Quiz: Context-Free Grammars and Pushdown Automata

Section 1: Context-Free Grammars (CFGs) and Parse Trees

1. Which of the following is NOT a component of a context-free grammar (CFG)?

A) A finite set of non-terminals

B) A start symbol

C) A stack

D) A finite set of productions

Answer: C

2. A string that can be generated in more than one way by a CFG is called _____.

Answer: Ambiguous

3. All ambiguous grammars generate ambiguous languages.

Answer: False

4. Define a leftmost derivation in a CFG.

Answer: A derivation in which the leftmost non-terminal is always replaced at each step.

5. Which of the following is used to show ambiguity in a grammar?

A) Left recursion

B) Parse trees

C) Finite automata

D) Null productions

Answer: B

Section 2: Ambiguity in Grammars and Languages

6. Every ambiguous language must have at least one ambiguous grammar.

Answer: True

7. Which grammar is ambiguous for arithmetic expressions?

A) E E + E | E * E | id

B) E id

C) S aSb |

D) A aA | a

Answer: A

8. How do you remove ambiguity from a grammar for arithmetic expressions?

Answer: By defining operator precedence and associativity.

9. In a parse tree, the _____ is always the start symbol.

Answer: Root

10. Ambiguity can be completely removed from every CFG.

Answer: False

Section 3: Pushdown Automata (PDA)

11. Which of the following pairs correctly represents a transition in PDA?

A) (q, a) = (p)

B) (q, a, Z) = {(p,)}

C) (q,) = (p, a)

D) (p, a, p) = q

Answer: B

12. The stack in PDA allows it to recognize nested structures like balanced parentheses.

Answer: True

13. What is the purpose of -transitions in PDA?

Answer: To change states without consuming input, enabling non-determinism.

14. Which of the following languages cannot be accepted by a PDA?

A) { ab | n 0 }

B) { abc | n 0 }

C) { w {a,b}* | w is a palindrome }

D) { ab | n > 0 }

Answer: B

15. PDA is to context-free languages as DFA is to _____.

Answer: Regular languages

16. A PDA can accept a language either by empty stack or by final state.

Answer: True

17. What happens if a PDA has no transition for a given input and stack symbol?

A) It crashes

B) It continues with an empty stack

C) It accepts

D) It loops infinitely

Answer: A

18. Why are PDAs more powerful than DFAs?

Answer: Because PDAs use a stack to recognize context-free languages.

Section 4: Equivalence of PDA and CFG

19. For every PDA, there exists an equivalent CFG that generates the same language.

Answer: True

20. Which of the following best represents the relationship between PDA and CFG?

A) PDA CFG

B) PDA CFG

C) PDA = CFG

D) PDA CFG =

Answer: C