AUTOMATA THEORY AND COMPILER DESIGN
Unit - I

1. What is the central concept of automata theory?
A) Structures
B) Alphabets
C) Numbers
D) Equations
Answer: B) Alphabets

2. Which of the following is not a structural representation of finite automata?
A) State transition diagram
B) Transition table
C) Regular expression
D) Turing machine
Answer: D) Turing machine

3. Which concept in automata theory deals with problems, alphabets, strings, and languages?
A) Transition functions
B) Deterministic finite automata
C) Central concepts
D) State diagrams
Answer: C) Central concepts

4. Which type of finite automata allows multiple transitions from a state on the same input symbol?
A) Deterministic finite automata
B) Non-deterministic finite automata
C) Context-free automata
D) Turing machines
Answer: B) Non-deterministic finite automata

5. What is the purpose of a finite automaton with epsilon-transitions?
A) To simulate randomness
B) To skip characters in input strings
C) To handle non-determinism
D) To reduce computational complexity
Answer: B) To skip characters in input strings

6. Which formal definition represents a non-deterministic finite automaton?
A) $(Q, \Sigma, \delta, q0, F)$
B) $(Q, \Sigma, \delta, q0, F, \varepsilon)$
C) $(Q, \Sigma, \delta, q0, F, \lambda)$
D) $(Q, \Sigma, \delta, q0, F, *)$
Answer: A) $(Q, \Sigma, \delta, q0, F)$

7. In text search applications, which type of finite automaton is commonly used?
A) Deterministic finite automata
B) Non-deterministic finite automata
C) Context-free automata

D) Turing machines
Answer: B) Non-deterministic finite automata

8. What is the language of a deterministic finite automaton (DFA)?
A) The set of all possible inputs
B) The set of strings accepted by the DFA
C) The set of non-deterministic transitions
D) The set of states in the DFA
Answer: B) The set of strings accepted by the DFA

9. Which conversion technique is used to convert NFA with epsilon-transitions to NFA without epsilon-transitions?
A) Subset construction
B) Complementation
C) Elimination of epsilon transitions
D) Union operation
Answer: C) Elimination of epsilon transitions

10. What is the process of converting a non-deterministic finite automaton (NFA) to a deterministic finite automaton (DFA) called?
A) Determinization
B) Minimization
C) Conversion
D) Simplification
Answer: A) Determinization

11. Which of the following is not a structural representation of finite automata?
A) State transition diagram
B) Transition table
C) Regular expression
D) Turing machine
Answer: D) Turing machine

12. Which concept in automata theory deals with problems, alphabets, strings, and languages?
A) Transition functions
B) Deterministic finite automata
C) Central concepts
D) State diagrams
Answer: C) Central concepts

13. Which type of finite automata allows multiple transitions from a state on the same input symbol?
A) Deterministic finite automata
B) Non-deterministic finite automata
C) Context-free automata
D) Turing machines
Answer: B) Non-deterministic finite automata

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A) To simulate randomness
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C) To handle non-determinism
D) To reduce computational complexity
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15. Which formal definition represents a non-deterministic finite automaton?
A) $(Q, \Sigma, \delta, q0, F)$
B) $(Q, \Sigma, \delta, q0, F, \varepsilon)$
C) $(Q, \Sigma, \delta, q0, F, \lambda)$
D) $(Q, \Sigma, \delta, q0, F, *)$
Answer: A) $(Q, \Sigma, \delta, q0, F)$

16. In text search applications, which type of finite automaton is commonly used?
A) Deterministic finite automata
B) Non-deterministic finite automata
C) Context-free automata
D) Turing machines
Answer: B) Non-deterministic finite automata

17. What is the language of a deterministic finite automaton (DFA)?
A) The set of all possible inputs
B) The set of strings accepted by the DFA
C) The set of non-deterministic transitions
D) The set of states in the DFA
Answer: B) The set of strings accepted by the DFA

18. Which conversion technique is used to convert NFA with epsilon-transitions to NFA without epsilon-transitions?
A) Subset construction
B) Complementation
C) Elimination of epsilon transitions
D) Union operation
Answer: C) Elimination of epsilon transitions

19. What is the process of converting a non-deterministic finite automaton (NFA) to a deterministic finite automaton (DFA) called?
A) Determinization
B) Minimization
C) Conversion
D) Simplification
Answer: A) Determinization

20. What is the primary concept of automata theory?
A) Alphabets
B) Numbers
C) Structures
D) Equations
Answer: A) Alphabets

21. What does DFA stand for?
A) Deterministic Function Automaton
B) Deterministic Finite Automaton
C) Discrete Finite Automaton
D) Dynamic Finite Automaton
Answer: B) Deterministic Finite Automaton

22. Which type of automaton has a unique transition for each input symbol and state?
A) Non-deterministic Finite Automaton
B) Deterministic Finite Automaton
C) Pushdown Automaton
D) Turing Machine
Answer: B) Deterministic Finite Automaton

23. What is the primary difference between NFA and DFA?
A) NFA has more states than DFA
B) NFA has more transitions than DFA
C) NFA has non-deterministic transitions
D) DFA has non-deterministic transitions
Answer: C) NFA has non-deterministic transitions

24. In automata theory, what is the purpose of the final state in a finite automaton?
A) To signify the acceptance of an input string
B) To specify the starting point of the automaton
C) To denote the transition function of the automaton
D) To represent the alphabet of the automaton
Answer: A) To signify the acceptance of an input string

25. How is a regular expression related to finite automata?
A) Regular expressions are a type of finite automata
B) Regular expressions and finite automata are completely unrelated
C) Regular expressions can be converted into finite automata and vice versa
D) Regular expressions are more powerful than finite automata
Answer: C) Regular expressions can be converted into finite automata and vice versa

26. Which of the following is a valid application of finite automata?
A) Image processing
B) Speech recognition
C) Pattern matching
D) Cryptography
Answer: C) Pattern matching

27. What is the primary function of the transition function in finite automata?
A) To change states based on input
B) To determine the starting state
C) To accept or reject input strings
D) To determine the alphabet of the automaton
Answer: A) To change states based on input

28. Which of the following statements about deterministic finite automata (DFA) is true?
A) DFA can accept non-regular languages
B) DFA can have multiple transitions on the same input symbol
C) DFA can accept inputs with epsilon-transitions
D) DFA always reaches a unique state for a given input string
Answer: D) DFA always reaches a unique state for a given input string

29. What is the significance of the empty string (ε) in automata theory?
A) It represents the absence of any input
B) It signifies the end of input string
C) It is used to denote non-deterministic transitions
D) It is used to denote transitions with infinite loops
Answer: A) It represents the absence of any input

30. In the conversion of NFA to DFA, what is the role of the power set construction method?
A) To determine the number of states in the DFA
B) To compute the transition function of the DFA
C) To handle non-deterministic transitions from NFA
D) To minimize the number of states in the DFA
Answer: C) To handle non-deterministic transitions from NFA

31. What is the language recognized by a finite automaton?
A) The set of input symbols
B) The set of states in the automaton
C) The set of strings that cause the automaton to accept
D) The set of strings that cause the automaton to reject
Answer: C) The set of strings that cause the automaton to accept

32. Which of the following statements is true regarding the conversion of NFA to DFA?
A) The resulting DFA always has fewer states than the original NFA
B) The resulting DFA may have more states than the original NFA
C) The resulting DFA always accepts the same language as the original NFA
D) The resulting DFA always accepts a superset of the language accepted by the original NFA
Answer: D) The resulting DFA always accepts a superset of the language accepted by the original NFA

33. What is the primary disadvantage of using non-deterministic finite automata?
A) They are more difficult to understand than deterministic finite automata
B) They require more memory to store transition functions
C) They are not as powerful as deterministic finite automata
D) They may require exponential time to process inputs
Answer: D) They may require exponential time to process inputs

34. Which of the following operations is NOT typically associated with finite automata?
A) Union
B) Concatenation
C) Kleene star
D) Exponentiation

Answer: D) Exponentiation

35. What is the primary role of the initial state in a finite automaton?
A) It determines the language accepted by the automaton
B) It represents the starting point for processing input strings
C) It signifies the end of an input string
D) It denotes the state where the automaton halts
Answer: B) It represents the starting point for processing input strings

36. Which of the following is a characteristic of regular languages?
A) They can be recognized by context-free grammars
B) They can be accepted by Turing machines
C) They can be recognized by finite automata
D) They always have infinite strings
Answer: C) They can be recognized by finite automata

37. What is the primary difference between a finite automaton and a pushdown automaton?
A) Finite automata have a stack while pushdown automata don't
B) Pushdown automata have a tape while finite automata don't
C) Pushdown automata have unbounded memory while finite automata have bounded memory
D) Finite automata can recognize context-free languages while pushdown automata can't
Answer: C) Pushdown automata have unbounded memory while finite automata have bounded memory

38. Which of the following automata can recognize context-free languages?
A) Deterministic finite automata
B) Non-deterministic finite automata
C) Pushdown automata
D) Turing machines
Answer: C) Pushdown automata

39. What is the primary difference between a deterministic finite automaton and a non-deterministic finite automaton?
A) Deterministic finite automata have non-deterministic transitions
B) Non-deterministic finite automata have a unique transition for each input symbol and state
C) Non-deterministic finite automata may have multiple transitions on the same input symbol and state
D) Deterministic finite automata have unbounded memory
Answer: C) Non-deterministic finite automata may have multiple transitions on the same input symbol and state

40. Which of the following statements about regular languages is true?
A) Regular languages are always context-free
B) Regular languages cannot be generated by regular expressions
C) Regular languages can be recognized by pushdown automata
D) Regular languages can be generated by context-sensitive grammars
Answer: A) Regular languages are always context-free

41. What is the purpose of minimizing the number of states in a finite automaton?
A) To reduce the time complexity of processing input strings
B) To decrease the number of transitions in the automaton
C) To minimize the memory usage of the automaton
D) To simplify the design and understanding of the automaton
Answer: D) To simplify the design and understanding of the automaton

42. Which of the following is a property of regular languages?
A) Closure under intersection
B) Closure under complement
C) Closure under concatenation
D) Closure under exponentiation
Answer: C) Closure under concatenation

43. What is the primary purpose of the transition table in a finite automaton?
A) To represent the set of states in the automaton
B) To define the transition function of the automaton
C) To specify the alphabet of the automaton
D) To determine the initial state of the automaton
Answer: B) To define the transition function of the automaton

44. Which of the following statements about regular expressions is true?
A) Regular expressions can only represent finite sets of strings
B) Regular expressions can represent any computable function
C) Regular expressions cannot represent infinite sets of strings
D) Regular expressions are equivalent to Turing machines
Answer: A) Regular expressions can only represent finite sets of strings

45. In automata theory, what is the purpose of defining a language?
A) To specify the set of all possible input symbols
B) To describe the set of all possible states in the automaton
C) To identify the set of strings accepted by the automaton
D) To determine the transition function of the automaton
Answer: C) To identify the set of strings accepted by the automaton

46. Which of the following is a limitation of finite automata?
A) They cannot recognize regular languages
B) They cannot process infinite input strings
C) They cannot handle non-deterministic transitions
D) They cannot represent context-free languages
Answer: B) They cannot process infinite input strings

47. What is the primary difference between a finite automaton and a Turing machine?
A) Turing machines have unbounded memory
B) Finite automata can recognize context-free languages
C) Finite automata have a tape for input
D) Turing machines have a fixed number of states
Answer: A) Turing machines have unbounded memory

48. Which of the following is a characteristic of regular languages?
A) They can be recognized by pushdown automata
B) They can be recognized by context-sensitive grammars
C) They can be generated by regular expressions
D) They can generate non-regular languages
Answer: C) They can be generated by regular expressions

49. What is the primary advantage of using deterministic finite automata (DFA)?
A) They require less memory compared to non-deterministic finite automata
B) They can recognize non-regular languages
C) They can process infinite input strings
D) They can represent context-free languages
Answer: A) They require less memory compared to non-deterministic finite automata

50. Which of the following is NOT a characteristic of regular languages?
A) Closure under union
B) Closure under concatenation
C) Closure under intersection
D) Closure under Kleene star
Answer: C) Closure under intersection

Unit - II

51. How does the conversion of NFA to DFA contribute to automata theory?
A) It allows for the recognition of non-regular languages.
B) It simplifies the representation of deterministic languages.
C) It aids in the understanding of the complexity of automata.
D) It enables the handling of non-deterministic transitions efficiently.
Answer: D) It enables the handling of non-deterministic transitions efficiently.

52. What is the relationship between finite automata and regular expressions?
A) Finite automata can only recognize regular expressions
B) Regular expressions can be converted into finite automata but not vice versa
C) Finite automata and regular expressions are equivalent
D) Finite automata are more powerful than regular expressions
Answer: C) Finite automata and regular expressions are equivalent

53. Which of the following is NOT an application of regular expressions?
A) Pattern matching in text processing
B) Lexical analysis in compiler design
C) Image processing
D) Data validation
Answer: C) Image processing

54. What are the algebraic laws for regular expressions used for?
A) To define the syntax of regular expressions
B) To simplify and manipulate regular expressions

C) To convert regular expressions to context-free grammars
D) To generate non-regular languages
Answer: B) To simplify and manipulate regular expressions

55. How can finite automata be converted into regular expressions?
A) By using subset construction
B) By applying algebraic laws
C) By minimizing the number of states
D) By eliminating non-deterministic transitions
Answer: B) By applying algebraic laws

56. What does the pumping lemma for regular languages state?
A) It provides a method for generating all possible strings in a regular language
B) It defines the maximum length of strings in a regular language
C) It guarantees the existence of a certain substring within all strings in a regular language
D) It offers a property that all regular languages must satisfy
Answer: D) It offers a property that all regular languages must satisfy

57. How is the pumping lemma for regular languages applied?
A) To prove that a language is regular
B) To generate regular expressions for given languages
C) To verify the correctness of finite automata
D) To convert regular languages into context-free grammars
Answer: A) To prove that a language is regular

58. What is the primary characteristic of context-free grammars?
A) They can generate regular languages
B) They have a finite number of rules
C) They can handle infinite strings
D) They can generate non-context-free languages
Answer: B) They have a finite number of rules

59. How are derivations carried out using a context-free grammar?
A) By applying algebraic laws
B) By applying the pumping lemma
C) By recursively applying production rules
D) By minimizing the number of states
Answer: C) By recursively applying production rules

60. What distinguishes leftmost and rightmost derivations in context-free grammars?
A) The order in which non-terminals are replaced
B) The number of terminals in the resulting string
C) The presence of epsilon transitions
D) The final state reached by the automaton
Answer: A) The order in which non-terminals are replaced

61. What does the language of a context-free grammar represent?
A) The set of all possible input symbols
B) The set of all possible states in the automaton
C) The set of strings generated by the grammar

D) The set of strings recognized by the automaton
Answer: C) The set of strings generated by the grammar

62. What are parse trees used for in the context of context-free grammars?
A) To visualize the structure of input strings
B) To simplify regular expressions
C) To verify the pumping lemma
D) To represent derivations in grammars
Answer: D) To represent derivations in grammars

63. What is ambiguity in the context of grammars and languages?
A) It refers to the presence of multiple parse trees for a single input string
B) It signifies the absence of a parse tree for an input string
C) It indicates the inability of a grammar to generate certain strings
D) It denotes the presence of non-deterministic transitions in an automaton
Answer: A) It refers to the presence of multiple parse trees for a single input string

64. Which of the following is NOT a characteristic of context-free grammars?
A) Closure under intersection
B) Closure under concatenation
C) Closure under union
D) Closure under Kleene star
Answer: A) Closure under intersection

65. What is the primary role of leftmost and rightmost derivations in context-free grammars?
A) To determine the start symbol of the grammar
B) To identify the non-terminals in the grammar
C) To generate parse trees for input strings
D) To describe the order of replacement of non-terminals
Answer: D) To describe the order of replacement of non-terminals

66. Which of the following statements about context-free grammars is true?
A) They can only generate regular languages
B) They can generate languages that regular expressions cannot represent
C) They cannot have epsilon productions
D) They can generate languages that Turing machines cannot recognize
Answer: B) They can generate languages that regular expressions cannot represent

67. How does the conversion of finite automata to regular expressions contribute to compiler design?
A) It simplifies the lexical analysis phase
B) It optimizes the code generation phase
C) It minimizes the number of states in the automaton
D) It ensures the correctness of the parsing phase
Answer: A) It simplifies the lexical analysis phase

68. What property of regular languages does the pumping lemma help to establish?
A) Closure under complementation
B) Closure under concatenation

C) Closure under Kleene star
D) Non-regularity
Answer: D) Non-regularity

69. In context-free grammars, what do leftmost and rightmost derivations determine?
A) The start symbol of the grammar
B) The production rules to be applied first
C) The order of replacement of non-terminals
D) The terminal symbols in the language
Answer: C) The order of replacement of non-terminals

70. Which of the following is NOT a characteristic of parse trees in context-free grammars?
A) They represent the hierarchical structure of the generated strings
B) They can be used to verify derivations
C) They always have a single root node
D) They are unique for each input string
Answer: D) They are unique for each input string

71. What is the primary purpose of regular expressions in the context of finite automata?
A) To define the set of possible input symbols
B) To represent the transition function of the automaton
C) To simplify the design of finite automata
D) To recognize patterns in input strings
Answer: D) To recognize patterns in input strings

72. Which of the following is NOT an application of regular expressions?
A) Lexical analysis in compiler construction
B) Text search and manipulation in text editors
C) Image processing algorithms
D) Data compression techniques
Answer: C) Image processing algorithms

73. How are regular expressions related to algebraic laws?
A) Regular expressions can be represented using algebraic equations
B) Algebraic laws can be applied to simplify regular expressions
C) Regular expressions can be converted into algebraic expressions
D) Algebraic laws define the syntax of regular expressions
Answer: B) Algebraic laws can be applied to simplify regular expressions

74. What is the primary advantage of converting finite automata to regular expressions?
A) It reduces the computational complexity of recognizing languages
B) It enables the use of more powerful automata models
C) It allows for easier visualization of automata behavior
D) It simplifies the process of generating automata from grammars
Answer: A) It reduces the computational complexity of recognizing languages

75. What property does the pumping lemma for regular languages guarantee?
A) All regular languages are infinite in size
B) All regular languages can be recognized by finite automata

C) All regular languages have strings of equal length
D) All regular languages have a minimum string length
Answer: B) All regular languages can be recognized by finite automata

76. How is the pumping lemma for regular languages applied in practice?
A) To prove the non-existence of regular languages
B) To generate infinite strings in regular languages
C) To identify patterns in regular languages
D) To prove the regularity of languages
Answer: D) To prove the regularity of languages

77. What distinguishes context-free grammars from regular expressions?
A) Context-free grammars can generate non-regular languages
B) Regular expressions can generate non-context-free languages
C) Context-free grammars have a limited number of rules
D) Regular expressions cannot handle non-deterministic transitions
Answer: A) Context-free grammars can generate non-regular languages

78. How are derivations in context-free grammars different from transitions in finite automata?
A) Derivations involve the transformation of input symbols into terminals
B) Derivations determine the set of possible input strings for a grammar
C) Transitions denote the change of state based on input symbols
D) Transitions can only be applied to non-terminals
Answer: C) Transitions denote the change of state based on input symbols

79. What does the language of a context-free grammar represent?
A) The set of all possible input symbols
B) The set of strings that can be recognized by the grammar
C) The set of states in the automaton generated by the grammar
D) The set of all possible derivations in the grammar
Answer: B) The set of strings that can be recognized by the grammar

80. How are parse trees used in the context of context-free grammars?
A) To represent the syntax of regular expressions
B) To visualize the hierarchical structure of input strings
C) To determine the starting state of the automaton
D) To minimize the number of states in the automaton
Answer: B) To visualize the hierarchical structure of input strings

81. What is ambiguity in the context of context-free grammars?
A) It refers to the presence of multiple parse trees for the same input string
B) It signifies the absence of parse trees for input strings
C) It indicates the inability of a grammar to generate certain strings
D) It denotes the presence of non-deterministic transitions in an automaton
Answer: A) It refers to the presence of multiple parse trees for the same input string

82. Which of the following statements about regular languages is true?
A) Regular languages are always context-free
B) Regular languages cannot be recognized by finite automata

C) Regular languages can generate infinite strings
D) Regular languages can be generated by Turing machines
Answer: C) Regular languages can generate infinite strings

83. How does the conversion of finite automata to regular expressions contribute to compiler design?
A) It simplifies the lexical analysis phase
B) It optimizes the code generation phase
C) It minimizes the number of states in the automaton
D) It ensures the correctness of the parsing phase
Answer: A) It simplifies the lexical analysis phase

84. What property of regular languages does the pumping lemma help to establish?
A) Closure under intersection
B) Closure under concatenation
C) Closure under Kleene star
D) Non-regularity
Answer: D) Non-regularity

85. In context-free grammars, what do leftmost and rightmost derivations determine?
A) The start symbol of the grammar
B) The production rules to be applied first
C) The order of replacement of non-terminals
D) The terminal symbols in the language
Answer: C) The order of replacement of non-terminals

86. Which of the following is NOT a characteristic of parse trees in context-free grammars?
A) They represent the hierarchical structure of the generated strings
B) They can be used to verify derivations
C) They always have a single root node
D) They are unique for each input string
Answer: D) They are unique for each input string

87. What is the primary purpose of regular expressions in the context of finite automata?
A) To define the set of possible input symbols
B) To represent the transition function of the automaton
C) To simplify the design of finite automata
D) To recognize patterns in input strings
Answer: D) To recognize patterns in input strings

88. Which of the following is NOT an application of regular expressions?
A) Lexical analysis in compiler construction
B) Text search and manipulation in text editors
C) Image processing algorithms
D) Data compression techniques
Answer: C) Image processing algorithms

89. How are regular expressions related to algebraic laws?
A) Regular expressions can be represented using algebraic equations

B) Algebraic laws can be applied to simplify regular expressions
C) Regular expressions can be converted into algebraic expressions
D) Algebraic laws define the syntax of regular expressions
Answer: B) Algebraic laws can be applied to simplify regular expressions

90. What is the purpose of minimizing the number of states in a finite automaton?
A) To reduce the time complexity of processing input strings
B) To decrease the number of transitions in the automaton
C) To minimize the memory usage of the automaton
D) To simplify the design and understanding of the automaton
Answer: D) To simplify the design and understanding of the automaton

91. What is the primary role of the transition function in a finite automaton?
A) To change states based on input
B) To determine the starting state
C) To accept or reject input strings
D) To determine the alphabet of the automaton
Answer: A) To change states based on input

92. Which of the following statements about regular expressions is true?
A) Regular expressions can only represent finite sets of strings
B) Regular expressions can represent any computable function
C) Regular expressions cannot represent infinite sets of strings
D) Regular expressions are equivalent to Turing machines
Answer: A) Regular expressions can only represent finite sets of strings

93. In the conversion of NFA to DFA, what is the role of the power set construction method?
A) To determine the number of states in the DFA
B) To compute the transition function of the DFA
C) To handle non-deterministic transitions from NFA
D) To minimize the number of states in the DFA
Answer: C) To handle non-deterministic transitions from NFA

94. What is the primary role of the initial state in a finite automaton?
A) It determines the language accepted by the automaton
B) It represents the starting point for processing input strings
C) It signifies the end of an input string
D) It denotes the state where the automaton halts
Answer: B) It represents the starting point for processing input strings

95. Which of the following is a characteristic of regular languages?
A) Closure under intersection
B) Closure under complement
C) Closure under concatenation
D) Closure under exponentiation
Answer: C) Closure under concatenation

96. What is the primary function of the transition table in a finite automaton?
A) To represent the set of states in the automaton

B) To define the transition function of the automaton
C) To specify the alphabet of the automaton
D) To determine the initial state of the automaton
Answer: B) To define the transition function of the automaton

97. Which of the following is a valid application of finite automata?
A) Image processing
B) Speech recognition
C) Pattern matching
D) Cryptography
Answer: C) Pattern matching

98. What is the primary difference between a finite automaton and a Turing machine?
A) Turing machines have unbounded memory
B) Finite automata can recognize context-free languages
C) Finite automata have a tape for input
D) Turing machines have a fixed number of states
Answer: A) Turing machines have unbounded memory

99. What is the primary disadvantage of using non-deterministic finite automata?
A) They are more difficult to understand than deterministic finite automata
B) They require more memory to store transition functions
C) They are not as powerful as deterministic finite automata
D) They may require exponential time to process inputs
Answer: D) They may require exponential time to process inputs

100. Which of the following operations is NOT typically associated with finite automata?
A) Union
B) Concatenation
C) Kleene star
D) Exponentiation
Answer: D) Exponentiation

Unit - III

101. What is a Pushdown Automaton (PDA) primarily used for?
A) Recognizing regular languages
B) Recognizing context-free languages
C) Recognizing context-sensitive languages
D) Recognizing recursively enumerable languages
Answer: B) Recognizing context-free languages

102. What distinguishes a Pushdown Automaton from a Finite Automaton?
A) PDAs have unbounded memory
B) PDAs can recognize non-context-free languages
C) PDAs cannot handle non-deterministic transitions
D) PDAs have a finite number of states
Answer: A) PDAs have unbounded memory

103. What defines the languages accepted by a Pushdown Automaton?
A) The set of input symbols
B) The set of states in the automaton
C) The set of strings that cause the automaton to accept
D) The set of strings that cause the automaton to reject
Answer: C) The set of strings that cause the automaton to accept

104. Which of the following describes the equivalence of Pushdown Automata (PDA) and Context-Free Grammars (CFG)?
A) PDAs can generate all languages accepted by CFGs
B) CFGs can simulate the behavior of PDAs
C) PDAs and CFGs have the same expressive power
D) CFGs are more powerful than PDAs
Answer: C) PDAs and CFGs have the same expressive power

105. What is the primary function of the final state in a Pushdown Automaton?
A) It determines the language accepted by the automaton
B) It represents the starting point for processing input strings
C) It signifies the end of an input string
D) It denotes the acceptance of input strings
Answer: D) It denotes the acceptance of input strings

106. What is the fundamental idea behind a Turing Machine (TM)?
A) It has unbounded memory
B) It can recognize recursively enumerable languages
C) It can solve any computable problem
D) It has a finite set of states
Answer: C) It can solve any computable problem

107. How is the language of a Turing Machine defined?
A) By the set of input symbols it accepts
B) By the set of states it can reach
C) By the set of input strings it halts on
D) By the set of strings it accepts
Answer: D) By the set of strings it accepts

108. What is an "instantaneous description" of a Turing Machine?
A) It represents the current state of the Turing Machine
B) It describes the transition function of the Turing Machine
C) It denotes the input alphabet of the Turing Machine
D) It specifies the final state of the Turing Machine
Answer: A) It represents the current state of the Turing Machine

109. What distinguishes undecidable problems in computability theory?
A) They can be solved by a Turing Machine
B) They have no algorithmic solution
C) They are always recursively enumerable
D) They can be recognized by Pushdown Automata
Answer: B) They have no algorithmic solution

110. Which of the following is an example of an undecidable problem?
A) Testing if a regular expression matches a string
B) Determining if a given Turing Machine halts on a given input
C) Finding the shortest path in a graph
D) Sorting a list of integers
Answer: B) Determining if a given Turing Machine halts on a given input

111. How is undecidability related to the concept of recursively enumerable languages?
A) All undecidable problems belong to recursively enumerable languages
B) Recursively enumerable languages are always decidable
C) Some undecidable problems are recursively enumerable
D) All recursively enumerable languages are decidable
Answer: C) Some undecidable problems are recursively enumerable

112. What does it mean for a language to be not recursively enumerable?
A) It cannot be recognized by a Turing Machine
B) It is recognizable by a Pushdown Automaton
C) It has no decision procedure
D) It is equivalent to a regular language
Answer: A) It cannot be recognized by a Turing Machine

113. Which of the following statements is true regarding undecidable problems about Turing Machines?
A) All undecidable problems about Turing Machines are recursively enumerable
B) Some undecidable problems about Turing Machines are recursively enumerable
C) All undecidable problems about Turing Machines are decidable
D) No undecidable problems exist about Turing Machines
Answer: B) Some undecidable problems about Turing Machines are recursively enumerable

114. What is the primary significance of understanding undecidability in computability theory?
A) It provides a theoretical limit to what can be computed
B) It simplifies the design of algorithms
C) It guarantees the existence of efficient solutions to problems
D) It ensures the correctness of computational models
Answer: A) It provides a theoretical limit to what can be computed

115. How does the notion of acceptance by final state apply to Pushdown Automata?
A) PDAs accept input strings by reaching a specified final state
B) PDAs accept input strings if the stack is empty at the end of processing
C) PDAs accept input strings if the stack contains a specific symbol
D) PDAs accept input strings if the transition function halts in a certain state
Answer: A) PDAs accept input strings by reaching a specified final state

116. What is the relationship between Pushdown Automata and Context-Free Grammars?
A) Pushdown Automata can generate all languages accepted by Context-Free Grammars
B) Context-Free Grammars can simulate the behavior of Pushdown Automata
C) Pushdown Automata are less powerful than Context-Free Grammars
D) Context-Free Grammars cannot be represented by Pushdown Automata

Answer: A) Pushdown Automata can generate all languages accepted by Context-Free Grammars

117. How does a Turing Machine differ from a finite automaton?
A) Turing Machines have unbounded memory
B) Turing Machines have a fixed number of states
C) Turing Machines can only recognize regular languages
D) Turing Machines have a finite alphabet
Answer: A) Turing Machines have unbounded memory

118. What distinguishes undecidable problems from decidable problems?
A) Decidable problems always have a halting solution
B) Undecidable problems cannot be solved algorithmically
C) Decidable problems are always recursively enumerable
D) Undecidable problems are always regular
Answer: B) Undecidable problems cannot be solved algorithmically

119. What defines the languages accepted by a Pushdown Automaton (PDA)?
A) The set of input symbols
B) The set of states in the automaton
C) The set of strings that cause the automaton to accept
D) The set of strings that cause the automaton to reject
Answer: C) The set of strings that cause the automaton to accept

120. What is the equivalence between Pushdown Automata (PDA) and Context-Free Grammars (CFG)?
A) PDAs can generate all languages accepted by CFGs
B) CFGs can simulate the behavior of PDAs
C) PDAs and CFGs have the same expressive power
D) CFGs are more powerful than PDAs
Answer: C) PDAs and CFGs have the same expressive power

121. What is the primary role of the final state in a Pushdown Automaton?
A) It determines the language accepted by the automaton
B) It represents the starting point for processing input strings
C) It signifies the end of an input string
D) It denotes the acceptance of input strings
Answer: D) It denotes the acceptance of input strings

122. How is the language of a Turing Machine defined?
A) By the set of input symbols it accepts
B) By the set of states it can reach
C) By the set of input strings it halts on
D) By the set of strings it accepts
Answer: D) By the set of strings it accepts

123. What is an "instantaneous description" of a Turing Machine?
A) It represents the current state of the Turing Machine
B) It describes the transition function of the Turing Machine
C) It denotes the input alphabet of the Turing Machine

D) It specifies the final state of the Turing Machine
Answer: A) It represents the current state of the Turing Machine

124. How does the concept of undecidability impact the field of computer science?
A) It limits the complexity of problems that can be solved
B) It ensures that all problems can be solved algorithmically
C) It guarantees the efficiency of computational models
D) It highlights the existence of unsolvable problems
Answer: D) It highlights the existence of unsolvable problems

125. What does it mean for a language to be not recursively enumerable?
A) It cannot be recognized by a Turing Machine
B) It is recognizable by a Pushdown Automaton
C) It has no decision procedure
D) It is equivalent to a regular language
Answer: A) It cannot be recognized by a Turing Machine