

CS 311O

Variants

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Spring 2020

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

CLICKER QUESTION 1



<WICC>

CLS Partner Finding Social

Tuesday, February 4
Gates 310 and 3rd Floor Lounge

5-6 pm for 1000-2000 level classes
6-7pm for 3000+ level classes

Women in Computing at Cornell

WICC

PATTERN MATCHING ON LISTS

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

Question 4

```
match ["taylor"; "swift"] with  
| [] -> "1989"  
| h :: t -> h
```

To what value does the above expression evaluate?

- A. "taylor"
- B. "swift"
- C. "1989"
- D. []
- E. h

Three ways pattern matching detects programmer error
Cf. textbook 3.1.1.4

PATTERN MATCHING IS INCREDIBLE

Review

Previously in 3110:

- Lists, records, tuples
- Pattern matching

Today:

- Variants

VARIANTS

Variant types

Type definition syntax:

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

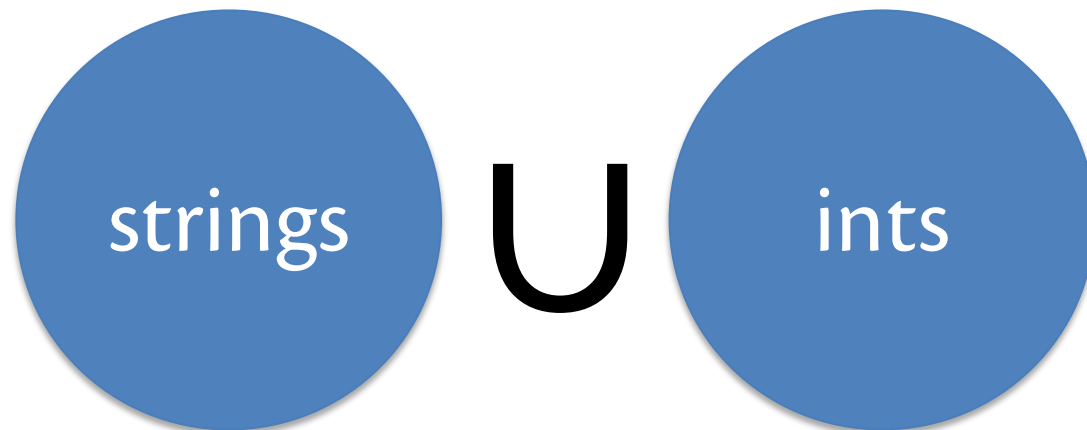
Optional data
carried by
constructor

Constructors
aka tags

CLICKER QUESTION 2

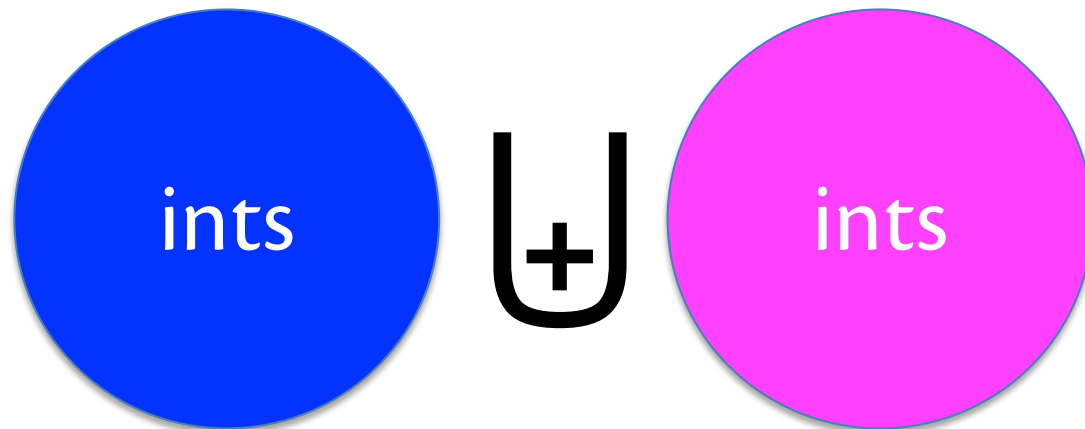
Variant: union

```
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

PARAMETERIZED VARIANTS

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

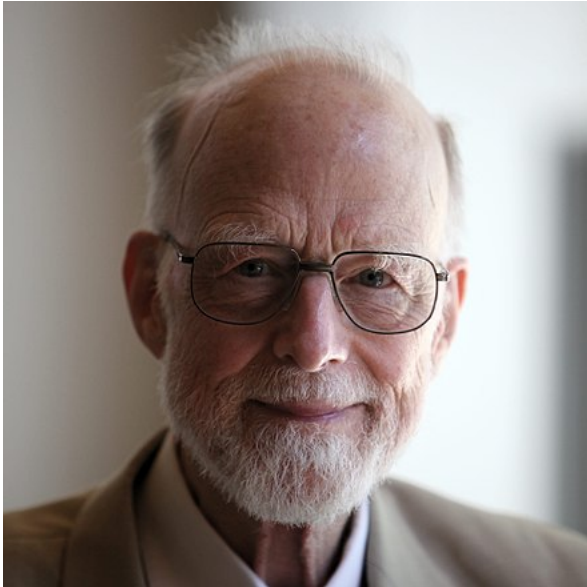
OPTIONS

Option: A built-in variant

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



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

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