Quiz 7

1. Consider the grammar $G = (V = \{S, A, C, X, Y\}, \Sigma = \{a, b, c\}, R, S)$ where the set of rules R is as follows:

$$\begin{array}{ll} S & \to AX|YC \\ A & \to aA|\epsilon \\ C & \to cC|\epsilon \\ X & \to bXc|\epsilon \\ Y & \to aYb|\epsilon \end{array}$$

   Which of the following strings can be derived in **one** step from $aaAbXc$?

   (A) $aaaAbbXcc$

   (B) $aaAbbXcc$

   (C) $aaAXbXc$

   (D) Nothing because $aaAbXc$ is not the start symbol of the grammar

2. Consider the grammar $G = (V = \{S, A, C, X, Y\}, \Sigma = \{a, b, c\}, R, S)$ where the set of rules R is as follows:

$$\begin{array}{ll} S & \to AX|YC \\ A & \to aA|\epsilon \\ C & \to cC|\epsilon \\ X & \to bXc|\epsilon \\ Y & \to aYb|\epsilon \end{array}$$

   Which of the following strings can be derived from S in zero or more steps?

   (A) $aaba$

   (B) $aabbbc$

   (C) $aaAbXc$

   (D) $abbccc$

3. Consider the grammar $G = (V = \{S, A, C, X, Y\}, \Sigma = \{a, b, c\}, R, S)$ where the set of rules R is as follows:

$$\begin{array}{ll} S & \to AX|YC \\ A & \to aA|\epsilon \\ C & \to cC|\epsilon \\ X & \to bXc|\epsilon \\ Y & \to aYb|\epsilon \end{array}$$

   The set of strings (over Σ) derivable from A is

   (A) $\mathbf{L}(a^*)$

   (B) Strings with an even number of as

   (C) $\emptyset$ because A is not the start symbol

   (D) $\{a^n b^n \mid n \geq 0\}$

4. Consider the grammar $G = (V = \{S, A, C, X, Y\}, \Sigma = \{a, b, c\}, R, S)$ where the set of rules R is as follows:

$$\begin{array}{ll} S & \rightarrow AX|YC \\ A & \rightarrow aA|\epsilon \\ C & \rightarrow cC|\epsilon \\ X & \rightarrow bXc|\epsilon \\ Y & \rightarrow aYb|\epsilon \end{array}$$

$\mathbf{L}(G)$ is

(A) $\mathbf{L}(a^*b^*c^*)$

(B) $\{a^n b^n c^n \mid n \geq 0\}$

(C) $\{a^i b^j c^k \mid i = j \text{ or } j = k\}$

(D) $\{a^i b^j c^k \mid i = k\}$

5. Let $G = (V, \Sigma, R, S)$ be a context-free grammar, where V is the set of variables, Σ is the set of terminals, R is the set of rules, and S is the start symbol. Which of the following is true about the language defined by G? Pick the most precise answer.

(A) $\mathbf{L}(G) \subseteq V^*$

(B) $\mathbf{L}(G) \subseteq \Sigma^*$

(C) $\mathbf{L}(G) \subseteq (V \cup \Sigma)^*$

(D) $\mathbf{L}(G) \subseteq V^* \cup \Sigma^*$

6. Consider the grammar $G = (V = \{S, A, C, X, Y\}, \Sigma = \{a, b, c\}, R, S)$ where the set of rules R is as follows:

$$\begin{array}{ll} S & \rightarrow AX|YC \\ A & \rightarrow aA|\epsilon \\ C & \rightarrow cC|\epsilon \\ X & \rightarrow bXc|\epsilon \\ Y & \rightarrow aYb|\epsilon \end{array}$$

Which of the following statements is true about G?

(A) G is ambiguous because there are at least two derivations from S producing abc.

(B) G is ambiguous because there are at least two parse trees with root labelled S and yield abc.

(C) G is not ambiguous because multiple derivations of abc from S does not imply ambiguity.

(D) G may not be ambiguous because derivations and parse trees for a single string abc do not determine ambiguity.