CS3311 Homework 8

Due date: Wednesday, October 27, 2010, in class

The answers, comments, and programs (if any) must be the original work of the author. While discussion with others is permitted and encouraged, the final work should be done individually. You are not allowed to work in groups. You are allowed to build on the material supplied in the class. If you use any other source than the class notes and the textbook, specify it clearly.

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1. *(20 points)* Convert the grammar G

$$\begin{aligned} &S \rightarrow aAbB \mid ABC \mid a \\ &A \rightarrow aA \mid a \\ &B \rightarrow bBcC \mid b \\ &C \rightarrow abc \end{aligned}$$

to Chomsky normal form. G already satisfies the conditions on the start symbol S, λ-rules, useless symbols, and chain rules.

2. *(30 points)* Convert the grammar G

$$\begin{aligned} &S \rightarrow ABC \mid \lambda \\ &A \rightarrow aA \mid a \\ &B \rightarrow bB \mid A \\ &C \rightarrow cC \mid \lambda \end{aligned}$$

to Chomsky normal form. Note that G first has to satisfy the conditions on the start symbol S, λ-rules, useless symbols, and chain rules.

3. *(10 points)* Let G be a grammar in Chomsky normal form, and $w \in L(G)$ be a string of length n ($n \geq 1$). How many steps are needed to derive w in G?

Please turn the page over.

4. *(20 points)* Consider the grammar G from Example 4.5.2:

$$S \to AT \mid AB$$
$$T \to XB$$
$$X \to AT \mid AB$$
$$A \to a$$
$$B \to b$$

Give the upper diagonal matrix produced by the CYK algorithm when run with G and the input string $abbb$.

5. *(20 points)* Consider the Chomsky normal grammar G;

$$S \to AX \mid AY \mid a$$
$$X \to AX \mid a$$
$$Y \to BY \mid a$$
$$A \to a$$
$$B \to b$$

Give the upper diagonal matrix produced by the CYK algorithm when run with G and the input strings $baaa$ and $abaaa$.