

Homework #3

1. Find context-free grammars for the following languages (with $n \geq 0$, $m \geq 0$, $k \geq 0$).

(a) $L = \{a^n b^m c^k : n = m \text{ or } m \neq k\}$

(b) $L = \{a^n b^m c^k : k = n + m\}$

a)

$S \rightarrow AD \mid EB \mid EC$

$A \rightarrow aAb \mid \lambda$

$B \rightarrow bBc \mid bB \mid b$

$C \rightarrow bCc \mid Cc \mid c$

$D \rightarrow Dc \mid \lambda$

$E \rightarrow aE \mid \lambda$

b)

$S \rightarrow aSc \mid A \mid \lambda$

$A \rightarrow bAc \mid \lambda$

2. Find an s-grammar for $L = \{a^n b^{2^n} : n \geq 2\}$.

$S \rightarrow aaAbbbb$

$A \rightarrow aAbb \mid \lambda$

3. Convert the grammar

$S \rightarrow AB \mid aB,$

$A \rightarrow abb \mid \lambda,$

$B \rightarrow bbA$

into Chomsky normal form.

$S \rightarrow AB \mid CB \mid B$

$A \rightarrow CD$

$B \rightarrow DA$

$C \rightarrow a$

$D \rightarrow EE$

$E \rightarrow b$

4. Convert the grammar

$S \rightarrow ABb \mid a \mid b$

$A \rightarrow aaA \mid B$

$B \rightarrow bAb$

into Greibach normal form.

$S \rightarrow aC|a|b$
 $C \rightarrow aABD$
 $A \rightarrow aDA|bAE$
 $B \rightarrow bAE$
 $D \rightarrow a$
 $E \rightarrow b$