

Homework Assignment 3 – Solutions

October 20, 2013

1 List splits

```
ghci 1> let {split :: [a] -> [(a), [a]]};  
        split [] = [([]), []];  
        split (x : xs) = [(x : ys, zs) | (ys, zs) <- split xs]
```

```
ghci 2> split [1..5]  
[([] , [1,2,3,4,5]), ([1], [2,3,4,5]), ([1,2], [3,4,5]), ([1,2,3], [4,5]), ([1,2,3,4], [5]), ([1,2,3,4,5], [])]
```

2 List permutations

```
ghci 3> let {perm :: [a] -> [[a]];  
        perm [] = [[]];  
        perm (x : xs) = [ys ++ [x] ++ zs | perm_xs <- perm xs, (ys, zs) <- split perm_xs]}
```

```
ghci 4> perm [1..5]
```

```
[[1,2,3,4,5],[2,1,3,4,5],[2,3,1,4,5],[2,3,4,1,5],[2,3,4,5,1],[1,3,2,4,5],[3,1,2,4,5],[3,2,1,4,5],[3,2,4,1,5],[3,2,4,5,1],[1,3,4,2,5],[3,1,4,2,5],[3,4,1,2,5],[3,4,2,1,5],[3,4,2,5,1],[1,3,4,5,2],[3,1,4,5,2],[3,4,1,5,2],[3,4,5,1,2],[3,4,5,2,1],[1,2,4,3,5],[2,1,4,3,5],[2,4,1,3,5],[2,4,3,1,5],[2,4,3,5,1],[1,4,2,3,5],[4,1,2,3,5],[4,2,1,3,5],[4,2,3,1,5],[4,2,3,5,1],[1,4,3,2,5],[4,1,3,2,5],[4,3,1,2,5],[4,3,2,1,5],[4,3,2,5,1],[1,4,3,5,2],[4,1,3,5,2],[4,3,1,5,2],[4,3,5,1,2],[4,3,5,2,1],[1,2,4,5,3],[2,1,4,5,3],[2,4,1,5,3],[2,4,5,1,3],[2,4,5,3,1],[1,4,2,5,3],[4,1,2,5,3],[4,2,1,5,3],[4,2,5,1,3],[4,2,5,3,1],[1,4,5,2,3],[4,1,5,2,3],[4,5,1,2,3],[4,5,2,1,3],[4,5,2,3,1],[1,4,5,3,2],[4,1,5,3,2],[4,5,1,3,2],[4,5,3,1,2],[4,5,3,2,1],[1,2,3,5,4],[2,1,3,5,4],[2,3,1,5,4],[2,3,5,1,4],[2,3,5,4,1],[1,3,2,5,4],[3,1,2,5,4],[3,2,1,5,4],[3,2,5,1,4],[3,2,5,4,1],[1,3,5,2,4],[3,1,5,2,4],[3,5,1,2,4],[3,5,2,1,4],[3,5,2,4,1],[1,3,5,4,2],[3,1,5,4,2],[3,5,1,4,2],[3,5,4,1,2],[3,5,4,2,1],[1,2,5,3,4],[2,1,5,3,4],[2,5,1,3,4],[2,5,3,1,4],[2,5,3,4,1],[1,5,2,3,4],[5,1,2,3,4],[5,2,1,3,4],[5,2,3,1,4],[5,2,3,4,1],[1,5,3,2,4],[5,1,3,2,4],[5,3,1,2,4],[5,3,2,1,4],[5,3,2,4,1],[1,5,3,4,2],[5,1,3,4,2],[5,3,1,4,2],[5,3,4,1,2],[5,3,4,2,1],[1,2,5,4,3],[2,1,5,4,3],[2,5,1,4,3],[2,5,4,1,3],[2,5,4,3,1],[1,5,2,4,3],[5,1,2,4,3],[5,2,1,4,3],[5,2,4,1,3],[5,2,4,3,1],[1,5,4,2,3],[5,1,4,2,3],[5,4,1,2,3],[5,4,2,1,3],[5,4,2,3,1],[1,5,4,3,2],[5,1,4,3,2],[5,4,1,3,2],[5,4,3,1,2],[5,4,3,2,1]]
```

```
ghci 5> length (perm [1..5])
```

```
120
```

3 Permutations of texts

Display 10 permutations of the words in the second sentence of the following text (from the Penn Treebank, WSJ section):

```
ghci 6> let text = "Pierre Vinken , 61 years old , will join the board " ++  
  "as a nonexecutive director Nov. 29 .\nMr. Vinken " ++  
  "is chairman of Elsevier N.V. , the Dutch publishing group ."
```

```
ghci 7> let ws_sent2 = words ((lines text) !! 1)
```

ghci 8> *take 10 (perm ws_sent2)*

```
[["Mr.", "Vinken", "is", "chairman", "of", "Elsevier", "N.V.", "", "the", "Dutch",  
"publishing", "group", "."], ["Vinken", "Mr.", "is", "chairman", "of", "Elsevier",  
"N.V.", "", "the", "Dutch", "publishing", "group", "."], ["Vinken", "is", "Mr.",  
"chairman", "of", "Elsevier", "N.V.", "", "the", "Dutch", "publishing", "group",  
"."], ["Vinken", "is", "chairman", "Mr.", "of", "Elsevier", "N.V.", "", "the", "Dutch",  
"publishing", "group", "."], ["Vinken", "is", "chairman", "of", "Mr.", "Elsevier",  
"N.V.", "", "the", "Dutch", "publishing", "group", "."], ["Vinken", "is", "chairman",  
"of", "Elsevier", "Mr.", "N.V.", "", "the", "Dutch", "publishing", "group", "."],  
["Vinken", "is", "chairman", "of", "Elsevier", "N.V.", "Mr.", "", "the", "Dutch",  
"publishing", "group", "."], ["Vinken", "is", "chairman", "of", "Elsevier", "N.V.", "",  
"Mr.", "the", "Dutch", "publishing", "group", "."], ["Vinken", "is", "chairman", "of",  
"Elsevier", "N.V.", "", "the", "Mr.", "Dutch", "publishing", "group", "."], ["Vinken",  
"is", "chairman", "of", "Elsevier", "N.V.", "", "the", "Dutch", "Mr.", "publishing",  
"group", "."]]
```

ghci 9> *take 5 (drop 500 (perm ws_sent2))*

```
[["chairman", "of", "Vinken", "Elsevier", "is", "N.V.", "Mr.", "", "the", "Dutch",  
"publishing", "group", "."], ["chairman", "of", "Vinken", "Elsevier", "is", "N.V.",  
"", "Mr.", "the", "Dutch", "publishing", "group", "."], ["chairman", "of", "Vinken",  
"Elsevier", "is", "N.V.", "", "the", "Mr.", "Dutch", "publishing", "group", "."],  
["chairman", "of", "Vinken", "Elsevier", "is", "N.V.", "", "the", "Dutch", "Mr.",  
"publishing", "group", "."], ["chairman", "of", "Vinken", "Elsevier", "is", "N.V.",  
"", "the", "Dutch", "publishing", "Mr.", "group", "."]]
```

ghci 10> *take 5 (drop 20000 (perm ws_sent2))*

```
[["Elsevier", "chairman", "Vinken", "of", "N.V.", "", "Mr.", "the", "Dutch", "is",  
"publishing", "group", "."], ["Elsevier", "chairman", "Vinken", "of", "N.V.", "",  
"the", "Mr.", "Dutch", "is", "publishing", "group", "."], ["Elsevier", "chairman",  
"Vinken", "of", "N.V.", "", "the", "Dutch", "Mr.", "is", "publishing", "group", "."],  
["Elsevier", "chairman", "Vinken", "of", "N.V.", "", "the", "Dutch", "is", "Mr.",  
"publishing", "group", "."], ["Elsevier", "chairman", "Vinken", "of", "N.V.", "",  
"the", "Dutch", "is", "publishing", "Mr.", "group", "."]]
```