

CS3133

HW#4

DUE: Friday, September 16

1. (8 points) Consider the CFG

$$S \rightarrow ABS \mid AB$$

$$A \rightarrow 0A \mid 0$$

$$B \rightarrow 1A$$

For each of the following strings, either give a parse tree to show that it belongs to $L(G)$ or reasons that it does not belong.

a 001001

b 000010

c 001100

d 010010

2. (6 points) Give context-free grammars to generate the following languages:

a $\{0^n 1^m 0^n \mid m, n \geq 0\}$

b $\{a^m b^{2m} c^n \mid m, n \geq 0\}$

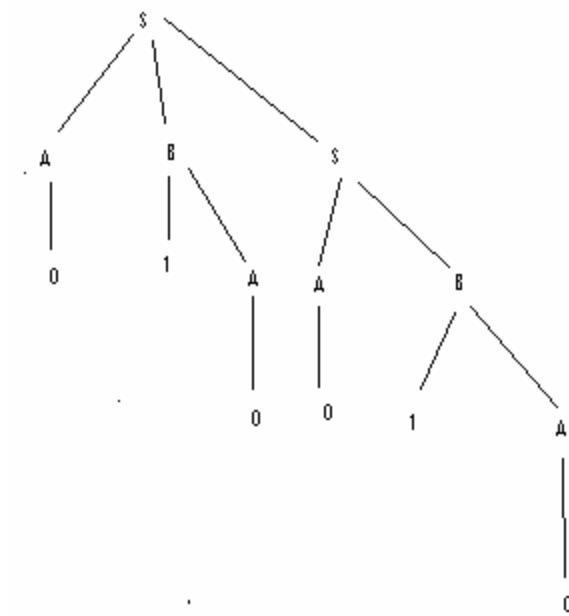
3. (8 points) Give a grammar without ε -productions or unit productions to generate $L(G) - \{\varepsilon\}$, where G is the context-free grammar

$$S \rightarrow 0S11 \mid A$$

$$A \rightarrow 1A00 \mid S \mid \varepsilon$$

4. (3 points) Give a grammar in Chomsky Normal Form to generate the same language as the grammar without ε -productions or unit productions you constructed in Problem 3

d



2. *a*

$$S \rightarrow 0A0 \mid \varepsilon$$

$$A \rightarrow 1A \mid \varepsilon$$

b

$$S \rightarrow AB \mid \varepsilon$$

$$A \rightarrow aAbb \mid \varepsilon$$

$$B \rightarrow cB \mid \varepsilon$$

3. *Nullable* = {A, S}

Removing ε -productions,

$$S \rightarrow 0S11 \mid 011 \mid A$$

$$A \rightarrow 1A00 \mid 100 \mid S$$

$$\text{CHAIN}(S) = \{S, A\}$$

$$\text{CHAIN}(A) = \{S, A\}$$

$$S \rightarrow 0S11 \mid 011 \mid 1A00 \mid 100$$

$$A \rightarrow 1A00 \mid 100 \mid 0S11 \mid 011$$

4.

$$S \rightarrow A_0Z_1 \mid A_0Z_2 \mid A_1Z_3 \mid A_1Z_4$$

$$Z_1 \rightarrow SZ_2$$

$$Z_2 \rightarrow A_1A_1$$

$$Z_3 \rightarrow AZ_4$$

$$Z_4 \rightarrow A_0A_0$$

$$A \rightarrow A_1Z_3 \mid A_1Z_4 \mid A_0Z_1 \mid A_0Z_2$$

$$A_0 \rightarrow 0$$

$$A_1 \rightarrow 1$$