

Theory of Computing – Assignment 3

1. Write a program in your favorite programming language that outputs its own code. Do not use any file system operations.
2. Which of the following are decidable languages? Prove your answer
 - (a) $L_1 = \{\langle M \rangle \mid L(M) = \overline{L(M)}\}$.
 - (b) $L_2 = \{\langle M \rangle \mid L(M) = \{0, 00, 000\}\}$.
 - (c) $L_3 = \{\langle M \rangle, \langle N \rangle \mid L(M) = L(N)\}$.
 - (d) $L_4 = \{\langle M \rangle \mid M(\lambda) \text{ eventually enters state } q_5\}$.
 - (e) $L_5 = \{\langle M \rangle \mid \text{For all inputs } x, M(x) \text{ takes at most 5000 steps}\}$.
3. Show that for any random-access Turing machine using time $t(n)$ can be simulated by a multi-tape Turing machine using time $t^k(n)$ for some constant k .
4. Show for every acceptable language A there is a language B in $\text{DTIME}(O(n^2))$ such that

$$x \in A \text{ if and only if there exists a } y \in \Sigma^* \text{ such that } (x, y) \in B.$$

Hint: Let $y = 1^t$ where t is the amount of time for a Turing machine to accept A .