PROGRAMMING IN HASKELL

Chapter 4.4 – Closures and Partial Functions

First Class Functions.. recall

```
inc :: Num a => a -> a
inc n = n + 1
```

```
double :: Num a => a -> a
double n = n * 2
```

```
square :: Num a => a -> a
square n = n ^ 2
```

```
ifEven :: Integral a => (a->a) -> a -> a
ifEven f n =
  if even n
   then f n
   else n
```

However, we are still repeating code

```
*Main> ifEven square 4
16
*Main> ifEven inc 4
5
*Main> ifEven inc 5
5
*Main> ifEven double 4
8
*Main> ifEven double 5
5
*Main> ifEven square 4
16
*Main> ifEven square 5
5
```

Use of lambdas leading to closures

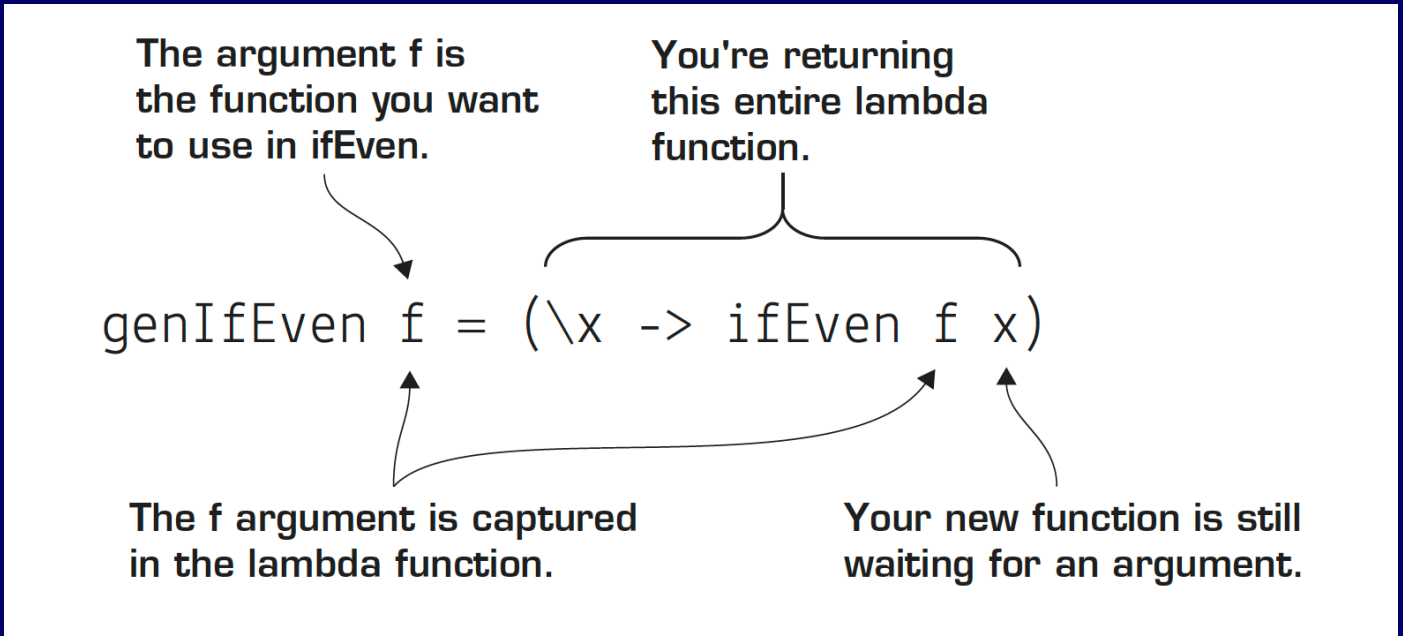
We would like to write a function that will return ifEvenX (where x is double etc.).

We introduce genIfEven:

```
genIfEven :: Integral a => (a -> a) -> a -> a
genIfEven f = (\x -> ifEven f x)
```

Closures

How this works:



You pass in a function and return a lambda function. The function f is captured inside the lambda function. When you capture a value inside a lambda function, this is referred to as a *closure.*

Example – genIfEven inc

```
ifEvenInc = genIfEven inc

(\x -> ifEven f x)

(\x -> ifEven inc x)

ifEvenInc = (\x -> ifEven inc x)
```

Closures and Partial Application

Closures are powerful and useful. But the use of lambda function to create the closure can make it less clear.
We can use Partial Application which is cleaner and easier to read

```
add4 :: Num n => n -> n -> n -> n -> n
add4 a b c d = a + b + c + d

addXto3 :: Num n => n -> n -> n -> n -> n
addXto3 x = (\b c d -> add4 x b c d)

addXYto2 :: Num n => n -> n -> n -> n -> n
addXYto2 x y = (\c d -> add4 x y c d)
```

Closures and Partial Application

```
mystery = add4 5
```

This returns a function that expects the remaining 3 arguments.

```
anotherMystery = add4 5 4
```

This returns a function that expects two arguments.

This is called Partial Application and is clearer to the reader.


ANY
QUESTIONS?

Reference

Based on material from ‘Get Programming in Haskell’, Will Kurt.