

CSE 341

Section 2

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Today's Agenda

- Type synonyms
- Polymorphism and type generality
- Equality types
- Some sugar!
 - Do we really need "if/then/else"?

Type Synonyms

- What does `int * int * int` represent?
- In HW1 we called 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

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

Type Generality

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
```

- But it is not more general than the type

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

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 $t2$

What does **consistently** mean?

Equality Types

Write a list contains 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 =
- You can ignore warnings about “calling `polyEqual`”

Syntactic Sugar

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

If-then-else

- We've just covered case statements
- How could we implement if-then-else?

```
case x of
  true => "apple"
| false => "banana"
```

```
if x then "apple" else "banana"
```

Adventures in pattern matching

- Shape example
- Function-pattern syntax if we get to it