

CPSC 351 — Tutorial Exercise #15

Additional Practice Problem

This problem will not be discussed during the tutorial, and solutions for this problem will not be made available. It can be used as a “practice” problem that can help you practice skills considered in the lecture presentation for Lectures #15–17, or in Tutorial Exercise #15.

1. Consider the following decision problem:

The Language Subset Problem

Instance: A pair of Turing machines, M_1 and M_2 , with the same input alphabet

Question: Is $L(M_1)$ a subset of $L(M_2)$?

Suppose that instances of this problem are encoded as strings over an alphabet Σ_{2TM} as described in the lecture presentation for Lecture #17, so that Pair_{TM} is the language of instances of this decision problem (just as it was for the decision problem considered in that lecture presentation). Let $\text{Subset}_{TM} \subseteq \text{Pair}_{TM}$ be the language of Yes-instances of this decision problem.

Prove that the Language Subset Problem is undecidable. That is, prove that the language Subset_{TM} is undecidable.