

PROBLEM SET 6  
Due Friday, May 23, 2003, in class

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1. Lewis and Papadimitriou, Problem 3.3.1.
2. Construct PDAs (informal but precise English descriptions will do) that recognize the following languages:
  - (a) The set of strings over the alphabet  $\{a, b\}$  with twice as many  $a$ 's as  $b$ 's.
  - (b) The complement of the language  $\{ww \mid w \in \{a, b\}^*\}$ .
3. Lewis and Papadimitriou, Problem 3.3.3.
4. Using the procedure (alternate proof of Lemma 3.4.2) described *in class* to simulate PDA's by grammars, convert the PDA of Example 3.3.3 in Lewis and Papadimitriou (that accepts precisely the set of strings with an equal number of  $a$ 's and  $b$ 's) into an equivalent context-free grammar. Simplify your grammar by eliminating any useless rules that your grammar may have.
5. Lewis and Papadimitriou, Problem 3.4.6.