Quiz 17

1. Consider the grammar $G = (\{S, A\}, \{0, 1\}, R, S)$ where the rules in R are

$$S \to 0A \mid \epsilon \qquad A \to S1$$

The grammar G belongs to

(A) Type 3
(B) Type 2 but not Type 3
(C) Type 1 but not Type 2
(D) Type 0 but not Type 1

Correct answer is (B).

2. Consider the language $L = \{ww^R \mid w \in \{0, 1\}^*\}$. Then there is a grammar G such that $L = \mathbf{L}(G)$ where G is in

(A) Type 3
(B) Type 2 but not Type 3
(C) Type 1 but not Type 2
(D) Type 0 but not Type 1

Correct answer is (B).

3. Consider the language $L = \{a^n b^n c^n \mid n \geq 0\}$. Then there is a grammar G such that $L = \mathbf{L}(G)$ where G is in

(A) Type 3
(B) Type 2 but not Type 3
(C) Type 1 but not Type 2
(D) Type 0 but not Type 1

Correct answer is (C).

4. Given that Type 3 grammars define regular languages and type 2 grammars define context-free languages, which of the following statements is necessarily true?

(A) If G_1 is a type 2 grammar then there is a type 3 grammar G_2 such that $\mathbf{L}(G_2) = \mathbf{L}(G_1)$.
(B) If G_1 is a type 2 grammar then G_1 is also a type 3 grammar.
(C) If G_1 is a type 2 grammar and G_2 is a type 3 grammar then $\mathbf{L}(G_2) \neq \mathbf{L}(G_1)$.
(D) There is a type 2 grammar G_1 such that for every type 3 grammar G_2, $\mathbf{L}(G_2) \neq \mathbf{L}(G_1)$.

Correct answer is (D).

5. Let us denote by $\mathbf{L}(\text{Type 0})$ the collection of all languages defined by type 0 grammars and by $\mathbf{L}(\text{Type 1})$ the collection of type 1 definable languages. We will use $\overline{\mathbf{L}(\text{Type 1})}$ to denote all languages that don't have a Type 1 grammar. Given that the Chomsky hierarchy is a strict hierarchy, which of the following is true?

(A) $\mathbf{L}(\text{Type 0}) \cap \mathbf{L}(\text{Type 1}) = \emptyset$.

(B) $\mathbf{L}(\text{Type 0}) \setminus \mathbf{L}(\text{Type 1}) = \emptyset$.

(C) $\mathbf{L}(\text{Type 1}) \setminus \mathbf{L}(\text{Type 0}) = \emptyset$.

(D) $\mathbf{L}(\text{Type 0}) \cap \overline{\mathbf{L}(\text{Type 1})} = \emptyset$.

Correct answer is (C).