1. What is an automaton?
a) A mechanical device
b) A mathematical model of computation
c) A programming language
d) A database management system
Answer: b

2. Which of the following automata can recognize regular languages?
a) Turing machine
b) Pushdown automaton
c) Finite automaton
d) Context-free grammar
Answer: c

3. A finite automaton consists of which components?
a) Input alphabet, transitions, output alphabet
b) Start state, input alphabet, output alphabet
c) States, input alphabet, transitions, start state, and final states
d) States, transitions, and input alphabet
Answer: c

4. What are transitions in an automaton?
a) Outputs associated with each state
b) Input symbols associated with each state
c) State transitions based on input symbols
d) Outputs and inputs associated with each state
Answer: c

5. What is the property of a finite automaton with no two transitions from the same state on the same input symbol?
a) Deterministic Finite Automaton (DFA)
b) Non-Deterministic Finite Automaton (NDFA)
c) Turing Machine
d) Pushdown automaton
Answer: a

6. In a DFA, if the machine is in state q1 and reads input symbol 'a', to which state does it transition?
a) The transition is determined by the automaton's output
b) The transition is determined by the automaton's input
c) The transition is determined by the current state and input symbol 'a'
d) The transition is determined randomly
Answer: c

7. Which of the following automata can recognize languages that a DFA cannot?
a) Turing machine
b) Pushdown automaton
c) Mealy machine
d) DFA can recognize all languages
Answer: b

8. What is the primary difference between DFA and NDFA?
a) NDFA can recognize a broader class of languages than DFA
b) DFA has more states than NDFA
c) NDFA has output alphabet, and DFA doesn't
d) DFA has transition functions while NDFA doesn't
Answer: a

9. A nondeterministic finite automaton can have:

a) Multiple final states
b) Multiple start states
c) Both multiple start and final states
d) Only one state
Answer: c

10. How is the equivalence between DFA and NDFA defined?
a) A language is regular if and only if it can be recognized by a DFA or NDFA
b) DFA and NDFA can recognize the same languages
c) There is no equivalence between DFA and NDFA
d) DFA is a special case of NDFA
Answer: a

11. What is the difference between Mealy and Moore machines?
a) Mealy machines have outputs on transitions, while Moore machines have outputs on states
b) Mealy machines have more states than Moore machines
c) Moore machines can recognize a broader class of languages than Mealy machines
d) There is no difference; they are two names for the same concept
Answer: a

12. In a Mealy machine, when are outputs produced?
a) On state transitions
b) On input symbols
c) On both state transitions and input symbols
d) Outputs are not used in Mealy machines
Answer: c

13. Which of the following is not a feature of Moore machines?
a) Outputs on states
b) Outputs on transitions
c) Outputs depend only on the current state
d) Outputs depend on the input symbol and current state
Answer: b

14. What is the process of reducing the number of states in an automaton called?
a) Simplification
b) Optimization
c) Minimization
d) Reduction
Answer: c

15. When are two states merged during automaton minimization?
a) When they have the same output
b) When they have the same input
c) When they have the same transitions
d) When they are both start states
Answer: c

16. Which of the following is true for a regular language recognized by a DFA?
a) It cannot be recognized by a Turing machine
b) It cannot be generated by a context-free grammar
c) It cannot be generated by a regular expression
d) It cannot be accepted by an NDFA
Answer: b

17. Can a DFA have multiple transitions for the same input symbol from the same state?
a) Yes

b) No
Answer: b

18. Which type of automaton can recognize context-free languages?
a) Finite automaton
b) Pushdown automaton
c) Mealy machine
d) Moore machine
Answer: b

19. The set of all strings that a finite automaton can accept is called:
a) Regular expression
b) Regular set
c) Transition set
d) Accepted set
Answer: b

20. What is the result of converting an NDFA into a DFA?
a) The language recognized becomes more complex
b) The language recognized remains the same
c) The language recognized becomes simpler
d) The language becomes non-regular
Answer: b

21. What is the difference between a transition function and an output function in automata?
a) Transition function deals with input symbols, and output function deals with output symbols
b) Transition function deals with output symbols, and output function deals with input symbols
c) Transition function deals with state transitions, and output function deals with outputs on transitions
d) Transition function deals with outputs on transitions, and output function deals with outputs on states
Answer: c

22. How many states does a DFA need to recognize a language with n symbols in the alphabet?
a) n
b) n+1
c) n^2
d) It depends on the specific language
Answer: d

23. Which of the following is not a property of a regular language?
a) Closure under union
b) Closure under concatenation
c) Closure under Kleene star
d) Closure under intersection
Answer: d

24. The power of an automaton refers to:
a) The number of states it has
b) The computational capabilities of the automaton
c) The size of its transition table
d) The number of input symbols it can recognize
Answer: b

25. If an automaton has multiple final states, what kind of language does it recognize?
a) Regular language
b) Context-free language
c) Non-regular language
d) The type of language depends on other factors as well

Answer: a

26. Which of the following automata is more expressive than the others in terms of the languages it can recognize?
a) DFA
b) NFA
c) Epsilon-NFA
d) NDFA
Answer: c

27. In which category of automata do Turing machines fall?
a) Finite automata
b) Pushdown automata
c) Linear-bounded automata
d) Unrestricted automata
Answer: d

28. A Mealy machine is a type of:
a) DFA
b) NFA
c) Context-free grammar
d) Finite automaton
Answer:

a

29. If a language is recognized by a Mealy machine, can it also be recognized by a Moore machine?
a) Yes
b) No
Answer: a

30. Can a DFA have epsilon transitions?
a) Yes
b) No
Answer: b

31. The set of all strings accepted by an automaton is called:
a) Input alphabet
b) Output alphabet
c) Language recognized by the automaton
d) Complement language
Answer: c

32. What is the purpose of a transition table in a finite automaton?
a) To store the outputs of each state
b) To define the input alphabet
c) To represent the transitions between states on each input symbol
d) To store the states of the automaton
Answer: c

33. Which of the following automata can accept infinite languages?
a) DFA
b) NFA
c) Mealy machine
d) Moore machine
Answer: b

34. What is the main limitation of a finite automaton?

a) It can only recognize regular languages
b) It cannot recognize any language
c) It cannot have more than 10 states
d) It requires a large amount of memory
Answer: a

35. Which of the following automata can accept languages that are not context-free?
a) Turing machine
b) Mealy machine
c) DFA
d) Pushdown automaton
Answer: a

36. Which type of automaton is used in lexical analysis for token recognition?
a) Finite automaton
b) Turing machine
c) Pushdown automaton
d) Mealy machine
Answer: a

37. If a language is context-free, can it also be regular?
a) Yes
b) No
Answer: a

38. A Mealy machine with n states can recognize a language with how many possible input strings?
a) n
b) n+1
c) 2^n
d) n!
Answer: c

39. Which automaton is used to recognize patterns described by regular expressions in text searching algorithms?
a) Mealy machine
b) Moore machine
c) Finite automaton
d) Turing machine
Answer: c

40. What is the result of converting a non-regular language into a DFA?
a) The DFA will accept the language
b) The DFA will not accept the language
c) The conversion process will fail
d) The language becomes regular
Answer: a

41. Which of the following is true for a regular language?
a) It can be recognized by a pushdown automaton
b) It can be recognized by a Turing machine
c) It can be recognized by a context-free grammar
d) It can be recognized by an unrestricted automaton
Answer: c

42. The concept of a non-deterministic finite automaton (NFA) is useful for:
a) Solving complex computational problems
b) Recognizing languages with nested structures
c) Representing automata with fewer states

d) Simulating a Turing machine
Answer: c

43. The language accepted by an NFA and its equivalent DFA are:
a) Different
b) The same
c) The DFA always accepts a superset of the NFA's language
d) The NFA always accepts a superset of the DFA's language
Answer: b

44. Which of the following is a correct representation of a transition function in a Mealy machine?
a) $\delta: Q \times \Sigma \rightarrow Q$
b) $\delta: Q \times \Sigma \rightarrow \Sigma$
c) $\delta: Q \times \Sigma \rightarrow P(Q)$
d) $\delta: Q \times \Sigma \rightarrow \Sigma \times Q$
Answer: d

45. The concept of an "ε-closure" is associated with which type of automaton?
a) Moore machine
b) DFA
c) NFA
d) Turing machine
Answer: c

46. An NDFA with n states can be converted into a DFA with:
a) n states
b) n+1 states
c) 2^n states
d) 2^(n+1) states
Answer: c

47. Which of the following automata can be simulated using a general-purpose computer?
a) Finite automaton
b) Pushdown automaton
c) Mealy machine
d) Turing machine
Answer: d

48. In automata theory, what does "complement" refer to?
a) The output of a Mealy machine
b) The inverse of a regular expression
c) The inverse of a language recognized by an automaton
d) The output of a Moore machine
Answer: c

49. Which type of automaton is most suitable for recognizing nested constructs, such as parentheses matching?
a) Finite automaton
b) Pushdown automaton
c) Mealy machine
d) Moore machine
Answer: b

50. The pumping lemma is a property associated with which type of languages?
a) Context-free languages
b) Regular languages
c) Non-regular languages
d) Turing decidable languages

Answer: c

1. What is a formal language?
a) A language spoken by a specific community
b) A language defined by a grammar or set of rules
c) A natural language like English or French
d) A language used in programming
Answer: b

2. A formal grammar consists of which components?
a) Vocabulary and syntax
b) Lexicon and semantics
c) Terminal and non-terminal symbols, production rules
d) Adjectives and verbs
Answer: c

3. In a formal grammar, terminal symbols are:
a) Symbols that can be expanded into other symbols
b) Symbols that cannot be expanded further
c) Symbols representing non-terminals
d) Reserved keywords in a programming language
Answer: b

4. What is a derivation in the context of formal grammars?
a) A sequence of steps to generate a sentence from a grammar
b) A process of removing terminal symbols from a sentence
c) A transformation that replaces non-terminal symbols with terminal symbols
d) A process of converting natural language into a formal language
Answer: a

5. Which of the following defines the language generated by a formal grammar?
a) The set of all non-terminal symbols in the grammar
b) The set of all terminal symbols in the grammar
c) The set of all sentences derivable from the grammar's start symbol
d) The set of all symbols in the grammar
Answer: c

6. What is the purpose of the Chomsky classification of grammars?
a) To categorize programming languages
b) To categorize formal languages based on their complexity
c) To classify natural languages into different families
d) To classify spoken languages into different dialects
Answer: b

7. Which type of grammar generates the most complex languages?
a) Type 0 (Unrestricted Grammar)
b) Type 1 (Context-Sensitive Grammar)
c) Type 2 (Context-Free Grammar)
d) Type 3 (Regular Grammar)
Answer: a

8. What is the distinguishing feature of a context-sensitive grammar?
a) Production rules with at most one symbol on the right-hand side
b) Production rules with at most two symbols on the right-hand side
c) Production rules with equal number of symbols on both sides
d) Production rules with varying lengths on both sides
Answer: d

9. Context-free grammars are useful for parsing:
a) Regular languages
b) Nested structures like parentheses
c) Complex natural languages
d) All types of languages
Answer: b

10. Which type of grammar can be parsed using a pushdown automaton?
a) Type 0 (Unrestricted Grammar)
b) Type 1 (Context-Sensitive Grammar)
c) Type 2 (Context-Free Grammar)
d) Type 3 (Regular Grammar)
Answer: c

11. Which type of grammar allows the most restrictions on its production rules?
a) Type 0 (Unrestricted Grammar)
b) Type 1 (Context-Sensitive Grammar)
c) Type 2 (Context-Free Grammar)
d) Type 3 (Regular Grammar)
Answer: d

12. Which type of grammar is commonly used to define the syntax of programming languages?
a) Type 0 (Unrestricted Grammar)
b) Type 1 (Context-Sensitive Grammar)
c) Type 2 (Context-Free Grammar)
d) Type 3 (Regular Grammar)
Answer: c

13. What is a recursive enumerable set?
a) A set of non-terminals in a grammar
b) A set of sentences derivable from a grammar
c) A set of terminals in a grammar
d) A set of symbols in a programming language
Answer: b

14. Which of the following is true for recursive enumerable languages?
a) They can be recognized by a Turing machine, but not generated by any grammar
b) They can be recognized by a pushdown automaton
c) They can be generated by a context-free grammar
d) They are always regular languages
Answer: a

15. The intersection of two context-free languages is:
a) Always a context-free language
b) Always a regular language
c) Always a context-sensitive language
d) Not necessarily a context-free language
Answer: d

16. Which operation on languages combines all possible concatenations of strings from two languages?
a) Intersection
b) Union
c) Concatenation
d) Kleene star
Answer: c

17. The Kleene star operation on a language L results in:
a) The set of all strings that are substrings of L
b) The set of all strings formed by concatenating zero or more strings from L
c) The set of all strings that have the same length as L
d) The set of all strings that are anagrams of L
Answer: b

18. The complement of a context-free language is:
a) Always context-free
b) Always regular
c) Always context-sensitive
d) Not necessarily context-free
Answer: d

19. Which operation on languages is analogous to logical OR?
a) Intersection
b) Union
c) Concatenation
d) Complementation
Answer: b

20. The set of all possible strings over an alphabet is known as:
a) Empty language
b) Universal language
c) Regular language
d) Context-free language
Answer: b

21. Which of the following is a non-regular language?
a) The set of all strings containing only a's and b's
b) The set of all strings containing an equal number of a's and b's
c) The set of all strings containing a prime number of a's
d) The set of all strings containing an equal number of a's, b's, and c's
Answer: c

22. Which type of automaton can recognize recursive enumerable languages?
a) Finite automaton
b) Pushdown automaton
c) Turing machine
d) Mealy machine
Answer: c

23. The intersection of two regular languages is always:
a) A regular language
b) A context-free language
c) A context-sensitive language
d) A non-regular language
Answer: a

24. Which operation on languages corresponds to logical AND?
a) Intersection
b) Union
c) Concatenation
d) Kleene star
Answer: a

25. The set of all possible strings over an alphabet Σ is denoted by:

a) Σ*
b) Σ+
c) Σ^
d) Σ°
Answer: a

26. Which type of grammar is suitable for defining the syntax of arithmetic expressions?
a) Type 0 (Unrestricted Grammar)
b) Type 1 (Context-Sensitive Grammar)
c) Type 2 (Context-Free Grammar)
d) Type 3 (Regular Grammar)
Answer: c

27. The union of two context-free languages is:
a) Always context-free
b) Always regular
c) Always context-sensitive
d) Not necessarily context-free
Answer: d

28. The power of a formal language refers to:
a) The number of symbols in the language
b) The number of

production rules in the grammar
c) The complexity of the language in terms of the grammar type
d) The size of the language alphabet
Answer: c

29. Which of the following is a context-sensitive language but not a context-free language?
a) The set of all palindromes
b) The set of all strings containing an equal number of a's and b's
c) The set of all strings containing a prime number of a's
d) The set of all strings containing an equal number of a's, b's, and c's
Answer: c

30. The complement of a regular language is always:
a) A regular language
b) A context-free language
c) A context-sensitive language
d) A non-regular language
Answer: a

31. What is the distinguishing feature of a context-free language?
a) Production rules with at most one symbol on the right-hand side
b) Production rules with at most two symbols on the right-hand side
c) Production rules with equal number of symbols on both sides
d) Production rules with varying lengths on the right-hand side
Answer: b

32. Which type of grammar can be parsed using a recursive descent parser?
a) Type 0 (Unrestricted Grammar)
b) Type 1 (Context-Sensitive Grammar)
c) Type 2 (Context-Free Grammar)
d) Type 3 (Regular Grammar)
Answer: c

33. The set of all possible strings of a finite length n over an alphabet Σ is denoted by:
a) Σ*
b) Σ+
c) Σ^n
d) Σ°
Answer: c

34. Which operation on languages is analogous to logical NOT?
a) Intersection
b) Union
c) Concatenation
d) Complementation
Answer: d

35. The union of two regular languages is always:
a) A regular language
b) A context-free language
c) A context-sensitive language
d) A non-regular language
Answer: a

36. Which type of automaton can recognize all regular languages?
a) Finite automaton
b) Pushdown automaton
c) Turing machine
d) Mealy machine
Answer: a

37. The set of all possible non-empty strings over an alphabet Σ is denoted by:
a) Σ*
b) Σ+
c) Σ^
d) Σ°
Answer: b

38. The Kleene star operation on a language L results in:
a) The set of all strings that are substrings of L
b) The set of all strings formed by concatenating zero or more strings from L
c) The set of all strings that have the same length as L
d) The set of all strings that are anagrams of L
Answer: b

39. The intersection of two context-free languages is:
a) Always a context-free language
b) Always a regular language
c) Always a context-sensitive language
d) Not necessarily a context-free language
Answer: d

40. Which operation on languages combines all possible concatenations of strings from two languages?
a) Intersection
b) Union
c) Concatenation
d) Kleene star
Answer: c

41. The set of all possible strings over an alphabet is known as:

a) Empty language
b) Universal language
c) Regular language
d) Context-free language
Answer: b

42. Which of the following is a non-regular language?
a) The set of all strings containing only a's and b's
b) The set of all strings containing an equal number of a's and b's
c) The set of all strings containing a prime number of a's
d) The set of all strings containing an equal number of a's, b's, and c's
Answer: c

43. Which type of automaton can recognize recursive enumerable languages?
a) Finite automaton
b) Pushdown automaton
c) Turing machine
d) Mealy machine
Answer: c

44. The intersection of two regular languages is always:
a) A regular language
b) A context-free language
c) A context-sensitive language
d) A non-regular language
Answer: a

45. Which operation on languages corresponds to logical AND?
a) Intersection
b) Union
c) Concatenation
d) Kleene star
Answer: a

46. The set of all possible strings over an alphabet Σ is denoted by:
a) Σ*
b) Σ+
c) Σ^
d) Σ°
Answer: a

47. Which type of grammar is suitable for defining the syntax of arithmetic expressions?
a) Type 0 (Unrestricted Grammar)
b) Type 1 (Context-Sensitive Grammar)
c) Type 2 (Context-Free Grammar)
d) Type 3 (Regular Grammar)
Answer: c

48. The union of two context-free languages is:
a) Always context-free
b) Always regular
c) Always context-sensitive
d) Not necessarily context-free
Answer: d

49. The power of a formal language refers to:
a) The number of symbols in the language

b) The number of production rules in the grammar
c) The complexity of the language in terms of the grammar type
d) The size of the language alphabet
Answer: c

50. Which of the following is a context-sensitive language but not a context-free language?
a) The set of all palindromes
b) The set of all strings containing an equal number of a's and b's
c) The set of all strings containing a prime number of a's
d) The set of all strings containing an equal number of a's, b's, and c's
Answer: c