Computability and Complexity
Jacobs University Bremen
Dragi Kamov and Dushan Terzikj

Course: CO21-320352
April 9, 2019

Homework 8

Exercise 1

Solution:
$LISTSUM = 4(lgl(if(null\ l)0(add(head\ l)(g(tail\ l)))))$
Reference: Ana Ambroladze

Exercise 2

Solution:
The λ-term **sortincreasing** is applied to a list of Church numerals which returns a list with the same elements in ascending order. The λ-term is defined the following way (we use the Y-combinator):

$$\begin{aligned}\textbf{sortincreasing} \equiv & Y(\lambda bcd.(\lambda fx.f(xx)) \\ & (\lambda fx.f(xx))(\lambda ef.f(\lambda ghi.g(\lambda j.h(\lambda kl.kj(ikl))) \\ & (hi))e(\lambda gh.h))(\lambda e.d)(\lambda e.b(\lambda f.e(f(\lambda ghi.hg)(\lambda gh.cfh)))))\end{aligned}$$

Reference: https://codegolf.stackexchange.com/questions/55231/sort-a-list-of-numbers-on-the-%CE%BB-calculus