CS 5000: Theory of Computability
Assignment 9

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1 Learning Objectives

1. Programming Language L

2. Partially Computable and Computable Functions

Problem 1 (2 points)

Let $f(x_1, ..., x_n)$ be a p.c. function. Show that f is computed by infinitely many L-programs whose length $l \geq k$, for some natural number $k \geq 0$. This problem offers a mathematical justification, after a fashion, of the TIMTOWTDI (there is more than one way to do it) principle to which some software engineers and architects adhere.

Problem 2 (2 points)

An L-program is a *straightline* if it contains no instructions, labeled or unlabeled, of the form `IF V != 0 GOTO L`, for some label `L`. Show that if `P` is a straightline L-program of length k, for some natural number k, then $\Psi_P^{(1)}(x) \leq k$.

Problem 3 (1 point)

This problem will give you a flavor of the formal theory of compilation. Let $L++$ be a programming language that extends the programming language L by adding one instruction $V \leftarrow k$, where k is a natural number. Show that a function is p.c. in $L++$ if and only if it is p.c.

What to Submit?

Save your solutions in hw09.pdf and submit it in Canvas.