CS350 2018-19 Homework 1

Due Date: August 24, 2018

---

1 Write Oz declarative functions to perform the following operations.

a {Take L N} forms a list consisting of the first N elements of the list L. Assume that N is non-negative. For example, {Take [1 2 3] 2} should evaluate to [1 2]. If N is greater than the length of the list, then return the entire list. [10 points]

b {Drop L N} forms a list consisting of all but the first N elements of the list L. Assume that N is non-negative. If N is greater than the length of the list, then return the empty list. [10 points]

c {Zip L1 L2} evaluates a list of lists where each inner list consists of two elements - the first element from L1 and the second from L2. Handle boundary cases in a meaningful manner. [10 points]

d {Freq L W} is a function which takes a list L of literals and a literal W. It should return the number of times W occurs in L. Write the function in a recursive manner without using helper functions. [10 points]

e Rewrite the above function using only Map and FoldR [10 points]

f {FoldL B L Id} is a function which takes a binary operator B, a list L and the identity of the binary operator, Id. It performs the left-associative fold. For example, {FoldL Sum [1 2 3] 0} should evaluate to {{{Sum 0 1} 2} 3}. [10 points]

g Define Map using FoldR. [10 points]

2 A partition of a positive integer N is a set of integers such that their sum is N. For example, the partitions of 3 are precisely the sets

$$\{3\}, \{1, 2\}, \{1, 1, 1\}.$$

In this question, define a function {NumPartition N} which evaluates to the number of partitions of N. [15 points]

3 A formal power series in a variable x is an infinite series of the form

$$a_0 x_0 + a_1 x^1 + a_2 x^2 + \ldots$$

This can be represented using the list [a_0 a_1 $\ldots$].

a Write a function {SumSeries Xs Ys} which when given two formal power series Xs and Ys, returns their sum. [10 points]

b Write a function {ProductSeries Xs Ys} which when given two formal power series Xs and Ys, returns the product series. [15 points]