CSE 2001: Introduction to the Theory of Computation
Tutorial 6, Nov 7, 7 pm

Problems:

1. Is the following language regular: $\{a^n b^{n+1} | n \geq 0\}$?
2. Construct a CFG for the following language $\{a^i b^j | 2i = 3j + 1\}$.
3. Construct a CFG for the following languages:
   (a) All words over $\Sigma = \{a, b, c\}$ in which letters a, b occurs exactly once.
   (b) All words w over $\Sigma = \{a, b\}$ for which $w^R \neq w$.
4. Prove that the following language is not regular.

   $$L = \{a^p | p \text{ is a prime number } \}$$

   Prove that it is not context-free either.
5. Prove that the following language is not regular.

   $$L = \{a^n b^{n^2} | n \geq 0\}$$

   Prove that it is not context-free either.
6. Show that the language $\{0^m 1^n | m, n \geq 0, m \neq 2n + 1\}$ is not regular.
7. Show that $L = \{w \in \{0, 1\}^* | w \text{ has unequal number of 0's and 1's } \}$ is not regular.
8. Consider the following grammar: $S \rightarrow AA, A \rightarrow AAA|Aa|b$. Show that the language generated by this grammar is composed of all words over $\Sigma = \{a, b\}$ with an even number of b's.
9. Problem 1.53, page 91 of the third edition of Sipser.
10. Problem 2.20, page 156 of the third edition of Sipser.
11. Problem 2.31, page 156 of the third edition of Sipser.