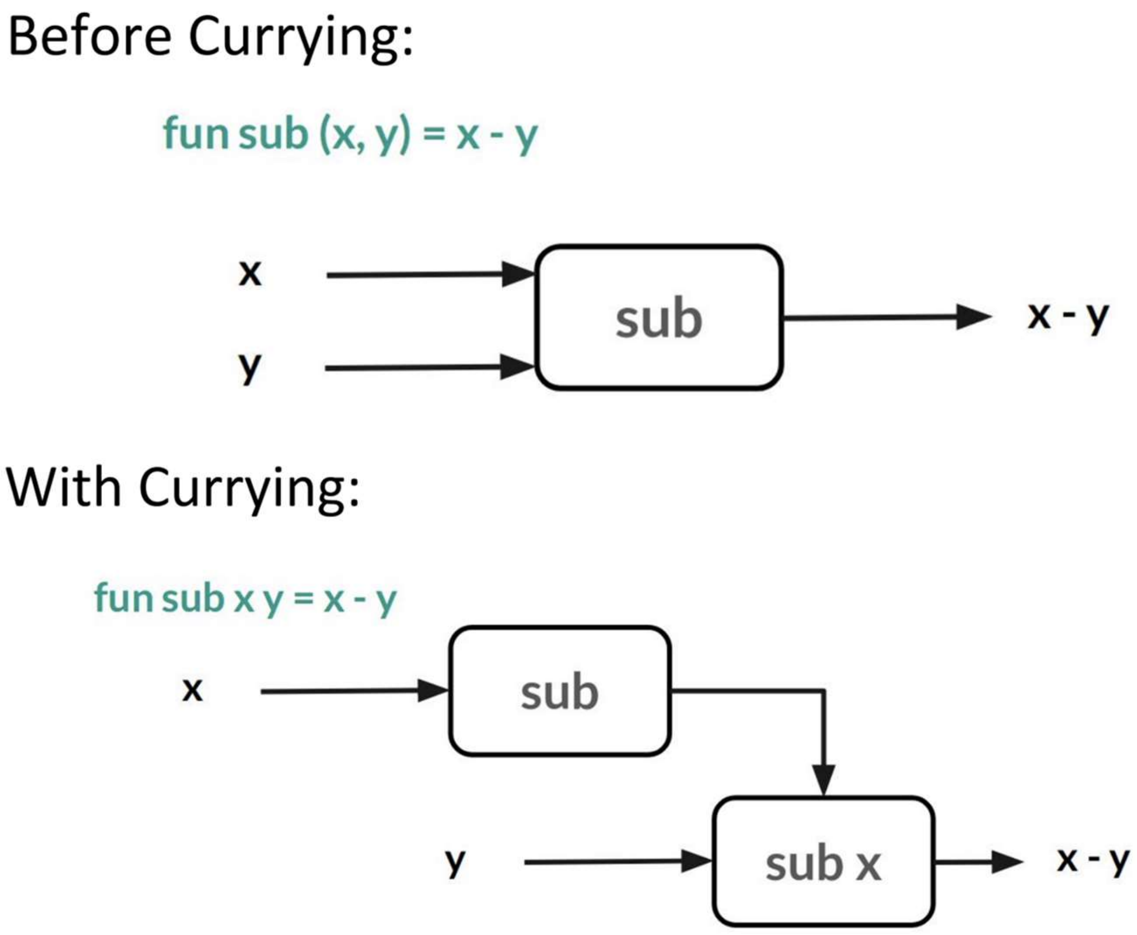
Key Concepts Review

- Currying
  - Have a function take the first conceptual argument and return another function that takes the second conceptual argument and so on.

- Modules
  - A powerful tool for enforcing abstraction and safety
  - Keep type representation opaque to outside client => guaranteed that invariants are protected

Currying

Recall every ML function takes exactly one argument


Before Currying:

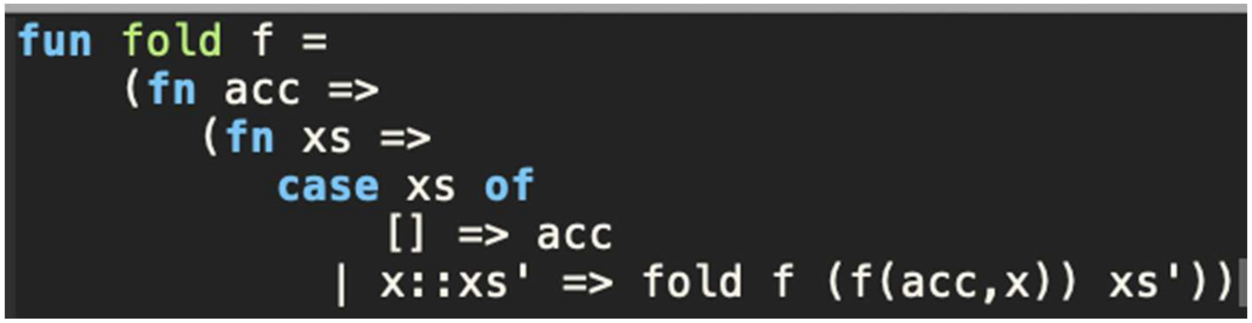
```
fun sub (x, y) = x - y
```

With Currying:

```
fun sub x y = x - y
```

Currying

Currying is particularly convenient for creating similar functions with iterators. Here is a curried version of a fold function for lists:



```
fun fold f =
    (fn acc =>
       (fn xs =>
          case xs of
              [] => acc
            | x::xs' => fold f (f(acc,x)) xs'))
```

Now we could use this fold to define a function that sums a list elements like this:

```
fun sum1 xs = fold (fn (x,y) => x+y) 0 xs
```

But that is unnecessarily complicated compared to just using partial application:

```
val sum2 = fold (fn (x,y) => x+y) 0
```

Currying

Let’s practice! (a), (b), (e), (i) on Worksheet

Modules

- Can group bindings into separate modules
- Good for maintaining invariants by hiding implementation details from client

```
structure MyModule = struct bindings end
```

- Inside a module, can use earlier bindings as usual
  - Can have any kind of binding (val, datatype, exception, ...)
- Outside a module, refer to earlier modules' bindings via

```
ModuleName.bindingName
```

- Just like **`List.foldl`** and **`Char.toLower`**; now you can define your own modules

Modules

Remember: `structure Foo :> BAR` is allowed if Foo provides:

- every non-abstract type in `BAR` (as specified)
- every abstract type in `BAR` (in some way)
- every val-binding in `BAR` (can have more general types)
- every exception in `BAR`

Foo can also define things that are not defined in `BAR`!

Modules

Let’s practice! (a) on Worksheet

Question Time

Feel free to ask questions about material, review questions, etc.