More types

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Agenda

- Recap
- Types
- Types & Values
- Custom types

Recap

Recap

Ok on our last lecture we learn that:

```
anItem : Html.Html msg
```

In this case anItem is a variable of type Html.Html msg

```
anItem = Html.li []
        [ Html.text "Static" ]
```

```
anItem : String -> Html.Html msg
```

In this case anItem is a function that receives a String and returns an Html.Html msg

```
anItem str = Html.li []
        [ Html.text str ]
```

Recap

We also learned that List.map is pretty powerfull

```
List.map (a -> b) -> List a -> List b
```

If we replace

- a => String
- b => Html.Html msg

```
List.map (String -> Html.Html msg) -> List String -> List (
Html.Html msg)
```

Recap

```
List.map (String -> Html.Html msg) -> List String -> List (
Html.Html msg)
```

We can turn a String into an Html (1st parameter) with:

```
anItem : String -> Html.Html msg
anItem str = Html.li []
        [ Html.text str ]
```

So given an arbitrary list of strings we can:

```
                                [ Html.li [] [ Html.text "1" ]
List.map anItem ["1", "2"]   => , Html.li [] [ Html.text "2" ]
                                ]
```

Recap

```
Html.ul []                          Html.ul []
                                      [ Html.li [] [ Html.text "1"
]
List.map anItem ["1", "2"]    =>    , Html.li [] [ Html.text "2"
]
                                      ]
```

We can use the List.map result => List (Html.Html msg) as the second parameter of any Html element

Recap

Before I forget, I want to introduce a brand new tool:

Recap

Maybe you notice but I have a horrible memory, I forget to give tokens, I forget names, I forget which lecture we are at.

But I really want to encourage you to ask questions, so:

I am offering two free tokens:

- To the person that remind's me to setup askqueue and share the link
- To the person that remind's me to check askqueue if an hour has passed and I havent checked

Recap

Learning material:

1. This slides
2. https://www.youtube.com/watch?v=WgJ2FUW1miA&list=PLuGpJqnV9DXq_ItwwUoJOGk_uCr72Yvzb
3. https://elmprogramming.com/
4. (Official guide) https://guide.elm-lang.org/
5. (Official docs) https://package.elm-lang.org/packages/elm/core/latest/
6. (Advanced level - Standard ML) https://www.youtube.com/watch?v=jjX68oHAw-Y&list=PLsydD1kw8jng2t2G8USQNLz0faYZetPnH

Types

Types

Let's say we want to track if a student approved or failed the course, which data type should we use?

Did I guess your solution?

```
approved : Bool
```

There's a little issue with using Bool, it's more limited than what we need. Right now did you pass this course? Should I register False?

```
approved : Bool
approved = False
```

That doesn't represent reallity, you haven't approved the course, yet you haven't failed the course either!

Types

The current state about your grade is "pending" but a Bool only allows us two possible states.

Which data type should we use?

```
result : String
result = "Failed"

extraExam : String -> Bool
extraExam result =
    case result of
        "approved" -> False
        "failed" -> True
        "pending" -> False
        _ -> False
```

This solution has two big disadvantages:

1. We have to case on _ because there are many other possible strings even if they are not real result values
2. This code outputs that `no one should pay!

```
("Failed" != "failed")
```

Types & values

Types & values

Which values does a trafic light might have?

- Green
- Yellow
- Red

Even though

- There are more colors (Purple, Brown, Blue)
- There are more strings ("Apple", "Car", "Traffic")

Types & values

Which values does a trafic light might have?

```
type TrafficLight
    = Green
    | Yellow
    | Red
```

Even though

- There are more colors (Purple, Brown, Blue)
- There are more strings ("Apple", "Car", "Traffic")

Types & values

> Types: Is a collection or grouping of data values, usually specified by a set of possible values, a set of allowed operations on these values, and/or a representation of these values as machine types.

A Bool (other type) can have the values:

- True
- False

A traffic light (our type) can have the values:

- Red
- Green
- Yellow

We can express this in elm with:

```
type TrafficLight
    = Green
    | Yellow
    | Red
```

▓▓▓ Types & values

A Bool can have the values:

- True
- False

```
type TrafficLight
    = Green
    | Yellow
    | Red
```

We can create a myBool of type Bool and bind the value True, because True is a possible value of type Bool

```
myBool : Bool
myBool = True
```

We can create a myTrafficLight of type TrafficLight and bind the value Green, because Green is a possible value of type TrafficLight

```
myTrafficLight : TrafficLight
myTrafficLight = Green
```

Custom types

Let's come back to our initial problem, we want to track if a student approved or failed the course or if the grade is still "Pending", Bool is to constrained, String is to loose, let's make a new type (collection of values) that fit this specific problem Let's make our own data type:

```
type GradeStatus
    = Approved
    | Failed
    | Pending
```

We created a new data type (just like Int, Float, Bool) that have three possible values!

We can create a variable of type GradeStatus

```
result: GradeStatus
result = Pending

falso : Bool
falso = False
```

▒▒▒ Custom types

Let's make our own data type:

```
type GradeStatus
    = Approved
    | Failed
    | Pending

result : GradeStatus
result = Pending
```

```
extraExam : GradeStatus -> Bool
extraExam result =
    case result of
        Approved -> False
        Failed -> True
        Pending -> False
```

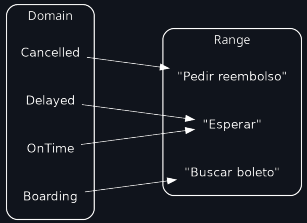
Approved is a posible value of the data type GradeStatus.
Just like True is a possible value of the data type Bool.

Custom types exercises

1.0 Create a function "categoricalGrade" that given a list of grades (float) return a list of (type) "GradeStatus" (with one of the following values) (Approved | Failed | Pending) where any negative number is Pending

2.1 Create a type "AirplaneStatus" (OnTime | Boarding | Delayed | Cancelled)

2.2 Create a function "airplaneScheduleAction" that maps as the following graph:



2.3 Create a function "airportAction" that given a list of AirplaneStatus transform it into a list of strings with airplaneScheduleActions