Frequently Used Haskell Functions

Infix Operators

$\cdot$	infixr 9	function composition
$\wedge$	infixr 8	exponentiation
$*$, /	infixl 7	multiplication, division
div	infixl 7	integral division
mod,rem	infixl 7	modulus, remainder
$+$, $-$	infixl 6	addition, subtraction
:, $+\!\!+$	infixr 5	list cons, appending
==, /=	infix 4	equality, inequality
$<$, $\leq$, $\geq$, $>$	infix 4	comparison
&&	infixr 3	logical and
||	infixr 2	logical or
\$	infixr 0	function application

List Processing Basics

$(:) :: a \to [a] \to [a]$
$1 : [2,3,4] == [1,2,3,4]$

$(+\!\!+) :: [a] \to [a] \to [a]$
$[1,2,3] +\!\!+ [4,5,6] == [1,2,3,4,5,6]$

$head :: [a] \to a$
$head\,[1,2,3] == 1$

$tail :: [a] \to [a]$
$tail\,[1,2,3] == [2,3]$

$last :: [a] \to a$
$last\,[1,2,3] == 3$

$init :: [a] \to [a]$
$init\,[1,2,3] == [1,2]$

$null :: [a] \to Bool$
$null\,[] == True$
$null\,[1] == False$

$length :: [a] \to Int$
$length\,[0,1,2] == 3$

$(!!) :: [a] \to Int \to a$
$[0,1,2,3] !! 3 == 2$

$reverse :: [a] \to [a]$
$reverse\,[1,2,3] == [3,2,1]$

$concat :: [[a]] \to [a]$
$concat\,[[1,2],[3],[\,],[4,5]] == [1,2,3,4,5]$

$map :: (a \to b) \to [a] \to [b]$
$map\,(1+)\,[1,2,3] == [2,3,4]$

Reducing Lists

$foldr :: (a \to b \to b) \to b \to [a] \to b$
$foldr\,(\oplus)\,z\,[x_1,x_2,x_3] == x_1 \oplus (x_2 \oplus (x_3 \oplus z))$

$foldr1 :: (a \to a \to a) \to [a] \to a$
$foldr1\,(\oplus)\,[x_1,x_2,x_3] == x_1 \oplus (x_2 \oplus x_3)$

$foldl :: (a \to b \to a) \to a \to [b] \to a$
$foldl\,(\oplus)\,z\,[x_1,x_2,x_3] == ((z \oplus x_1) \oplus x_2) \oplus x_3$

$foldl1 :: (a \to a \to a) \to [a] \to a$
$foldl1\,(\oplus)\,[x_1,x_2,x_3] == (x_1 \oplus x_2) \oplus x_3$

Special Folds

$and :: [Bool] \to Bool$
$and\,[True, False, True] == False$

$or :: [Bool] \to Bool$
$or\,[True, False, True] == True$

$any :: (a \to Bool) \to [a] \to Bool$
$any\ even\ [1,2,3] == True$

$all :: (a \to Bool) \to [a] \to Bool$
$all\ even\ [1,2,3] == False$

$sum :: Num\ a \Rightarrow [a] \to a$
$sum\ [1,2,3,4] == 10$

$product :: Num\ a \Rightarrow [a] \to a$
$product\ [1,2,3,4] == 24$

Building Lists

$scanr :: (a \to b \to a) \to a \to [b] \to [a]$
$scanr\ (\oplus)\ z\ [x_1,x_2,x_3] ==$
$[x_1 \oplus (x_2 \oplus (x_3 \oplus z)), x_2 \oplus (x_3 \oplus z), x_3 \oplus z, z]$

$scanl :: (a \to b \to a) \to a \to [b] \to [a]$
$scanl\ (\oplus)\ z\ [x_1,x_2,x_3] ==$
$[z, z \oplus x_1, (z \oplus x_1) \oplus x_2, ((z \oplus x_1) \oplus x_2) \oplus x_3]$

$iterate :: (a \to a) \to a \to [a]$
$iterate\ (2*)\ 1 == [1,2,4,8,16,\ldots]$

$repeat :: a \to [a]$
$repeat\ 1 == [1,1,1,\ldots]$

Sublists

$take :: Int \to [a] \to [a]$
$take\ 3\ [0,1,2,3,4] == [0,1,2]$

$drop :: Int \to [a] \to [a]$
$drop\ 3\ [0,1,2,3,4] == [3,4]$

$splitAt :: Int \to [a] \to ([a],[a])$
$splitAt\ n\ xs = (take\ n\ xs, drop\ n\ xs)$

For all $n :: Integer$, $take\ n\ xs +\!\!+ drop\ n\ xs == xs$.

$takeWhile :: (a \to Bool) \to [a] \to [a]$
$takeWhile\ (<3)\ [1,2,3,4,1,2,3,4] == [1,2]$

$dropWhile :: (a \to Bool) \to [a] \to [a]$
$dropWhile\ (<3)\ [1,2,3,4,1,3] == [3,4,1,3]$

$span :: (a \to Bool) \to [a] \to ([a],[a])$
$span\ p\ xs = (takeWhile\ p\ xs, dropWhile\ p\ xs)$

$filter :: (a \to Bool) \to [a] \to [a]$
$filter\ even\ [1,2,3,4] == [2,4]$

$partition :: (a \to Bool) \to [a] \to ([a],[a])$
$partition\ p\ xs = (filter\ p\ xs, filter\ (not \cdot p)\ xs)$

$elem :: (Eq\ a) \Rightarrow a \to [a] \to Bool$
$elem\ 3\ [1,2,3,4] == True$

$lookup :: (Eq\ a) \Rightarrow a \to [(a,b)] \to Maybe\ b$
$lookup\ 3\ [(1,\texttt{'a'}),(2,\texttt{'b'}),(3,\texttt{'c'})] == Just\ \texttt{'c'}$
$lookup\ 0\ [(1,\texttt{'a'}),(2,\texttt{'b'}),(3,'\texttt{'c'}] == Nothing$

Zipping

$zip :: [a] \to [b] \to [(a,b)]$
$zip\ [1,2,3]\ \texttt{"abc"} == [(1,\texttt{'a'}),(2,\texttt{'b'}),(3,\texttt{'c'})]$

$zipWith :: (a \to b \to c) \to [a] \to [b] \to [c]$
$zipWith\ (+)\ [1,2,3]\ [2,3,4] == [3,5,7]$

$unzip :: [(a,b)] \to ([a],[b])$
$unzip\ [(1,\texttt{'a'}),(2,\texttt{'b'}),(3,\texttt{'c'})] == ([1,2,3],\texttt{"abc"})$

List Transformation

$group :: Eq\ a \Rightarrow [a] \to [[a]]$
$group\ \texttt{"Mississippi"} ==$
$[\texttt{"M"},\texttt{"i"},\texttt{"ss"},\texttt{"i"},\texttt{"ss"},\texttt{"i"},\texttt{"pp"},\texttt{"i"}]$

$intersperse :: a \to [a] \to [a]$
$intersperse\ \texttt{','}\ \texttt{"abcde"} == \texttt{"a,b,c,d,e"}$

$transpose :: [[a]] \to [[a]]$
$transpose\ [[1,2,3],[4,5,6]] == [[1,4],[2,5],[3,6]]$

$inits :: [a] \to [[a]]$
$inits\ [1,2,3] == [[],[1],[1,2],[1,2,3]]$

$tails :: [a] \to [[a]]$
$tails\ [1,2,3] == [[1,2,3],[2,3],[3],[]]$