Homework Assignment 4

1. Give the CFG that recognizes $L_1 = \{a^i b^j a^k | j = i + k\}$. Hint: Try replacing $j$ by $i + k$ in the set builder expression.

2. Give the CFG that recognizes $L_2 = \{a^i b^j | j = 2i\}$.

3. Create the new start symbol and remove nullable reductions of the following grammar. This exercise concerns step 1 and step 2 of the CNF algorithm taught in class.

   $$C \rightarrow BbA$$
   $$A \rightarrow BAC \mid \epsilon$$
   $$B \rightarrow \epsilon \mid AbA$$

4. Remove the unit transitions from the following grammar. This exercise concerns step 3 of the CNF algorithm taught in class.

   $$A \rightarrow 0 \mid B$$
   $$B \rightarrow BA \mid E$$
   $$C \rightarrow 10A \mid C \mid F$$
   $$D \rightarrow 010 \mid C$$
   $$E \rightarrow A \mid DE$$
   $$F \rightarrow AB \mid DE$$

5. Restructure rules with long ($\geq 3$) righthand side in the grammar below. This exercise concerns step 4 of the CNF algorithm taught in class.

   $$A \rightarrow BCac \mid c \mid aB$$
   $$B \rightarrow AbBA \mid CAB$$
   $$C \rightarrow c \mid d$$