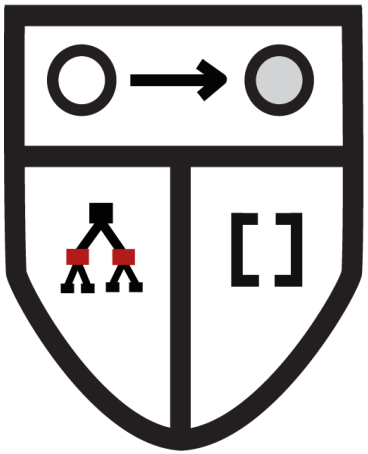


CS 3110

Variants

Nate Foster

Spring 2020

Today's music: *Union* by The Black Eyed Peas (feat. Sting)

CLICKER QUESTION 1

Women in Computing at Cornell

WICC

PATTERN MATCHING ON LISTS

Demo

Pattern matching

Syntax:

```
match e with
 | p1 -> e1
 | p2 -> e2
 | …
 | pn -> en
```

p1..**pn**:
pattern expressions

Semantics of pattern matching

- `[]` matches `[]` and nothing else
- `h :: t`
  - matches `2::[]`, binding `h` to `2` and `t` to `[]`
  - matches `1::3::[]`, binding `h` to `1` and `t` to `3::[]`
- `_` matches everything
  underscore character, called wildcard
  (it's like a blank space)

Full details in textbook

Three ways pattern matching detects programmer error

Cf. textbook 3.1.1.4

PATTERN MATCHING IS INCREDIBLE

Demo

Review

Previously in 3110:

- Lists, records, tuples
- Pattern matching

Today:

- Variants

VARIANTS

Demo

Variant types

Type definition syntax:

```
type t =
| C1 of t1
| ...
| Cn of tn
```

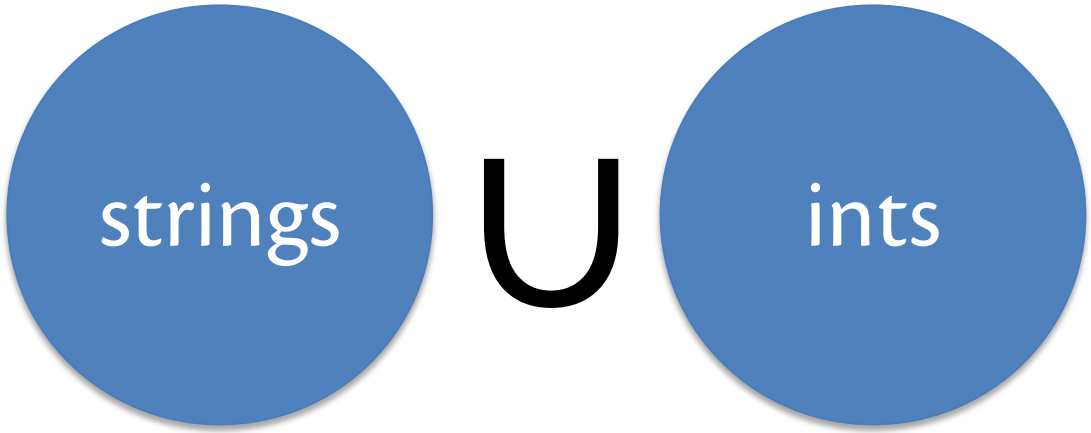
Optional data carried by constructor

Constructors *aka* tags

CLICKER QUESTION 2

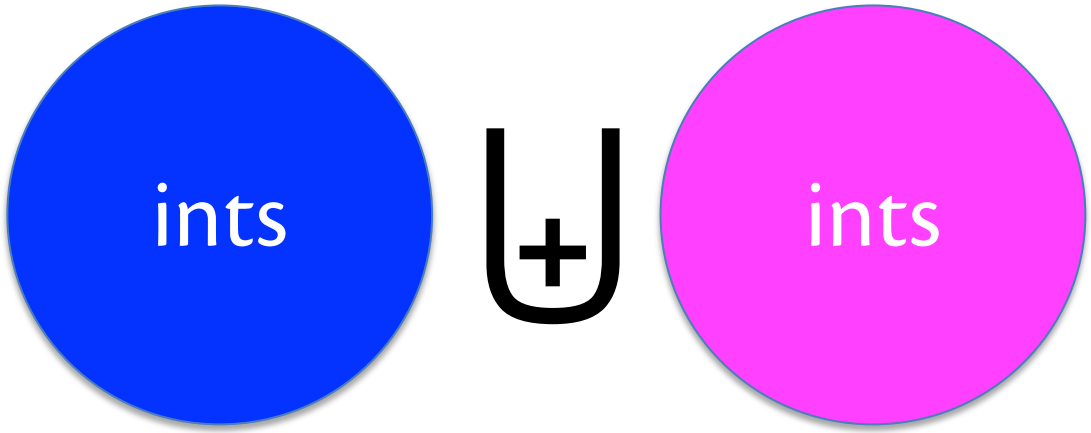
Variant: union

```
type string_or_int =
    | String of string
    | Int of int
```



Variant: tagged union

```
type blue_or_pink_int =
  | Blue of int
  | Pink of int
```



RECURSIVE VARIANTS

Demo

PARAMETERIZED VARIANTS

Demo

List implementation

OCaml just codes up lists as variants:

```
type 'a list = [] | (::) of 'a * 'a list
```

- **`list`** is a type constructor parameterized on type variable **`'a`**
- **`[]`** and **`::`** are constructors

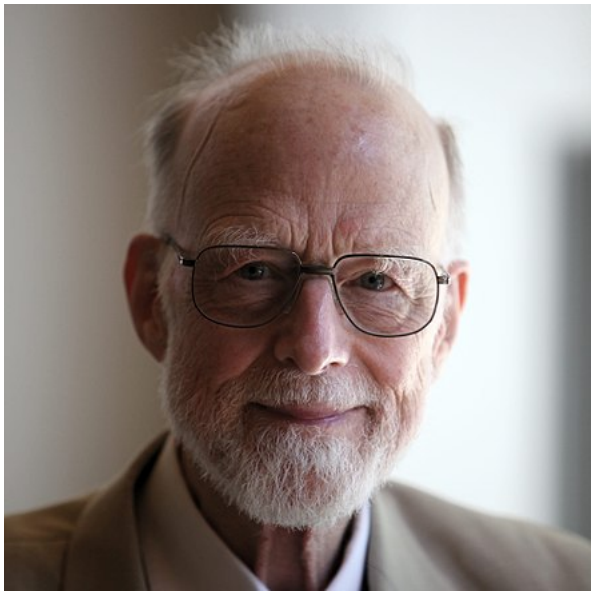
OPTIONS

Option: A built-in variant

```
type 'a option = None | Some of 'a
```

Demo

Tony Hoare



b. 1934

Turing Award 1980

For his “fundamental contributions to the definition and design of programming languages.”

Inventor of quicksort

“I call `[null]` my billion-dollar mistake…I was designing the…type system for…an object-oriented language. I couldn’t resist the temptation to put in a null reference…This has led to innumerable errors, vulnerabilities, and system crashes, which have probably caused a billion dollars of pain and damage in the last forty years."


Null
Pointer
Exception
Pattern
Match
against None
imgflip.com

EXCEPTIONS

Exceptions are extensible variants

```
type exn
exception MyNewException of string
```

- Type **`exn`** is an extensible variant that may have new constructors added after its original definition
- Raise exceptions with **`raise e`**, where **`e`** is a value of type **`exn`**
- Handle exceptions with pattern matching, just like you would process any variant

Upcoming events

- [Tonight, 6-7pm] WICC Partner Finding
- [Wed] A1 due
- [Thu] A2 out
- [Mon] R2 due

This is powerful.

THIS IS 3110