Announcements

- HW due Monday
- HW7 is up, due next Friday
How about reversing a list?

Code this one yourself, or think recursively.

Start:
\[ \text{rev}: \ [a] \rightarrow [a] \]
\textit{rev} :: \texttt{[a]} \rightarrow \texttt{[a]}

\textit{rev} \texttt{[]} = \texttt{[]}

\textit{rev} \texttt{[x]} = \texttt{[x]}

\textit{rev} \texttt{(x:xs)} = \textit{rev} \texttt{xs} ++ \texttt{[x]}
Another example: `zipWith`

\[
\text{\textit{zipWith}} :: (a \rightarrow b \rightarrow c) \rightarrow [a] \rightarrow [b] \rightarrow [c]
\]

-- base cases
\[
\text{\textit{zipWith}} [] = []
\]
\[
\text{\textit{zipWith}} [x] [] = [x]
\]
\[
\text{\textit{zipWith}} f (x:xs) (y:ys) = f x y : \text{\textit{zipWith}} f xs ys
\]
Another useful function:

Flip : gives inverse function

\( \text{flip} : (a \rightarrow b \rightarrow c) \rightarrow (b \rightarrow a \rightarrow c) \)

\( \text{flip} \ f = g \) where \( g \ x \ y \ = \ f \ y \ x \)
Other useful functions

Map: takes a function & a list & applies the function to every member of the list

Filter: takes a predicate (function which returns a boolean) & returns a new list w/ things that satisfy the predicate

Ex: \( \text{filter (>3)} \) [1, 2, 6, 5, 1, 3, 9]  \( \rightarrow \) [6, 9]

\( \text{filter (even)} \) [1..10]  \( \rightarrow \) [2, 4, 6, 8, 10]
(More on `filter` - nice application)

\[\text{quicksort} :: (\text{ord } a) : [a] \rightarrow [a]\]

\[\text{quicksort} \; [] = []\]

\[\text{quicksort} \; (x : xs) =\]

\[\begin{align*}
\text{let } & \text{smaller} = \text{quicksort} \; (\text{filter } (\leq x) \; xs) \\
& \text{bigger} = \text{quicksort} \; (\text{filter } (> x) \; xs) \\
\text{in } & \text{smaller} \; ++ \; [x] \; ++ \; \text{bigger}
\end{align*}\]
Ex: find largest # under 100,000 divisible by 3829

let largestDiv =

head(filter p [100000, 99999 ..])

where p x = x `mod` 3829 == 0
Lambdas:  

"Anonymous" functions.  

Look at previous example.  

p was only defined to pass along (which is a bit silly).  

So a better way: use \( p \) don't have to give a name!
Another lambda example:

\[
\text{zipWith } (\lambda a, b \rightarrow (a * 2 + 5) / 6) \ [1, 2, 3, 4, 5] \ [5, 4, 3, 2, 1]
\]
The $ function
Can be useful — makes a function
low priority

sqrt (9 + 16) \approx 5

answer?

sqrt 9 + 16
Next week

- Modules
- Making our own types