CS3311 Homework 9 Due date: Wednesday, November 9, 2016, in class

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The answers 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. Any other source must be specified clearly.

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1. *(20+10 points)* Consider the grammar G from Example 4.5.2:

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

(a) Give the upper diagonal matrix produced by the CYK algorithm when run with G and the input string $abbb$. **Show all your work.**

(b) Is $abbb \in L(G)$? Why? Provide the reason based on the upper diagonal matrix you constructed.

2. *(20+10+10 points)* Consider the following grammar G. Note that G was obtained by transforming the grammar $S \to aSa \mid bSb \mid a \mid b \mid \lambda$ to Chomsky Normal Form.

$S \to AR \mid BX \mid AA \mid BB \mid a \mid b \mid \lambda$
$T \to AR \mid BX \mid AA \mid BB \mid a \mid b$
$R \to TA$
$X \to TB$
$A \to a$
$B \to b$

(a) Give the upper diagonal matrix produced by the CYK algorithm when run with G and the input string $abba$. **Show all your work.**

(b) Is $abba \in L(G)$? Why? Provide the reason based on the upper diagonal matrix you constructed.

(c) Is $abb \in L(G)$? Why? Provide the reason based on the upper diagonal matrix you constructed.

3. *(30 points)* Remove left recursion from the following grammar using the method described in class.

$S \to A \mid B$
$A \to AAA \mid a \mid B$
$B \to BBb \mid b$