

CS263. Homework Assignment 5

(Solutions due March 8)

March 1, 2007

Exercise 1: Show the encoding of the predecessor function in lambda-calculus, using the encoding of natural numbers that we have given in class. The predecessor of 0 should be 0. Please do not write your solution as a big mess of lambdas. Use intermediate functions (like we did for `add` and `succ`) that make it easy to understand how your encoding works.

Exercise 2: Show that a combinator that can be written only with K and I always has a normal-form in normal-order evaluation.

Exercise 3: Consider a fixed combinator f . Write a combinator A_f (using only the combinators S , K , I , and f), with the property that $A =_{\beta} \lambda x.f(xx)$. The combinator A plays a role in the encoding of combinator Y from lecture.

Exercise 4: Show how you can encode lists in lambda-calculus. Show the encoding of `nil` (empty list), `cons` (prepend an element to a list), `length` (return the natural number representing the length of a list), and `append`. Please keep it simple.