

CS 341 Automata Theory
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Homework 12
Due: Tuesday, April 10

This assignment covers Chapter 20.

1) * Let L_1, L_2, \dots, L_k be a collection of languages over some alphabet Σ such that:

- For all $i \neq j$, $L_i \cap L_j = \emptyset$.
- $L_1 \cup L_2 \cup \dots \cup L_k = \Sigma^*$.
- $\forall i$ (L_i is in SD).

Prove that each of the languages L_1 through L_k is in D .

Proof.

□

2) If L_1 and L_3 are in D and $L_1 \subseteq L_2 \subseteq L_3$, what can we say about whether L_2 is in D ?

Answer.

□

3) Let M be a Turing machine that lexicographically enumerates the language L . Prove that there exists a Turing machine M' that decides L^R .

Proof.

□

4) Construct a standard one-tape Turing machine M to enumerate the language $A^n B^n$. Assume that M starts with its tape equal to \square . Also assume the existence of the printing subroutine P , defined in Section 20.5.1.

Solution.

□

5) Recall the function mix , defined in Example 8.23. Neither the regular languages nor the context-free languages are closed under mix . Are the decidable languages closed under mix ? Prove your answer.

Answer.

□

Proof.

□

6) Let $\Sigma = \{a, b\}$. Consider the set of all languages over Σ that contain only even length strings.

a) How many such languages are there?

Answer.

□

b) How many of them are semidecidable?

Answer.

□