Assignment 1

Paul Vrbik : 301056796 : CMPT 731 : Fall 2006

October 4, 2006

Assignment 2

Question 1.2.4

This can be reduced in two ways:

1. ```
   =add(succ(pred(Zero),Zero)
   =succ(add(pred(Zero),Zero))
   =succ(pred(add(Zero,Zero)))
   =succ(pred(Zero)
   =Zero
   ```

2. ```
   =add(succ(pred(Zero)),Zero)
   =add(Zero,Zero)_
   =Zero
   ```

Question 1.3.2

Suppose f and g are strict then we have that $f\perp = \perp$ and $g\perp = \perp$,

$$\begin{aligned}
&\Rightarrow h\perp = f(g\perp) = f\perp = \perp \\
&\Rightarrow h\perp = \perp \\
&\Rightarrow \text{h is strict}
\end{aligned}$$

Question 1.4.3

```
mylog :: Float -> Float -> Float
mylog x b = log(x)/log(b)
```

Question 1.4.7

```
uncurry :: (a->b->t) -> ((a,b)->t)
uncurry g (x,y) = g x y
```

Question 1.6.2

Defining $\texttt{swap}(\mathrm{x},\mathrm{y}) = (\mathrm{y},\mathrm{x})$ we verify:

```
flip(curry f) x y = (curry f) y x = f(y,x)

curry(f.swap) x y = (f.swap)(x,y) = f(swap(x,y))=f(y,x)
```

Question 2.4.1

```
=cross(f,g).cross(h,k)
=cross(f,g).pair(h.fst,k.snd)        (by defn. of cross)
=pair(f.h.fst,g.k.snd)               (by property 3)
=cross(f.h,g.k)                      (by defn. of pair)
```

Question 2.4.3

```
age (d1,m1,y1) (d2,m2,y2)
        | m1>m2                       = y1-y2
        | (d1>=d2) && (m1==m2)        = y1-y2
        | otherwise                   = (y1-y2)-1
```

Question 2.5.1

```
case2 (Left x) = 1
case2 (Right x) = 2
```

Question 2.5.2

```
=case(f,g).plus(h,k)
=case(f,g).case(Left.h,Right.k) (by defn.)
=case(case(f,g).Left.h,case(f,g).Right.l) (by prop. 3)
=case(f.h,g.k) (by prop 1. and prop 2)
```

Question 3.2.4

Let $\Pi(p)$ be the proposition $\Pi(p) \Leftrightarrow (m+n)+p = m+(n+p)\ \forall m,n \in \mathbb{N}$ where $p \in \mathbb{N}$.

Base: $\Pi(0)$

Utilizing the definition $x+0=x$ for $p=0$ we have

$$\text{LHS} = (m+n)+0 = (m+n) = m+n$$
$$\text{RHS} = m+(n+0) = m+(n) = m+n$$

So $\Pi(0)$ is true.

Assumption: We will assume $\Pi(p)$, that is, $(m+n)+p = m+(n+p)\ \forall m,n \in \mathbb{N}$.

Induction step: (Show $\Pi(P) \Rightarrow \Pi(suc(p))$)

$$\begin{aligned}
&= (m+n)+suc(p) \\
&= suc((m+n)+p) \text{ by defn. of } + \\
&= suc(m+(n+p)) \text{ by assumption} \\
&= m+suc(n+p) \text{ by defn. of } + \\
&= m+(n+succ(p))
\end{aligned}$$

So we have that $\Pi(p) \Rightarrow (m+n)+suc(p) = m+(n+succ(p)) \Rightarrow \Pi(suc(p))$. So by induction we have that $\Pi(p)\ \forall p \in \mathbb{N}$ as desired.