

CS 350 2015-16 Homework 1

Instructions

- Due Date: August 24, 2015 11:59 PM
- Kindly program in the declarative sequential model. Please do not use **Cells**.

1. Programming with Lists

1.1. Take

Write an Oz function **Take** which takes two arguments, a list **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. Drop

Write an Oz function **Drop** 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 less than the list length, to the whole list if **N** is either 0 or negative, and evaluates to nil 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 i^{th} elements in **Xs** and **Ys**.

[15 points]

2.2. Map Using FoldR

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

[15 points]

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. Lazy Programming

3.1. Taylor Series

Write an Oz function which will evaluate to yield the Taylor Series for $\sin(x)$.

[10 points]

3.2. Termination Criteria

3.2.1.

Write a function, which for a given argument x and a positive integer N , evaluates the first N terms of the Taylor Series of $\sin(x)$.

[10 points]

3.2.2.

Write a function, which, for a given argument x and error ϵ , will evaluate the Taylor

series for $\sin(x)$ until the adjacent terms get within ϵ of each other. The output should be the series truncated to those many terms.

[10 points]

3.3. Tic-Tac-Toe

A tic-tac-toe position is a nested list of 3 lists containing 3 elements each. Each element can be a s, o or an x (all small letters, hence literals, representing space, nought or a cross respectively). For example,

```
[[s s s] [s s o] [s s x]]
```

represents the grid

		o
		x

3.3.1.

Write an Oz function, which, if given such a list, outputs o if the "o" player has won in the given position, x if the "x" player has won and "draw" otherwise.

[15 points]

3.3.2.

Write an Oz function, which, given a position and either o or x, will output a list of all possible positions resulting from a single move of that player.

For example, if the position is

```
[[o o s] [x o x] [x o s]]
```

the output should be

```
[ [[o o o] [x o x] [x x s]]
  [[o o s] [x o x] [x x o]]]
```

[20 points]