CS 321 Quiz 7 (15 min., 5 pts) November 23, 2015

Last Name = _____, First Name = _____

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1. (1 pt) Convert the following grammar G into CNF. Hint: you only need to binarize.

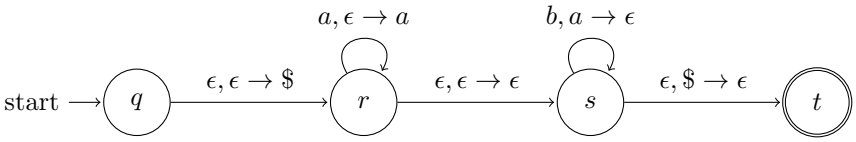
   $S \to TBCA \quad T \to CBCA \quad A \to a \quad B \to b \quad C \to c$

2. (1 pt) Assume n is the length of the input string:

   (a) What is the time complexity of applying a CKY-style parsing algorithm to the above non-CNF grammar G?

   (b) What is the time complexity of applying CKY to the converted grammar in CNF?

3. (1 pt) As shown in class (and slides and textbook), here is a PDA for the language $\{a^n b^n \mid n \geq 0\}$.



   Run *aabb* on this PDA that leads to acceptance. I have drawn the first three steps for you. You can add more steps.

step	0	1	2	3	4	5	6
state	q	r	r				
input	*aabb*	*aabb*	$\not{a}abb$				
stack	ϵ	\$	\$$a$				

4. (1 pt) Now based on the above PDA, draw a PDA for the language $\{w\#w^R \mid w \in \{a,b\}^*\}$, i.e., $\Sigma = \{a, b, \#\}$.

5. (1 pt) Observe that the PDA in Problem 4 is deterministic (like DFA, only one path for each input string) while the one in Problem 3 is non-deterministic (like NFA, due to the ⓡ $\xrightarrow{\epsilon,\epsilon\to\epsilon}$ ⓢ transition).

   (a) Can we make a deterministic PDA for $\{a^n b^n \mid n \geq 0\}$ (Problem 3)? Briefly justify.

   (b) Can we make a deterministic PDA for $\{ww^R \mid w \in \{a,b\}^*\}$? Briefly justify.