Types and Programming Languages week4

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1 Pierce Exercises: 5.2.1*, 5.2.3, 5.2.4, 5.2.5, 5.2.6

5.2.1* Define logical or and not functions.

or:

$\lambda ab.aTb$ = or

$\lambda xy.x$ = true

$\lambda xy.y$ = false

$\lambda ab.aTb(T)(T)$	$\lambda ab.aTb(T)(F)$	$\lambda ab.aTb(F)(T)$	$\lambda ab.aTb(F)(F)$
$\lambda b.TTb(T)$	$\lambda b.FTb(T)$	$\lambda b.TTb(F)$	$\lambda b.FTb(F)$
TTT	FTT	TTF	FTF
$\lambda xy.x(T)(T)$	$\lambda xy.y(T)(T)$	$\lambda xy.x(T)(F)$	$\lambda xy.y(T)(F)$
$\lambda y.T(T)$	$\lambda y.y(T)$	$\lambda y.T(F)$	$\lambda y.y(F)$
T	T	T	F

not: (not done... lost)

$\lambda ab.aFb(T)(T)$	$\lambda ab.aFb(F)(F)$
$\lambda b.TFb(T)$	$\lambda b.FTb(F)$
TFT	FTF
$\lambda xy.x(F)(T)$	$\lambda xy.y(T)(F)$
$\lambda y.F(T)$	
F	

5.2.3 Is it possible to define multiplication on Church numerals without using plus?

Yes you want to create a function that iterates n times for m. I know I have done it before just don't fully remember. Addition is easier

5.2.4 Define a term for raising one number to the power of another.

$$\lambda nm.nm$$

$$\lambda nm.(nm)(\text{two})(\text{three})$$

$$\lambda m.(\text{two})m(\text{three})$$

$$(\text{two})(\text{three})$$

$$(f(fx))(f(f(fx)))$$

uhhhh....

5.2.5 Use prd to define a subtraction function.

5.2.6