Quiz 14

1. Let $G = (\{S, A, B, C, D\}, \{0\}, R, S)$ where the rules in R are

$$S \rightarrow AB \mid AC$$
$$A \rightarrow BAB \mid B \mid \epsilon$$
$$B \rightarrow 00 \mid \epsilon$$
$$C \rightarrow 0D$$
$$D \rightarrow C0$$

The set of nullable variables in G is

(A) $\{A, B\}$

(B) $\{S, A, B\}$

(C) $\{A, B, C, D\}$

(D) $\{S, A, B, C, D\}$

Correct answer is (B).

2. Let $G = (\{S, A, B, C, D\}, \{0\}, R, S)$ where the rules in R are

$$S \rightarrow AB \mid AC$$
$$A \rightarrow BAB \mid B \mid \epsilon$$
$$B \rightarrow 00 \mid \epsilon$$
$$C \rightarrow 0D$$
$$D \rightarrow C0$$

The set of useless variables in G is

(A) $\{S, A, B\}$

(B) $\{D\}$

(C) $\{C, D\}$

(D) $\{A, C, D\}$

Correct answer is (C).

3. Given a grammar G, in order to remove all the useless variables, we need to

(A) First remove the non-generating variables, and then remove the unreachable variables.

(B) First remove the unreachable variables and then remove the non-generating variables.

(C) Remove the non-generating variables and unreachable variables; the order of removing them does not matter.

(D) First start from a grammar that has no ϵ-productions and no unit productions, and then remove the non-generating variables and unreachable variables in some order.

Correct answer is (A).

4. Let $G = (V, \Sigma, R, S)$ be a context-free grammar that has *no unit productions but may have ϵ-productions.* Suppose $w \in \Sigma^n$ such that $S \stackrel{*}{\Rightarrow} w$. Pick the best answer that bounds the number of steps in the derivation $S \stackrel{*}{\Rightarrow} w$.

   (A) $O(\log n)$

   (B) $O(n)$

   (C) $O(2^n)$

   (D) The number of steps cannot be bound.

   Correct answer is (D).

5. Let $G = (V, \Sigma, R, S)$ be a context-free grammar that has *no unit productions and no ϵ-productions.* Suppose $w \in \Sigma^n$ such that $S \stackrel{*}{\Rightarrow} w$. Pick the best answer that bounds the number of steps in the derivation $S \stackrel{*}{\Rightarrow} w$.

   (A) $O(\log n)$

   (B) $O(n)$

   (C) $O(2^n)$

   (D) The number of steps cannot be bound.

   Correct answer is (B).