CSE 341 SECTION 2

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Adapted from slides by Nicholas Shahan, Patrick Larson, and Dan Grossman

TODAY'S AGENDA

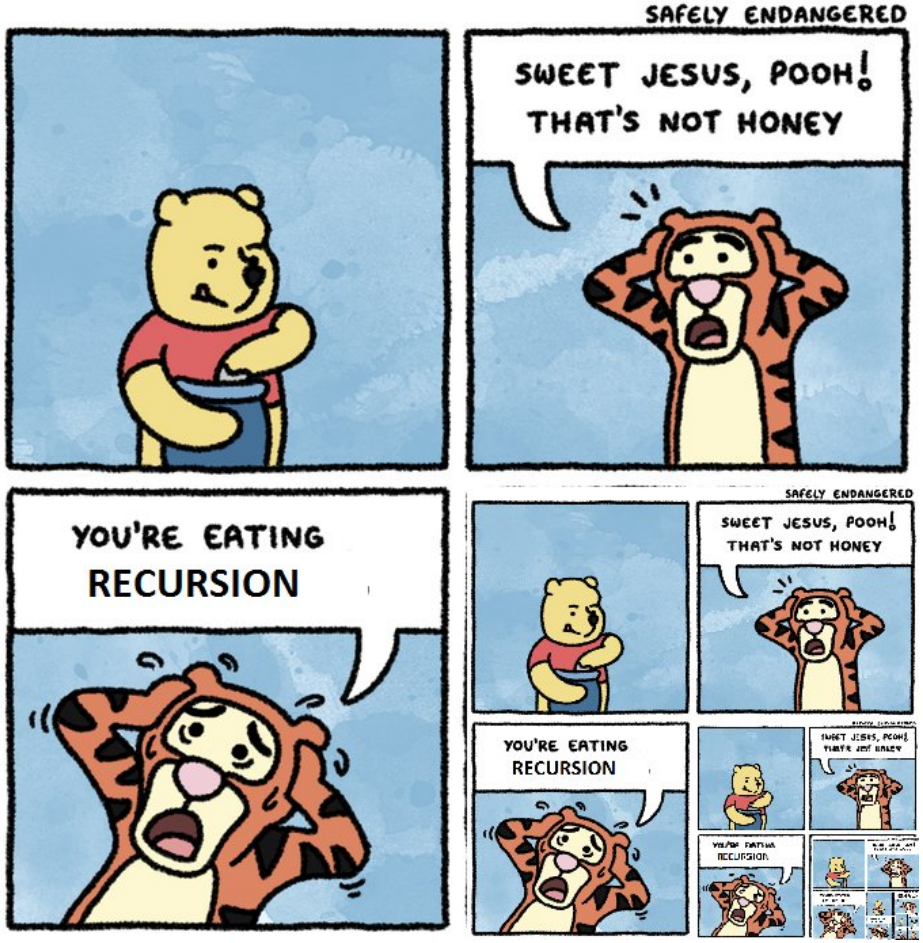
HW1 Reminders/Tips

Type Synonyms

Type Generality

Equality Types

More Syntactic Sugar



HW1 REMINDERS

- Don’t use pattern-matching! (just for the hw)
- If you want to introduce a new variable in your function, use a let expression. (Good for avoided repeated calculations).
- Test your code & include ‘tests’ in submission
- Tests can just be calling functions on different inputs, and manually inspecting the output (put ‘tests’) in hw1_test.sml
- What to test? “Some, one, none”

TYPE SYNONYMS

What does `int * int * int` represent?

In HW1 we're calling it a date

Wouldn't it be nice to reflect this representation in the source code itself?

```
type date = int * int * int
```

TYPE VS. DATATYPE

datatype introduces a new type name, distinct from all existing types

```
datatype suit = Club | Diamond | Heart | Spade
datatype rank = Jack | Queen | King | Ace
              | Num of int
```

type is just another name

```
type card = suit * rank
```

TYPE SYNONYMS

Why?

- For now, just for convenience
- It doesn’t let us do anything new
- Easier to read code

Later in the course we will see another use related to modularity.

TYPE GENERALITY

Let's write a function that appends two string lists...

TYPE GENERALITY

We would expect

```
string list * string list -> string list
```

- But the type checker found

```
'a list * 'a list -> 'a list
```

- Why is this OK?

MORE GENERAL TYPES

The type

```
'a list * 'a list -> 'a list
```

is more general than the type

```
string list * string list -> string list
```

and “can be used” as any less general type, such as

```
int list * int list -> int list
```

MORE GENERAL TYPES

The type

```
'a list * 'a list -> 'a list
```

is <u>not</u> more general than the type

```
int list * string list -> int list
```

Takeaway: More general types “can be used” as any less general type.

THE TYPE GENERALITY RULE

The “more general” rule

A type *t1* is more general than the type *t2* if you can take *t1*, replace its type variables consistently, and get *t2*

EQUALITY TYPES

Let's write a list containment function…

EQUALITY TYPES

The double quoted variable arises from use of the
= operator

- We can use **=** on most types like **`int`**, **`bool`**, **`string`**, tuples (that contain only “equality types”)
- Functions and **`real`** are not ”equality types”

Generality rules work the same, except substitution must be some type which can be compared with **=**

SYNTACTIC SUGAR

If-then-else is implemented as syntactic sugar for a case statement.

PATTERN-MATCHING EXERCISE

Let's write a function using pattern-matching that acts like an if-expression returning something of type int.