

Homework Assignment 4

1. Give the CFG that recognizes $L_1 = \{a^i b^j a^k \mid j = i + k\}$. *Hint:* Try replacing j by $i + k$ in the set builder expression.
2. Give the CFG that recognizes $L_2 = \{a^i b^j \mid j = 2i\}$.
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.

$$\begin{aligned}C &\rightarrow BbA \\A &\rightarrow BAC \mid \epsilon \\B &\rightarrow \epsilon \mid AbA\end{aligned}$$

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

$$\begin{aligned}A &\rightarrow 0 \mid B \\B &\rightarrow BA \mid E \\C &\rightarrow 10A \mid C \mid F \\D &\rightarrow 010 \mid C \\E &\rightarrow A \mid DE \\F &\rightarrow AB \mid DE\end{aligned}$$

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

$$\begin{aligned}A &\rightarrow BCac \mid c \mid aB \\B &\rightarrow AbBA \mid CAB \\C &\rightarrow c \mid d\end{aligned}$$