

Lecture #14: Oracle Reductions

What Will Happen During the Lecture

Remember... You Had Homework!

Students were asked to work through the following set of lecture notes before this lecture.

- Lecture Notes — “Oracle Reductions”.

As always, you may attend the lecture presentation if you have not worked through this material ahead of time — but it will not be repeated for you, and you might get a little bit lost, during the presentation, if you haven’t worked through this.

Problems To Be Solved

Two problems will be solved. If you have time then you should try to solve the first one after you have completed the preparatory reading for this lecture but before you attend the lecture presentation.

1. Let $\Sigma = \{a, b, c\}$, let $L \subseteq \Sigma^*$, and let

$$L_a = \{\omega \in \Sigma^* \mid \omega \in L \text{ and } \omega \text{ ends with “a”}\}.$$

Prove that $L_a \preceq_O L$.

2. Consider the language $\text{LOOP}_{\text{TM}} \subseteq \Sigma_{\text{TM}}^*$, including encodings of Turing machines M and input strings ω for M such that M **loops** on ω .

Establish an oracle reduction, involving LOOP_{TM} and some other language, that can be used to prove that the language LOOP_{TM} is undecidable.