HASKELL STYLE

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Check out *HaskellStyle*, open *style.hs*

THE GOLDEN RULE OF HASKELL INDENTATION

Code which is part of some expression should be indented farther than the line containing the beginning of that expression

Live it.
Learn it.
Pass it on.

BINARY TREE DATATYPE

- What do we need to store for a binary tree node?
- Nodes contain other nodes
- Need *recursive data type*:

  -
    ```
    data BinaryTree a =
             ExtNode
           | IntNode a (BinaryTree a) (BinaryTree a)
       deriving Show
    ```

RECORDS

- Define custom data types with named "fields"
- Automatically create accessor functions

```
type CustomerID = Int
type Address = [String]

data Customer = Customer {
        customerId      :: CustomerID,
        customerName    :: String,
        customerAddress :: Address
    } deriving (Show)
```

CONTROL FLOW EXPRESSIONS

Matches a pair and binds x and y

- *case* expression:

```
eo xs =
    case xs of
        [] -> []
        (x:[]) -> [x]
        (x':_:xs') -> x' : eo xs'
```

- Cases must have **same type**
- Uses pattern matching

- *guards:*

```
data Pair a b = Pair a b

twins::Eq a => Pair a a -> String
twins (Pair x y)
          | x == y  = “yep”
          | otherwise   = “nope”
```

- Similar to cases, but use *Bool* values to select

Q2,3

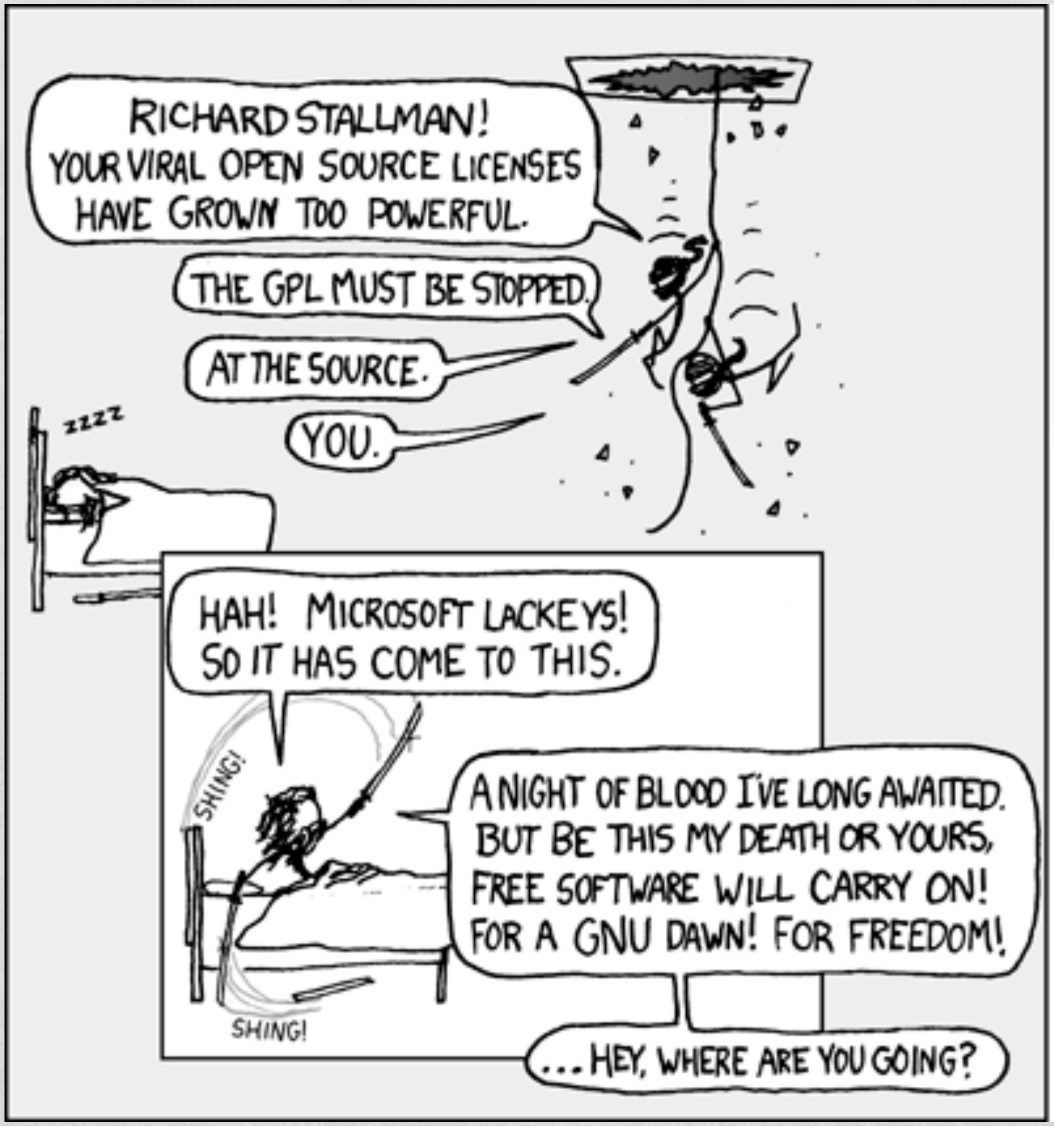
BINDING EXPRESSIONS

- *let* expressions define local names for values
  - Not "variables"
  - Can't mutate them
- *where* expressions give supporting definitions at the end of a function

Example

```
fib n = fst (ffp n)
  where
    ffp 0 = (0, 0)
    ffp 1 = (1, 0)
    ffp n =
      let (nm1, nm2) = ffp (n-1)
      in (nm1 + nm2, nm1)
```

OPEN SOURCE


RICHARD STALLMAN! YOUR VIRAL OPEN SOURCE LICENSES HAVE GROWN TOO POWERFUL.
THE GPL MUST BE STOPPED.
AT THE SOURCE.
YOU.
zzzz
HAH! MICROSOFT LACKEYS! SO IT HAS COME TO THIS.
SHING!
A NIGHT OF BLOOD I'VE LONG AWAITED. BUT BE THIS MY DEATH OR YOURS, FREE SOFTWARE WILL CARRY ON! FOR A GNU DAWN! FOR FREEDOM!
SHING!
...HEY, WHERE ARE YOU GOING?

MAN, YOU'RE RIGHT, THAT NEVER GETS OLD.
LET'S DO ERIC S. RAYMOND NEXT.
OR LINUS TORVALDS. I HEAR HE SLEEPS WITH NUNCHUCKS.

Later we'll dress up like Big Oil and jump Ralph Nader

INFIX OPERATORS

- Surrounding binary function names with `backticks` lets us use them as infix operators:
```
> 4 `div` 2
> "foo" `isPrefixOf` "foolish"
```
- Surround infix operators with parentheses lets us treat them like function names:
```
(<-*) :: BinaryTree a -> BinaryTree a -> BinaryTree a
_ <-* ExtNode = error "Can't add a left child to ext. node"
t <-* (IntNode x _ right) = IntNode x t right
```

Q4

LOADS OF LIST FUNCTIONS

length	(++)	take	elem
null	concat	drop	notElem
head	reverse	splitAt	filter
tail	and	takeWhile	isPrefixOf
last	or	dropWhile	isInfixOf
init	all	span	isSuffixOf
lines/unlines	any	break	zip

See *http://www.haskell.org/ghc/docs/latest/html/libraries/*

EXAMPLE: ADLER-32

Teasing Thursday's Topics

- Concatenates two 16-bit checksums
  - First is the sum of all the input bytes, plus 1
  - Second is the running total of the intermediate values of the first checksum
  - Both are modulo 65521