CS 310, Assignment 4

Due on 13 March in class

1. Let $\Sigma = \{0, 1\}$. Give a context-free grammar that generate the following language:

$$\{0^{i+k}1^{2i} : k \geq 0, i \geq 2\} + \{0^{2i+k}1^{i+k} : i, k \geq 0\}$$

2. The following grammar with start symbol S generates the language $\{0^i1^j0^k : i = j \text{ or } j = k\}$:

$$S \rightarrow XO \quad S \rightarrow OY \quad O \rightarrow O0 \quad O \rightarrow \varepsilon$$
$$X \rightarrow 0X1 \quad X \rightarrow \varepsilon \quad Y \rightarrow 1X0 \quad Y \rightarrow \varepsilon$$

   (a) Show that this grammar is ambiguous.

   (b) Is this language inherently ambiguous? State your thoughts one way or another (you only need to provide your thoughts, not a proof).

3. Design a *deterministic* pushdown automaton that recognizes the language

$$\{a^i b^k a^{2i} : i, k \geq 1\}$$

   Draw a table that traces the behavior of your pushdown automaton on the input *aabbaaaa* and explain how this input is accepted or rejected (as the case might be).

4. Is the language $L = \{a^i b^i c^j d^i : i \geq 0, j \geq 0\}$ context-free? Prove one way or another.

Make sure you review the submission guidelines posted on the course's Web site before handing in your answers.