Beginning Haskell

```
f(a, b)          f a b

sqrt 2 + sqrt 3

map sqrt [1..5]

filter odd [1..5]
                 [1,3,5]
```

```
map (*2) [1..5]
```

```
[2,4,6,8,10]
```

```
filter (>3) [1..5]
```

```
[4,5]
```

```
map (^2) [1..5]
```

```
[1,4,9,16,25]
```

```
map (2^) [1..5]
```

```
[2,4,8,16,32]
```

```
   map (^2)
      (filter odd [1..5])


sum
   (map (^2)
      (filter odd [1..5]))
```

```
sin (cos (tan (sqrt 2)))

f x                 f $ x

f (g x)             f $ g x

sin $ cos $ tan $ sqrt 2

sin cos tan sqrt 2
```

```
sum
   (map (^2)
      (filter odd [1..5]))


sum $
   map (^2) $
      filter odd [1..5]
```

```
[1..]
```

Demo

```
takeWhile (<100) $
  map (2^) [1..]
```

```
[2,4,8,16,32,64]
```

Exercises 1

http://dominicprior.github.io/

Defining Functions

```
sq x = x^2
```

```
sq = \x -> x^2
```

```
sq = (^2)
```

Factorial

```
f 0 = 1
f n = n * f (n-1)
```

4! = 4 * 3!

```
f 2
2 * f 1
2 * (1 * f 0)
2 * (1 * 1)
```

```
[2,3] ++ [4,5,6]
```

```
[2,3,4,5,6]
```

~~i++~~

```
[5,6,7] !! 2
```

```
7
```

```
4 : [5,6]
```

```
[4,5,6]
```

```
[2,4]
2 : [4]
2 : (4 : [])
2 : 4 : []
```

```
"hi"          ['h', 'i']
```

```
"hello" !! 1        'e'
```

Writing our own sum function

```
sum [] = 0
```

sum [2, 3, 4] = 2 + sum [3, 4]

```
sum (x:xs) = x + sum xs
```

Exercises 2

http://dominicprior.github.io/

Types

Int		[Int]
Integer		[Integer]
Float		[Float]
Double		[Double]
Char	*'a'*	[Char]
String	*"hi"*	[String]
Bool	*True*	[Bool]
	False	

[[Int]]

```
Int
Integer
Float
Double
Char
String
Bool
```

```
[Int]
[Integer]
```

```
(Int,String)  (3,"hi")
(Char,Bool,[Int])
```

```
Set String
```

```
Maybe Int
```

```
Just 3      Nothing
```

```
Int -> Bool
Char -> Int
Int -> [Char] -> Char
```

```
sum :: [Int] -> Int
sum [] = 0
sum (x:xs) = x + sum xs
```

```
rev :: [a] -> [a]
rev :: [Char] -> [Char]
rev :: [Int] -> [Int]
rev [] = []
rev (x:xs) = rev xs ++ [x]
```

```
sum :: Num a => [a] -> a
sum :: [a] -> a
sum :: [Int] -> Int
sum [] = 0
sum (x:xs) = x + sum xs
```

```
map sqrt [1..5]

map :: function -> list -> list

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

Exercises 3

http://dominicprior.github.io/

```
map (*2) [1,2,3]
```

```
zipWith (*) [1,2,3] [4,5,6]
        [4,10,18]
```

[1,2,3,4] 1+2+3+4

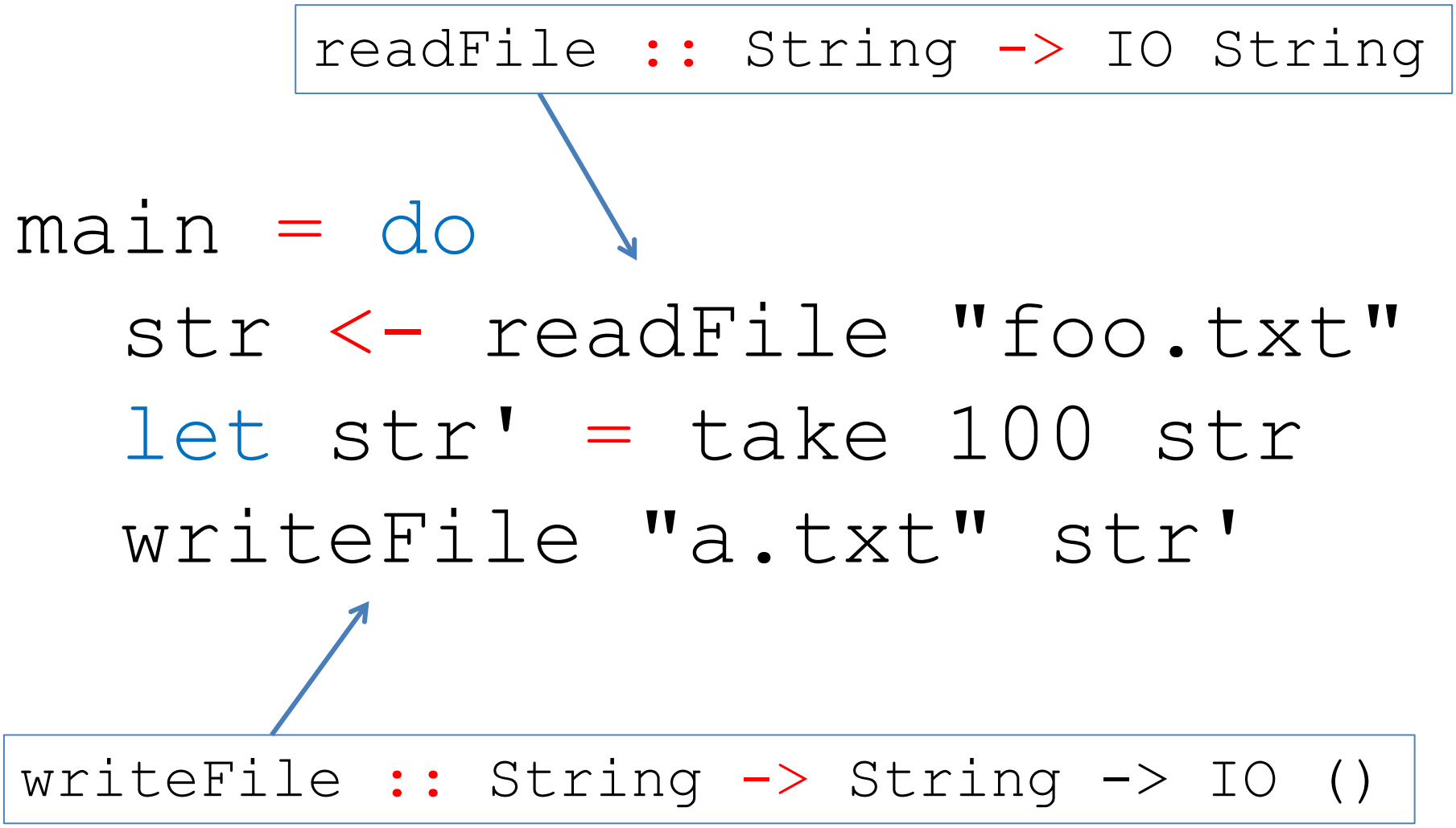
foldr 1+(2+(3+4))

foldl' ((1+2)+3)+4

```
map (sqrt . sqrt) [1,2,3]
```

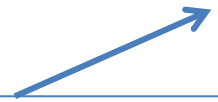
I/O

```
f :: String -> String

g :: String -> IO String

readFile :: String -> IO String

getChar :: IO Char

putStr :: String -> IO ()

main :: IO ()
```


readFile :: String -> IO String
main = do
str <- readFile "foo.txt"
let str' = take 100 str
writeFile "a.txt" str'
writeFile :: String -> String -> IO ()

```
main = do
   str <- getContents
   let str' = f str
   putStr str'

f = take 100
```

```
main = interact $ take 100
```



```
interact :: (String -> String) -> IO ()
```

Exercises 4

http://dominicprior.github.io/

Laziness

Defining our own map function

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

map _ [] = []
```

map f [1,2,3] = [f 1, f 2, f 3]

= f 1 : [f 2, f 3]

= f 1 : map f [2,3]

```
map f (x:xs) = f x : map f xs
```