

# Beautiful Types

by Mike Harris



# What does this do?

$(a \rightarrow b) \rightarrow [a] \rightarrow [b]$



# Map

```
map ::  
(a -> b) -> [a] -> [b]
```



# What does this do?

```
forall a b. (b -> a -> b) -> b -> [a] -> b
```



# Fold

```
foldl ::  
forall a b. (b -> a -> b) -> b -> [a] -> b
```



# What does this do?



Int -> [a] -> [a]



# Take

take ::

Int -> [a] -> [a]



What happens if  
 $\text{Int} < \text{length } [a]$ ?

`take ::`

`Int -> [a] -> [a]`



[ ]

take \_ [ ]

=

[ ]



# What happens if $\text{Int} < 0$ ?

```
take ::
```

```
Int -> [a] -> [a]
```



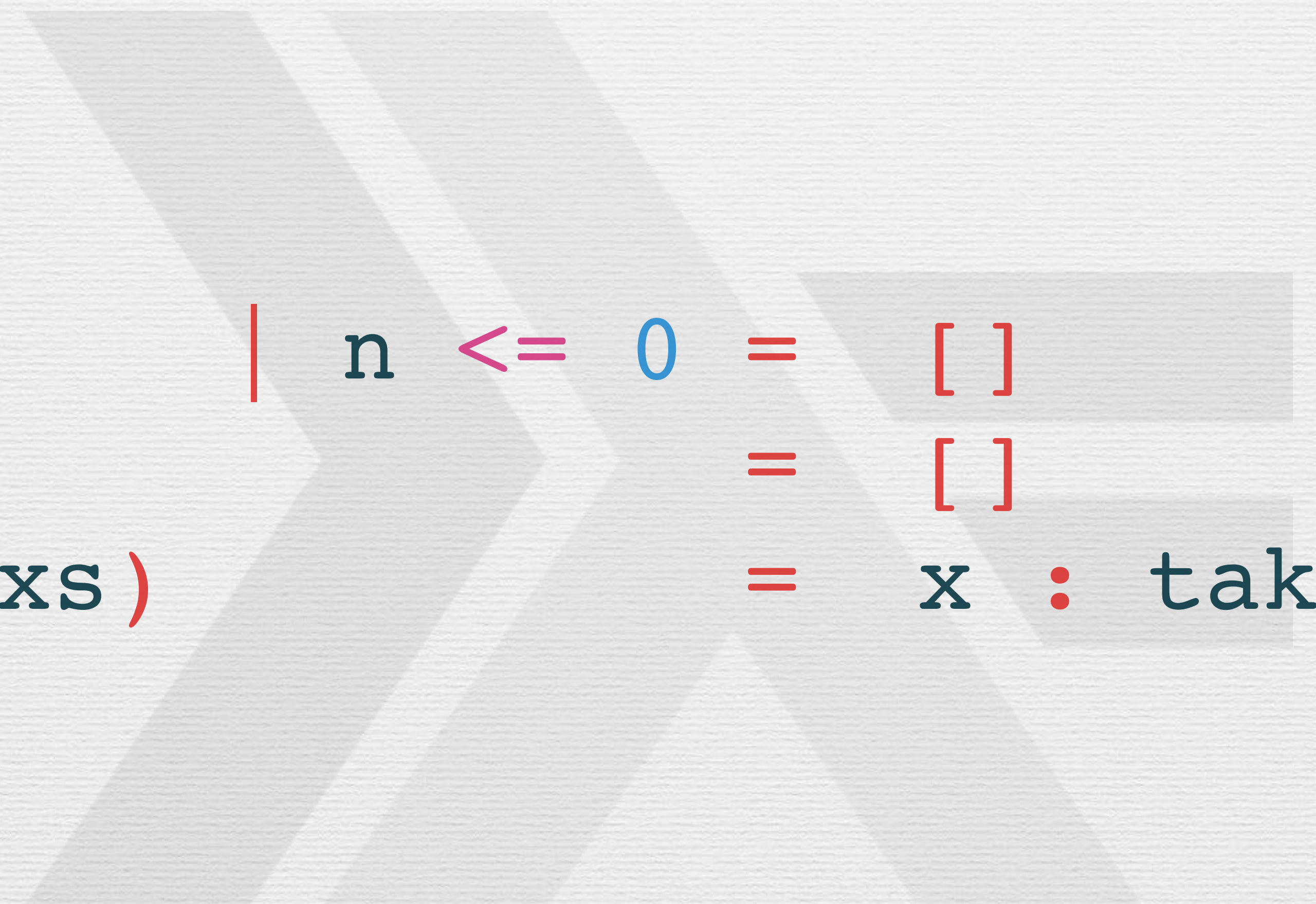
[]

take n \_

| n <= 0 = []



# Take



```
take n _ | n <= 0 = []  
take _ [] = []  
take n (x:xs) = x : take (n-1) xs
```



# What does this do?

$(n : \text{Nat}) \rightarrow (xs : \text{List } a) \rightarrow \text{List } a$



# What does this do?

take :  
(n : Nat) -> (xs : List a) -> List a





What happens if  
 $\text{Int} < \text{length } [a]$ ?

`take :`  
`(n : Nat) -> (xs : List a) -> List a`





# What does this do?

take (S n) [] = []

A large, stylized red question mark graphic is positioned to the right of the code snippet. It is composed of several curved, overlapping strokes that form the shape of a question mark, with the top part being a series of concentric curves and the bottom part being a single, thick, curved stroke.



# Take

`take Z xs = []`  
`take (S n) [] = []`  
`take (S n) (x :: xs) = x :: take n xs`



# What does this do?

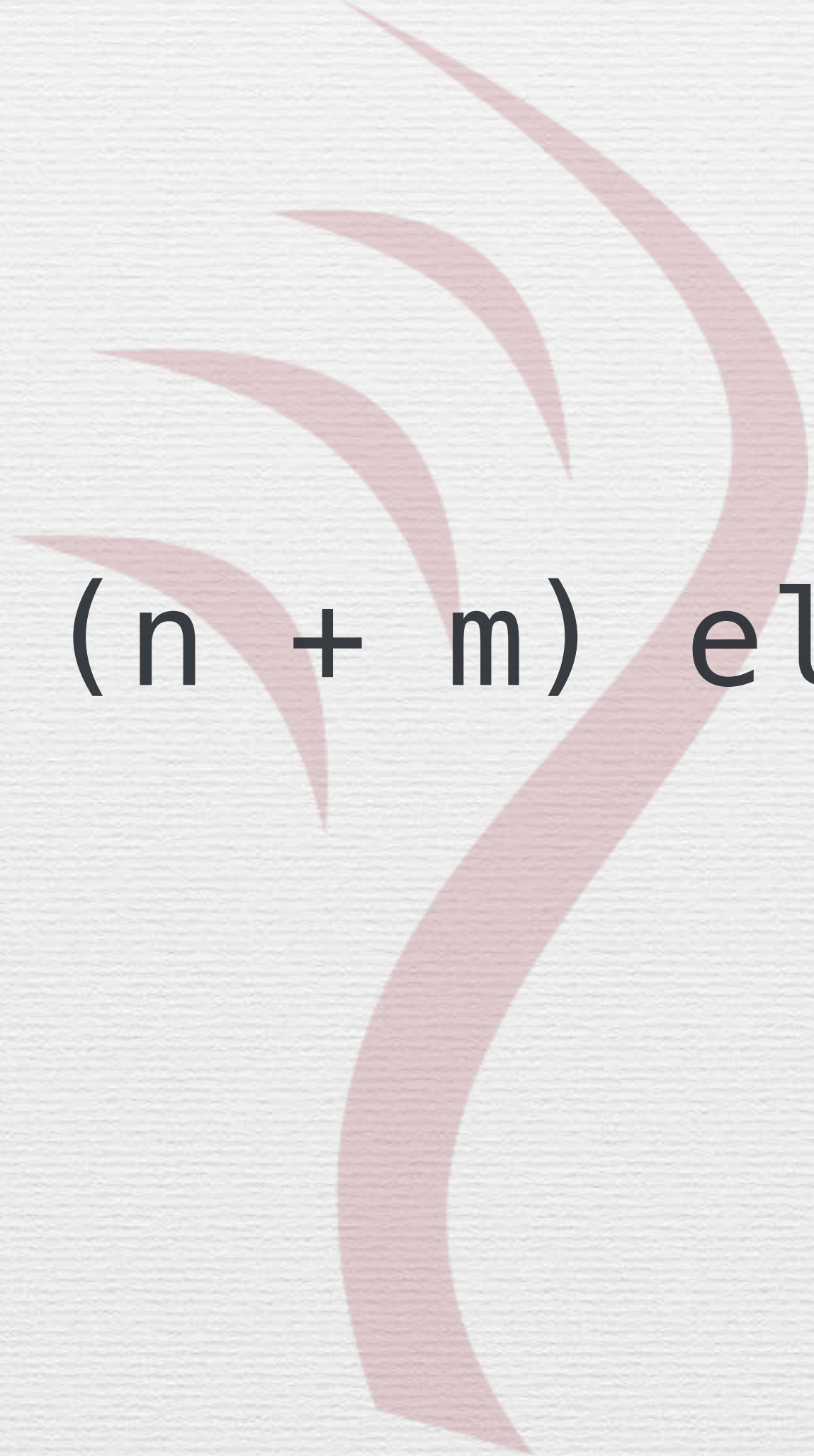
$(n : \text{Nat}) \rightarrow \text{Vect } (n + m) \text{ elem} \rightarrow \text{Vect } n \text{ elem}$





# Take

take :  
(n : Nat) -> Vect (n + m) elem -> Vect n elem





# Take



take Z xs = []  
take (S k) (x :: xs) = x :: take k xs



# What does this do?

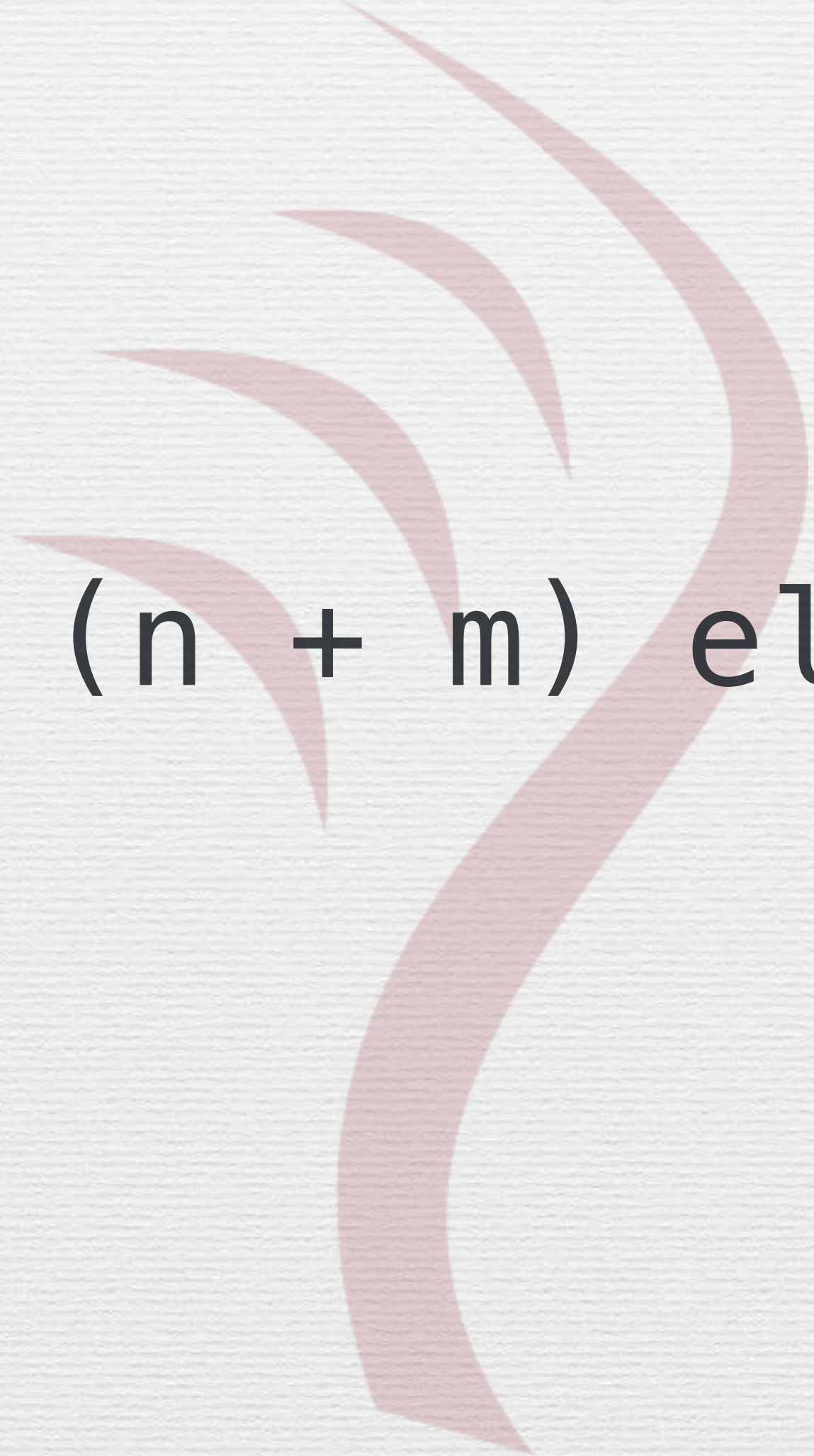
$(n : \text{Nat}) \rightarrow \text{Vect } (n + m) \text{ elem} \rightarrow \text{Vect } m \text{ elem}$





# Drop

`drop :`  
`(n : Nat) -> Vect (n + m) elem -> Vect m elem`





# Drop

$\text{drop } Z \text{ } xs = xs$   
 $\text{drop } (S \ k) \ (x :: xs) = \text{drop } k \ xs$





Thank you!

Mike Harris

@MikeMKH

[https://github.com/MikeMKH/  
talks/tree/master/beautiful-types](https://github.com/MikeMKH/talks/tree/master/beautiful-types)





# S steps

- Learn more about Idris - <http://docs.idris-lang.org/en/latest/tutorial/index.html>
- Try Idris - <https://tryidris.herokuapp.com/console>
- Watch about Type Driven Development with Idris - [https://www.youtube.com/watch?v=X36ye-1x\\_HQ](https://www.youtube.com/watch?v=X36ye-1x_HQ)



# Haskell Source Code

- map - <http://hackage.haskell.org/package/base-4.10.1.0/docs/src/GHC.Base.html#map>
- foldl - <http://hackage.haskell.org/package/base-4.10.1.0/docs/src/GHC.List.html#foldl>
- take - <http://hackage.haskell.org/package/base-4.10.1.0/docs/src/GHC.List.html#take>



# Idris Source Code

- List take - <https://github.com/idris-lang/Idris-dev/blob/beb8e9cdb881f540094b4f457fd03d44af116103/libs/prelude/Prelude/List.idr#L191-L194>
- Vect take - <https://github.com/idris-lang/Idris-dev/blob/beb8e9cdb881f540094b4f457fd03d44af116103/libs/base/Data/Vect.idr#L104-L106>
- Vect drop - <https://github.com/idris-lang/Idris-dev/blob/beb8e9cdb881f540094b4f457fd03d44af116103/libs/base/Data/Vect.idr#L110-L112>



# Images

- Idris logo - Created by Heath Johns (<https://twitter.com/edwinbrady/status/566261662303653888>) and added to GitHub by Jan de Muijnck-Hughes, Public Domain, <https://github.com/idris-lang/Idris-dev/blob/master/icons/text-x-idris.svg>
- Haskell logo - Thought up by Darrin Thompson and produced by Jeff Wheeler - Thompson-Wheeler logo on the haskell wiki, Public Domain, <https://commons.wikimedia.org/w/index.php?curid=8479507>