Problem Set 5 — Due May 6, 2004

Note: there is a midterm on Friday, May 7. This problem set is due on Thursday, as usual, the day just before.

Problem 1. Give an algorithm to solve the following problem: given a regular expression α, does $L(\alpha)$ contain a string having more a's then b's?

Problem 2. Is the following language regular or not? Prove your answer either way.

$L = \{w \in \{0, 1, 2\}^* : w \text{ has an equal number of 01's and 10's}\}$.

Problem 3. Give a context free grammar for

$$L = \{a^n b^m : n \neq 2m\}.$$

Then describe, informally, an NPDA for the same language.

Problem 4. Consider the grammar $S \rightarrow AA$, $A \rightarrow AAA \mid bA \mid Ab \mid a$.

Part A. Describe, in careful English, the language of this grammar.

Part B. Show that this grammar is ambiguous.

Part C. Devise an unambiguous grammar for the same language and argue, informally, why your grammar is unambiguous.

Problem 5 Prove that the context free languages are closed under reversal: if L is context free, so is L^R.