

CS 3110

Variants

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Fall 2019

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

CLICKER QUESTION 1

Women in Computing at Cornell

WICC

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
```

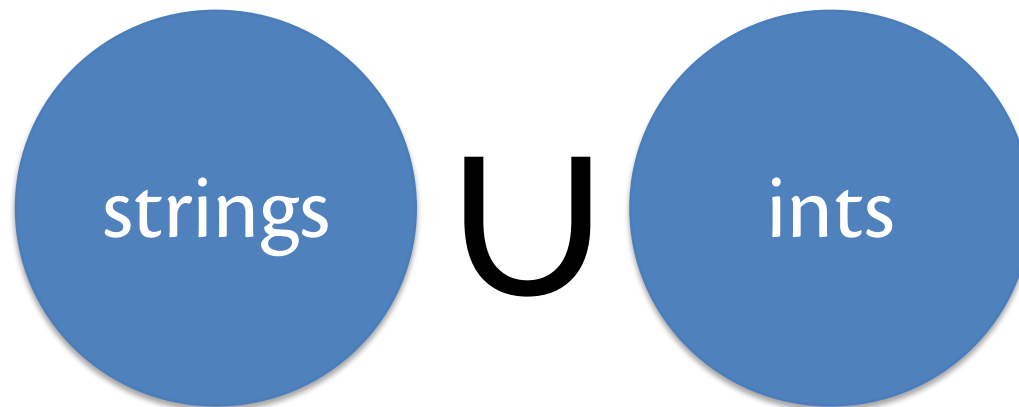
Optional data
carried by
constructor

Constructors
aka tags

CLICKER QUESTION 2

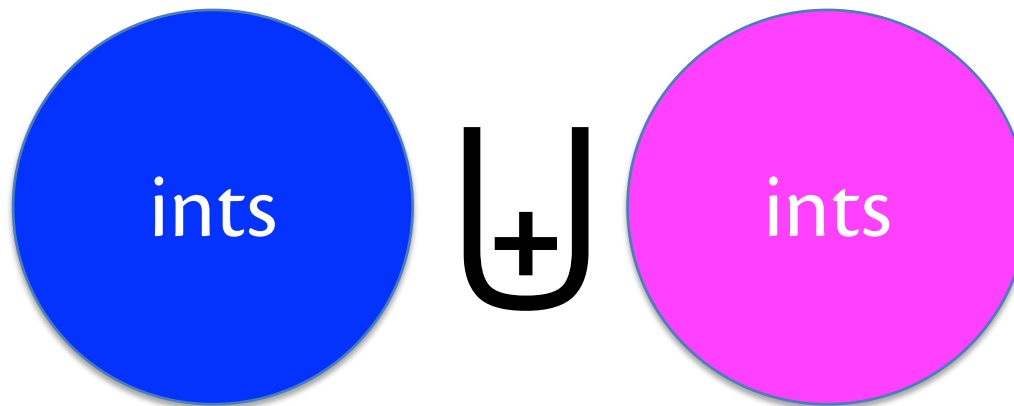
Variant: union

```
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

CLICKER QUESTION 3

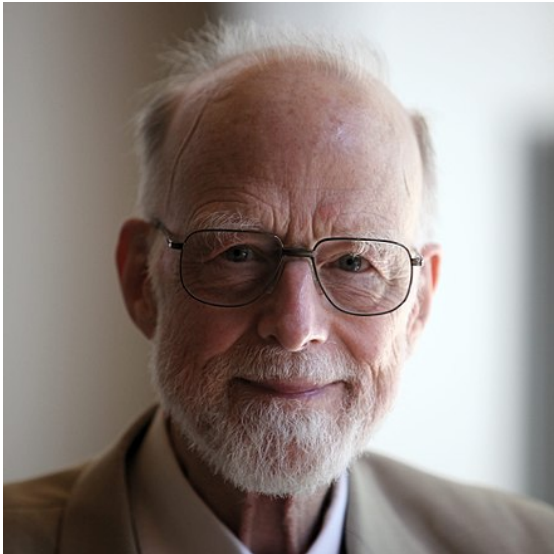
OPTIONS

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

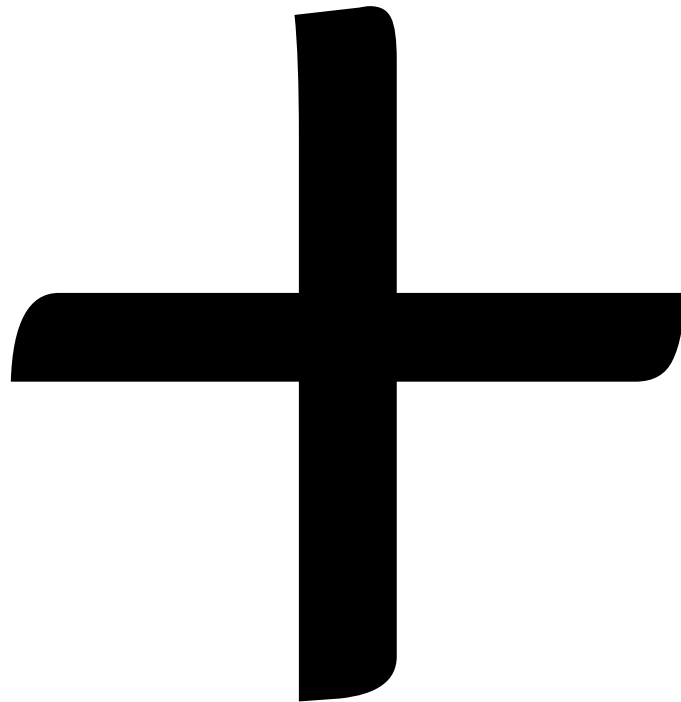
Upcoming events

- [Mon] R2 due
- [Mon] Level Up: git

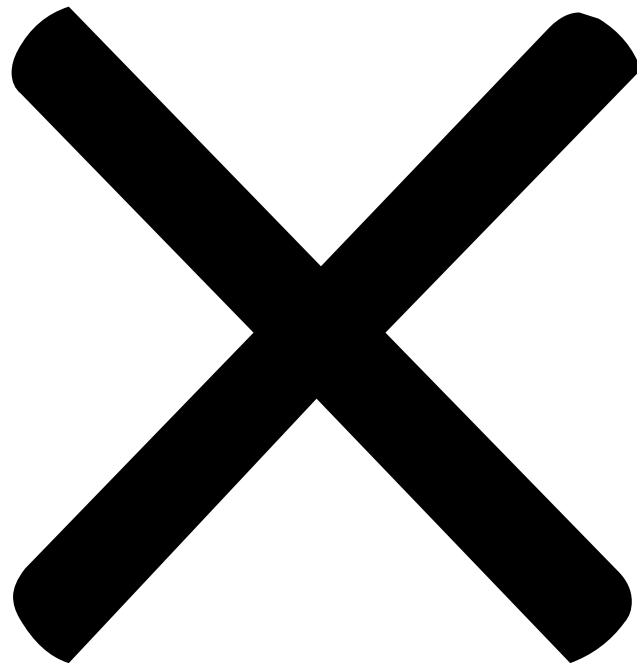
This is powerful.

THIS IS 3110

Move to recitation



One Of: Sum Type



Each Of: Product Type

Algebraic Data Types