

050.371/671 — Formal Methods in Cognitive Science
Problem Set 4
Due April 19, 2000

Problem 1

Part A Suppose that \mathcal{L} is an unidentifiable collection of languages. Argue that any \mathcal{L}' for which $\mathcal{L} \subseteq \mathcal{L}'$ is also not identifiable.

Part B Conclude on the basis of part A that $RE = \{W_i \mid i \in \mathbb{N}\}$ is not identifiable.

Problem 2

Part A Let \mathcal{L} be an identifiable collection of infinite languages. Show that if $L_0 \in \mathcal{L}$, then there is an $x_0 \in L_0$ such that $L = L_0 - x_0$ is not in \mathcal{L} .

Part B Use the result from part A to show that for any identifiable collection of infinite languages \mathcal{L} , there is some infinite language $L \notin \mathcal{L}$ such that $\mathcal{L} \cup \{L\}$ is identifiable. (Hint: modify the learning function ϕ that identifies \mathcal{L} to identify $\mathcal{L} \cup \{L\}$ for the L given in part A.)

Problem 3

Show that there are identifiable collections of languages \mathcal{L} and \mathcal{L}' for which $\mathcal{L} \cup \mathcal{L}'$ is not identifiable.

Problem 4

A learning function φ is *conservative* just in case for all $\sigma \in \text{SEQ}$, if $\text{rng}(\sigma) \subseteq W_{\varphi(\sigma^-)}$, then $\varphi(\sigma) = \varphi(\sigma^-)$. Show that $[\mathcal{F}^{\text{conservative}}] \cap [\mathcal{F}^{\text{recursive}}] \not\subseteq [\mathcal{F}^{\text{consistent}}] \cap [\mathcal{F}^{\text{recursive}}]$ by exhibiting a class of languages that is identifiable by a computable conservative learner, but not by a computable consistent learner.