

# CPSC 351 — Tutorial Exercise #12

## Additional Practice Problems

### About These Problems

These problems will not be discussed during the tutorial, and solutions for these problems will not be made available. They can be used as “practice” problems that can help you practice skills considered in the lecture presentation for Lecture #14, or in Tutorial Exercise #12.

### Practice Problems

1. Let  $\Sigma = \{a, b, c, d\}$  and let  $L \subseteq \Sigma^*$ . Show that each of the following languages is oracle-reducible to  $L$ .

(a) The language  $L_{\text{end}} \subseteq \Sigma^*$  that includes all strings in  $\Sigma^*$  the *end* with a string in  $L$  — that is, the language

$$L_{\text{end}} = \{\mu \cdot \nu \mid \mu \in \Sigma^* \text{ and } \nu \in L\}.$$

(b) The language  $L_{\text{xorA}} \subseteq \Sigma^*$  consisting of all strings  $\omega \in \Sigma^*$  which satisfy **exactly one** of the following conditions:

- $\omega$  begins with “a”.
- $\omega \in L$ .

Thus, if  $\mu \in \Sigma^*$  then the string  $a \cdot \mu$  is in  $L_{\text{xorA}}$  if and only if  $a \cdot \mu \notin L$ . On the other hand, the string  $b \cdot \mu$  is in  $L_{\text{xorA}}$  if and only if  $b \cdot \mu \in L$ .