CS 350 2020-21 Homework 1

Instructions

- This assignment must be done individually.
- Please create and share your repository with the instructor and the TAs.

1. Programming with Lists

1.1. Take

Write an Oz function **Take** which takes two arguments, a list
.B Xs and a number **N** and evaluates to the first **N** elements of the list if **N** is a positive number less than the list length, to nil if **N** is either 0 or negative, and evaluates to the whole list if the list is shorter than **N**

[10 points]

1.2. Last

Write an Oz function **Last** which takes two arguments, a list **Xs** and a number **N** and evaluates to the last **N** elements of the list if **N** is a positive number at most the list length, to nil if **N** is either 0 or negative, and evaluates to the whole list if **N** is longer than the list.

[10 points]

1.3. Merge

Write an Oz function **Merge** which takes two sorted lists of integers as arguments, and evaluates to a merged list in sorted order. The two lists need not be of equal length.

[10 points]

2. Higher-Order Programming

2.1. ZipWith

Write an Oz function **ZipWith** which takes 3 arguments - the first, a 2-argument function **BinOp** followed by two lists, **Xs** and **Ys** , and outputs the list whose i^{th} position is got by evaluating **BinOp** on the ith elements in **Xs** and **Ys.**

[15points]

2.2. Map Using FoldR

Rewrite **Map** using **FoldR**

[15points]

2.3. FoldL

Write an Oz function **FoldL** which folds a binary operation from the left. For example,

```
{FoldL Sum [1 2 3] 0}
```

should evaluate to

```
{Sum {Sum {Sum 0 1} 2} 3}.
```

[10 points]

3.

3.1.

Write a lazy Oz function to generate the Taylor series for $sin(x)$. Write the function to produce a list of successive terms in the Taylor series.

[10 points]

3.2.

Write a function **{Approximate S Epsilon}** which takes a Taylor series **S** and evaluates it until the point where successive terms differ from each other by at most **Epsilon.** It should then return the sum of the terms taken until then. The series **S** may have infinitely many terms.

[10 points]

4. Suppose a square matrix

$$a_{11} \quad a_{12} \quad a_{13}$$
$$a_{21} \quad a_{22} \quad a_{23}$$
$$a_{31} \quad a_{32} \quad a_{33}$$

is represented in row-major manner as

```
[[a11 a12 a13]
 [a21 a22 a23]
 [a31 a32 a33]].
```

Write an Oz function **{IsDiagonal M}** which takes a square matrix represented in row-major manner, and returns true if it is a diagonal matrix, and false otherwise. You can assume that **M** is always a square matrix, but it need not be a 3×3 matrix.

[15 points]