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Note Title

2013-11-14

Product example (calculates product of a list
of numbers)

Step 1, define the type

product: $[Int] \rightarrow Int$

(we may generalize later; we "start simple")

Step 2 enumerate the cases

product [] =

(empty list)

product (x:xs) =

(non-empty list)

Step 3 define the simple cases

$$\text{product}([]) = 1$$

$$\text{product}(x : xs) =$$

(usually, the simple cases become base cases,
as it happens here.)

Step 4 Define the other cases

$$\text{product} [] = 1$$

$$\text{product} (x:xs) = x * \text{product} xs$$

(As in this example, the "other" cases of `len` become the recursive cases)

Step 5 generalize and simplify

product :: Num a => [a] -> a

The function defn is unchanged when we generalize from Int to any type of the Num class.

foldr (*) 1

← the value of the function you defn when applied to []

← the function that replaces cons (" : ")

foldr is actually very similar to
FP's insert (!)

!* is the FP equivalent to
foldr (*) 1

!* works only on lists with at least two values

foldr 1 (*) is actually closer to !*.

Homeworks: PR 8. Exercise,
6.3, 6.4, 6.5 (Ch 6 [+])

Please follow the hint for exercise 6.5.

$$\underline{\text{qsort}} [5, 4, 3, 2, 1] = \text{qsort}(5; [4, 3, 2, 1]) =$$

$$\text{qsort}(\text{smaller}) ++ [5] ++ \text{qsort}(\text{larger}) =$$

$$\text{qsort} [4, 3, 2, 1] ++ [5] ++ \underline{\text{qsort}} [] =$$

$$\text{qsort}(4; [3, 2, 1]) ++ [5] ++ [] =$$

$$(\text{qsort smaller} ++ [4] ++ \text{qsort larger}) ++ [5] ++ [] =$$

$$(\text{qsort } [3, 2, 1] ++ [4] ++ \text{qsort } []) ++ [5] ++ [] =$$

$$(\text{qsort } (3; [2, 1]) ++ [4] ++ []) ++ [5] ++ [] =$$

$$(\text{qsort } [2, 1] ++ [3] ++ \text{qsort } []) ++ [4] ++ [] ++ [5] ++ [] =$$

$$\text{qsort } (2; [1]) ++ [3] ++ [] ++ [4] ++ [] ++ [5] ++ [] =$$

qsort smaller ++ [2] ++ qsort larger ++ [3] ++ [] ++ [4] ++
[] ++ [5] ++ [] =

qsort [1] ++ [2] ++ qsort [] ++ [3] ++ [] ++ [4] ++
[] ++ [5] ++ [] =

qsort (1; []) ++ [2] ++ [] ++ [3] ++ [] ++ [4] ++ [] ++ [5] ++
[] =

qsort smaller ++ [1] + qsort larger ++ [2] ++ [] ++ [3] ++
[] ++ [4] ++ [] ++ [5] ++ [] =

qsort [] ++ [1] + qsort [] ++ [2] ++ [] ++ [3] ++ [] ++
[4] ++ [] ++ [5] ++ [] =

[] ++ [1] ++ [] ++ [2] ++ [] ++ [3] ++ [] ++ [4] ++ [] ++ [5] ++
[] =

... =
[1, 2, 3, 4, 5].