Introduction to Programming: Lecture 4

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20 Aug 2013

foldr

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foldr f v (x:xs) = f x (foldr f v xs)
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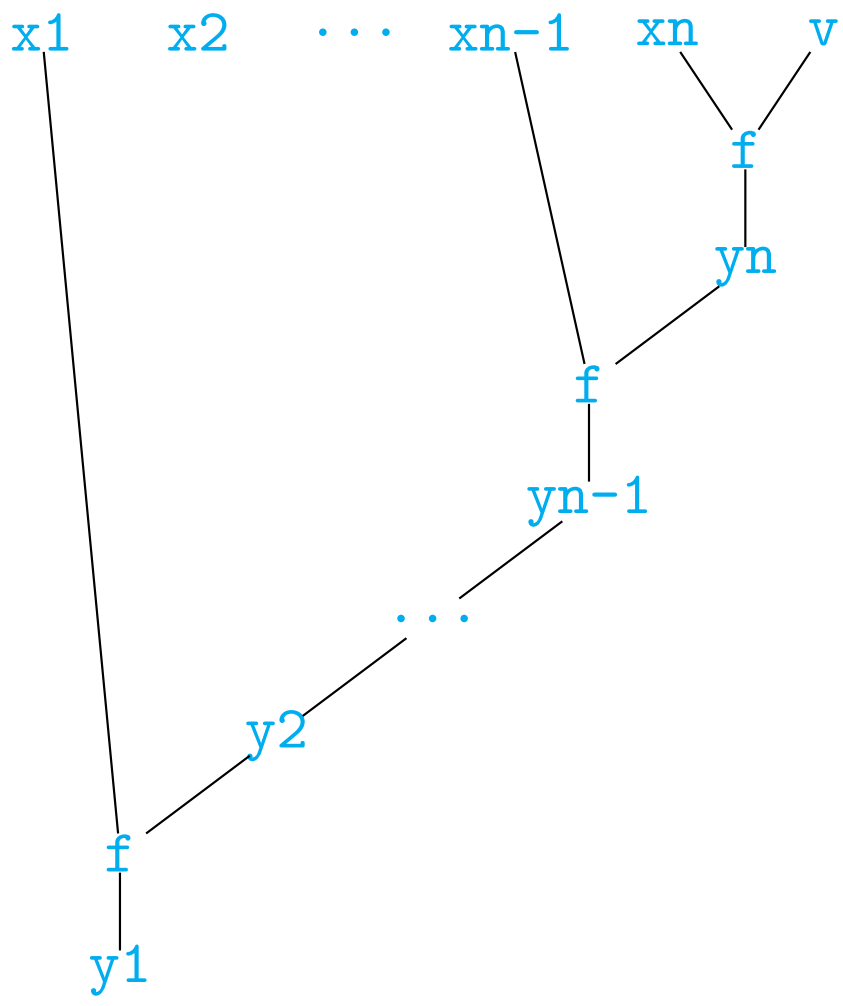

Combining the elements of List

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

multlist :: [Int] -> Int
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multlist [] = 1
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```

- Rewritten using `foldr`

```
sumlist ls  = foldr (+) 0 ls
multlist ls = foldr (*) 1 ls
```

mylength via foldr

```
foldr f v [] = v
foldr f v (x:xs) = f x (foldr f v xs)

mylength :: [Int] -> Int
mylength ls =  foldr f 0 ls

f x y = y+1
```

`foldr`: more examples

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  Transforms a list of lists into a list by dissolving one level of brackets.

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- What does the following calculate?

  `foldr (++) []`

  Transforms a list of lists into a list by dissolving one level of brackets.

- The haskell function `concat`.

foldr

- What is the type of `foldr`?

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- Allows reuse of code. Fewer bugs.
- Makes code easier to read.
- Allows you to define your own programming language!

The function `foldr1`

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- `maxlist = foldr1 max`

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- Given a letter `c` and a string `s` find the position of the left most occurnace of `c` in `s`.

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position 'a' "battle axe" = 1
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position c []     = 0
position c (x:xs)
  | (x == c)    = 0
  | otherwise   = 1 + (position c xs)
```

`position` ...

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```
posAux :: Int -> Char -> String -> Int
posAux i c [] = i
posAux i c (x:xs)
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position c s = posAux 0 c s
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position :: Char -> String -> Int
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- `posAux` is not visible outside `position`.

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```

- Reduces the number of arguments that need to be used.

The function `takeWhile`

```
takeWhile ::  (a -> Bool) -> [a] -> [a]
takeWhile (> 7) [8,1,9,10] = [8]
takeWhile (< 10) [8,1,9,10]= [8,1,9]
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- There is also a corresponding function `dropWhile`

`zipWith` function

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zipWith (+) [1,2,3] [7,8,6] = [8,10,9]
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zipWith ::  (a -> b -> c) -> [a] -> [b] -> [c]
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Example: Mark Lists

- `marks` – a list of list of integers
- Each list in `marks` corresponds to an assignment. The ith number is the mark obtained by the ith student.
- Compute the total marks obtained by each student.

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= [30,21,34]
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- Write down Haskell code for `addMarks`

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addMarks [x] = x
addMarks (x:xs) = zipWith (+) x (addMarks xs)
```

or equivalently

```
addMarks = foldr1 (zipWith (+))
```

Mark Lists ...

- `marks` – as before.
- Rearrange it so that you have a list of lists in which each list gives the marks obtained by one student.

```
transpose [[10,10,8], [9,2,10]]
      = [[10,9],[10,2],[8,10]]

transpose [[3,4],[2]] = undefined
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- Write a haskell function to do this.