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## QUIZ 5

### CS 373: THEORY OF COMPUTATION

Date: November 16, 2010.    Lecture Section AL1.    Time limit: 15 minutes.

<b>Name</b>	
<b>netid</b>	
<b>Discussion</b>	Tu 2-2:50    Tu 3-3:50    Tu 4-4:50    W 4-4:50    W 5-5:50

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Pick the correct alternative from among the choices (A), (B), and (C) provided for each question below. Each question is worth **1 point**.

$$\begin{aligned} S &\rightarrow AX \mid YC \\ A &\rightarrow aA \mid \epsilon \\ B &\rightarrow bB \mid \epsilon \\ C &\rightarrow cC \mid \epsilon \\ X &\rightarrow bXc \mid bB \mid cC \\ Y &\rightarrow aYb \mid aA \mid bB \end{aligned}$$

Figure 1: Context Free Grammar  $G_* = (V = \{S, A, B, C, X, Y\}, \Sigma = \{a, b, c\}, R, S)$  for problems 1, 2, and 3. The rules for  $G_*$  are given above.

1. In grammar  $G_*$ , which of the following strings can be derived from  $S$  in zero or more steps?
  - (A)  $aaba$
  - (B)  $aabbcc$
  - (C)  $aaAbXc$
  
2. The set of strings (over  $\Sigma$ ) derivable from  $A$  in  $G_*$  is
  - (A)  $L(a^*)$
  - (B) Strings with an even number of  $as$
  - (C)  $\emptyset$  because  $A$  is not the start symbol
  
3. Which of the following is true about grammar  $G_*$ ?
  - (a)  $G_*$  is ambiguous because  $abbccc$  has two derivations from  $S$
  - (b)  $G_*$  is ambiguous because  $abbccc$  has two parse trees
  - (c)  $G_*$  is not ambiguous because we can transform the grammar using the techniques discussed in class

$$\begin{aligned}
\delta(q_0, [, \epsilon) &= \{(q_0, A)\} \\
\delta(q_0, \epsilon, \epsilon) &= \{(q_1, \epsilon)\} \\
\delta(q_1, ], A) &= \{(q_1, \epsilon)\} \\
\delta(q, a, x) &= \emptyset \quad \text{otherwise}
\end{aligned}$$

Figure 2: Pushdown automata  $P_* = (Q = \{q_0, q_1\}, \Sigma = \{[, ]\}, \Gamma = \{A\}, q_0, F = \{q_1\}, \delta)$  for problems 4 and 5. The transition function  $\delta$  is given above.

4. Suppose the current instantaneous description of  $P_*$  is  $\langle q_1, AAAAAA \rangle$  and the unread portion of the input is  $]]]$ . The instantaneous description after one step is
  - (A) The machine crashes
  - (B)  $\langle q_1, AAAAAAA \rangle$
  - (C)  $\langle q_1, AAAAA \rangle$
  
5. The language recognized by PDA  $P_*$  is
  - (A)  $\{[n]^n \mid n \geq 0\}$
  - (B)  $\{[i]^j \mid i \geq j \geq 0\}$
  - (C)  $\{[i]^j \mid j \geq i \geq 0\}$
  
6. Suppose  $L$  is recognized by a linear bounded automata  $A$ . Then,
  - (A)  $A$  always halts on all inputs because  $L$  is decidable
  - (B)  $L$  maybe undecidable because  $A$  need not halt on all inputs
  - (C)  $L$  need not be a context-free language