

CS 3500: Introduction to the Theory of Computation

Problem Set 4

Problem 1 [20 Points]

Problem 5.9 on page 195 of Sipser.

Problem 2 [20 Points]

Problem 5.12 on page 195 of Sipser.

Problem 3 [80 Points]

For each of the following languages, determine whether it is *decidable*, and prove your answer.

1. $L_1 = \{\langle N, k \rangle : N \text{ is a NFA and } L(N) \text{ contains a string of length } k\}$.
2. $L_2 = \{\langle M \rangle : M \text{ is a Turing Machine and } L(M) \text{ is context-free}\}$.
3. $L_3 = \{\langle M \rangle : M \text{ is a Turing Machine and } L(M) \text{ is finite}\}$.
4. $L_4 = \{\langle M, T, w \rangle : M \text{ is a TM, } T \text{ is a computable function, and } M \text{ accepts } w \text{ in } T(|w|) \text{ steps}\}$.