

Assignment Project Exam Help

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Challenge

- # Assignment Project Exam Help
- Can you write a function that takes a list of numbers (containing only the values 1, 2 and 0, where at least one 0 must occur) and returns a three-tuple containing :
 - ▶ The number of 1
 - ▶ The number of 2
 - ▶ The length of the list
 - Notes :
 - ▶ The value of this challenge is NOT in knowing the answer — the value is in the process of finding the answer! So please don't "cheat" yourself by searching for the answer.
 - ▶ Start by writing down the type of the function (always!)
 - ▶ Be prepared to write small "helper" functions, or look in the online material for list operators.
 - ▶ If you find this easy, try designing the program a different way so that it makes use of higher order functions (e.g. filter, dropwhile, takewhile)
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Solution 1

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challenge :: [num] → (num, num, num)

challen

xchalle

xchallenge (1 : xs) (a, b, c, d) = xch

xchallenge (2 : xs) (a, b, c, d) = xch

xchallenge any (a, b, c, d) = erro

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Solution 2

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challenge any = f a, b, c where

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c = f segment 0 0

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*f [] longest current = max [f
f (2 : xs) longest current = f xs ([,])
f (1 : xs) longest current = f xs longest (current + 1)
f any longest current = error "bad input format"*

Solution 3

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challenge any $\equiv a, b, c$
where

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$c = my$

$g_1(a, b) = (a,$
 $g_2(a, b) = (m$

$g \times (a, b) = err$ “ ”

$mymax(a, b) = a, \text{ if } a > b$
 $= b, \text{ otherwise}$

Foldr (sometimes known as “reduce”)

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Distributes a dyadic function over the elements of a list

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Example :

$\text{foldr } (+) 0 [1, 2]$
 $\rightarrow (1 + (2$
 $\rightarrow 6$

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Foldl (sometimes known as “accumulate”)

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Distributes a dyadic function over the elements of a list; associates to the LEFT

`foldl` (

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Example :

`foldl (+) 0 [1,2,3] =`
 $\rightarrow (((0 + 1) + 2) + 3)$
 $\rightarrow 6$

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Definition of foldr

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$$\text{foldr } f \text{ def } [] = \text{def}$$

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- Note "f" is used in PREFIX position

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$$\begin{aligned} & \text{foldr } (+) 0 [1, 2, 3] \\ & \equiv \text{foldr } (+) 0 ((:) 1 (\\ & \rightarrow ((+) 1 ((+) 2 ((+) 3 0))) \\ & \equiv (1 + (2 + (3 + 0))) \end{aligned}$$

Definition of foldl

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$$\text{foldl} :: (* *) \rightarrow * \rightarrow (* *) \rightarrow * \rightarrow [*] \rightarrow *$$

$$\text{foldl } f \text{ def } [] = \text{def}$$

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- Note again “f” is used in PREFIX position

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$$\begin{aligned} & \text{foldl } (+) 0 [1, 2, 3] \\ \equiv & \text{foldl } (+) 0 ((:) 1) \\ \rightarrow & ((+) ((+) ((+) 0 1) 2) 3) \\ \equiv & (((0 + 1) + 2) + 3) \end{aligned}$$

Examples

- $\text{foldr} (*) 1 [1,2,3,4] \rightarrow 24$
- $\text{foldl} (+) 0 [1,2,3,4] \rightarrow 10$
- $\text{foldr} (:) [] [1,2,3,4]$
-

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where
 $\text{Add WeChat } x y =$
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 $\rightarrow 4$

“Solution 3” revisited :

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```

c = my
)
g 1(a, b) = (a,
g 2(a, b) = (m
g x (a, b) = err “
mymax (a, b) = a, if a > b
               = b, otherwise

```

“Solution 3” revisited :

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$g\ 1\ (a, b)$
 $g\ 2\ (a, b)$
 $g \times (a, b)$

$= (a, b + 1)$
 $= (\max [a, b], 0)$
 $= \text{error "bad input format"}$

my <https://eduassistpro.github.io/>
 →
 → *mymax* (*g* 1 (*g* 2 (*foldr* *g* (0,0) [1, 1, 1, 2])))
 →→ *mymax* (*g* 1 (*g* 2 (*g* 1 (*g* 1 (*g* 1 (*g* 2 (0,0
 → *mymax* (*g* 1 (*g* 2 (*g* 1 (*g* 1 (*g* 1 (0,0))))))
 → *mymax* (*g* 1 (*g* 2 (*g* 1 (*g* 1 (0,1))))))
 → *mymax* (*g* 1 (*g* 2 (*g* 1 (0,2))))
 → *mymax* (*g* 1 (*g* 2 (0,3)))
 → *mymax* (*g* 1 (3,0))
 → *mymax* (3,1)
 → 3

Equivalence of foldr and foldl ?

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- Can foldr be replace

- ▶ `foldr (-) 0 [1,2,3]`
 - ▶ `foldl (-) 0 [1,2,3]`

- Never ?

- Always ?

- Sometimes ? ... if so, when ?

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Equivalence of foldr and foldl

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- They CAN be interc
 - ▶ Associative,
 - ▶ Commutati
- Caveat – they don't work the same on infinite lists!
 - ▶ `hd (foldr (:) [] ones)` → 1
 - ▶ `hd (foldl (swap ()) [] ones)` → ?

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Combining HOFs

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```
results = [("fred", 45), ("sally", 79), ("chris", 65)]
```

```
f      = (
```

```
main  =
```

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→ `(map fst) ((filter ((< 50).snd)) re`

→ `map fst (filter ((< 50).snd) [("fre`

→ `map fst [("fred", 45)]`

→ `["fred"]`

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Combining HOFs

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```
myreverse = foldl (swap ()) []
main      = myreverse [1, 2, 3, 4]
```

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→ foldl (swap (:)) (swap (:)) (swap

→ foldl (swap (:)) (swap (:)) (swap

→ foldl (swap (:)) (swap (:)) (swap (:)) 3) 4) []

→ (swap (:)) (swap (:)) (swap (:)) (swap (:)) [] 1) 2) 3)

→ (:) 4 (swap (:)) (swap (:)) (swap (:)) [] 1) 2) 3)

→→ (:) 4 ((:) 3 ((:) 2 ((:) 1 []))

→→ (4 : (3 : (2 : (1 : [])))) ≡ [4, 3, 2, 1]

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Combining HOFs

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Don't go overboard :thing
What does this do?

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```
g = (foldr (+) 0) . (foldr (λ x y. (x + y)) . (λ x. [x])) . []
```

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Summary

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- Discussion of solutions
- Capturing comments
 - ▶ The Miranda functions `foldr` and `foldl`
 - ★ (reduce and accumulate)
 - ▶ Examples
- Combining HOFs

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