

Compiler Design

1. Match the description of several parts of a classic optimizing compiler in List - I, with the names of those parts in List - II:

List - I

- (a) A part of a compiler that is responsible for recognizing syntax.
- (b) A part of a compiler that takes as input a stream of characters and produces as output a stream of words along with their associated syntactic categories.
- (c) A part of a compiler that understand the meanings of variable names and other symbols and checks that they are used in ways consistent with their definitions.
- (d) An IR-to-IR transformer that tries to improve the IR program in some way (Intermediate representation).

List - II

- (i) Optimizer
- (ii) Semantic Analysis
- (iii) Parser
- (iv) Scanner

Code:

- (a) (b) (c) (d)
- (1) (iii) (iv) (i) (ii)
- (2) (iv) (iii) (ii) (i)
- (3) (ii) (iv) (i) (iii)
- (4) (ii) (iv) (iii) (i)

Answer: 1

2. Consider the following statements related to compiler construction:

- I. Lexical Analysis is specified by context-free grammars and implemented by pushdown automata.
 - II. Syntax Analysis is specified by regular expressions and implemented by finite-state machine.
- Which of the above statement(s) is/are correct?
- (1) Only I
 - (2) Only II
 - (3) Both I and II
 - (4) Neither I nor II

Answer: 4

3. In, the bodies of the two loops are merged together to form a single loop provided that they do not make any references to each other.

- (A) Loop unrolling
- (B) Strength reduction
- (C) Loop concatenation
- (D) Loop jamming

Answer: D

4. Which of the following is FALSE ?

- (A) The grammar $S \rightarrow aSb|bSa|SS|\epsilon$, where S is the only non-terminal symbol and ϵ is the null string, is ambiguous.
- (B) SLR is powerful than LALR.
- (C) An LL(1) parser is a top-down parser.

(D) YACC tool is an LALR(1) parser generator.

Answer: B

5. If all the production rules have single non-terminal symbol on the left side, the grammar defined is :

- (A) context free grammar (B) context sensitive grammar
(C) unrestricted grammar (D) phrase grammar

Answer: A

6. Which one from the following is false ?

- (A) LALR parser is Bottom - Up parser
(B) A parsing algorithm which performs a left to right scanning and a right most deviation is RL(1).
(C) LR parser is Bottom - Up parser.
(D) In LL(1), the 1 indicates that there is a one - symbol look - ahead.

Answer: B

7. Which phase of compiler generates stream of atoms ?

- (A) Syntax analysis (B) Lexical Analysis
(C) Code generation (D) Code optimization

Answer: A

8. A grammar G is LL(1) if and only if the following conditions hold for two distinct productions

$A \rightarrow \alpha \mid \beta$

I. $\text{First}(\alpha) \cap \text{First}(\beta) \neq \{a\}$ where a is some terminal symbol of the grammar.

II. $\text{First}(\alpha) \cap \text{First}(\beta) \neq \lambda$

III. $\text{First}(\alpha) \cap \text{Follow}(A) = \emptyset$ if $\lambda \in \text{First}(\beta)$

- (A) I and II (B) I and III
(C) II and III (D) I, II and III

Answer: D

9. Which of the following suffices to convert an arbitrary CFG to an LL(1) grammar ?

- (A) Removing left recursion alone.
(B) Removing the grammar alone
(C) Removing left recursion and factoring the grammar
(D) None of the above

Answer: D

10. The context free grammar for language $L = \{a^n b^m c^k \mid k = |n - m|, n \geq 0, m \geq 0, k \geq 0\}$ is

- (A) $S \rightarrow S_1 S_3, S_1 \rightarrow a S_1 c \mid S_2 \mid \lambda, S_2 \rightarrow a S_2 b \mid \lambda, S_3 \rightarrow a S_3 b \mid S_4 \mid \lambda, S_4 \rightarrow b S_4 c \mid \lambda$
(B) $S \rightarrow S_1 S_3, S_1 \rightarrow a S_1 S_2 c \mid \lambda, S_2 \rightarrow a S_2 b \mid \lambda, S_3 \rightarrow a S_3 b \mid S_4 \mid \lambda, S_4 \rightarrow b S_4 c \mid \lambda$
(C) $S \rightarrow S_1 \mid S_2, S_1 \rightarrow a S_1 S_2 c \mid \lambda, S_2 \rightarrow a S_2 b \mid \lambda, S_3 \rightarrow a S_3 b \mid S_4 \mid \lambda, S_4 \rightarrow b S_4 c \mid \lambda$
(D) $S \rightarrow S_1 \mid S_3, S_1 \rightarrow a S_1 c \mid S_2 \mid \lambda, S_2 \rightarrow a S_2 b \mid \lambda, S_3 \rightarrow a S_3 b \mid S_4 \mid \lambda, S_4 \rightarrow b S_4 c \mid \lambda$

Answer: D

11. The regular grammar for the language $L = \{w \mid n_a(w) \text{ and } n_b(w) \text{ are both even, } w \in \{a, b\}^*\}$ is given by :

(Assume, p, q, r and s are states)

- (A) $p \rightarrow aq \mid br \mid \lambda, q \rightarrow bs \mid ap$
 $r \rightarrow as \mid bp, s \rightarrow ar \mid bq,$
p and s are initial and final states.
(B) $p \rightarrow aq \mid br, q \rightarrow bs \mid ap$
 $r \rightarrow as \mid bp, s \rightarrow ar \mid bq,$

- p and s are initial and final states
(C) $p \rightarrow aq|br|\lambda$, $q \rightarrow bs|ap$
 $r \rightarrow as|bp$, $s \rightarrow ar|bq$,
p is both initial and final states
(D) $p \rightarrow aq|br$, $q \rightarrow bs|ap$
 $r \rightarrow as|bp$, $s \rightarrow ar|bq$,
p is both initial and final states.

Answer: C

12. Given the following statements :

- S_1 : SLR uses follow information to guide reductions. In case of LR and LALR parsers, the look-aheads are associated with the items and they make use of the left context available to the parser.
 S_2 : LR grammar is a larger sub-class of context free grammar as compared to that SLR and LALR grammars.

Which of the following is true ?

- (A) S_1 is not correct and S_2 is not correct.
(B) S_1 is not correct and S_2 is correct.
(C) S_1 is correct and S_2 is not correct.
(D) S_1 is correct and S_2 is correct.

Answer: D

13. The context free grammar for the language

- $L = \{a^n b^m \mid n \leq m+3, n \geq 0, m \geq 0\}$ is
(A) $S \rightarrow aaaA$; $A \rightarrow aAb|B$, $B \rightarrow Bb|\lambda$
(B) $S \rightarrow aaaA|\lambda$, $A \rightarrow aAb|B$, $B \rightarrow Bb|\lambda$
(C) $S \rightarrow aaaA|aaA|\lambda$, $A \rightarrow aAb|B$, $B \rightarrow Bb|\lambda$
(D) $S \rightarrow aaaA|aaA|aA|\lambda$, $A \rightarrow aAb|B$, $B \rightarrow Bb|\lambda$

Answer: D

14. Given the following statements :

- S_1 : If L is a regular language then the language $\{uv \mid u \in L, v \in L^R\}$ is also regular.
 S_2 : $L = \{ww^R\}$ is regular language.

Which of the following is true ?

- (A) S_1 is not correct and S_2 is not correct.
(B) S_1 is not correct and S_2 is correct.
(C) S_1 is correct and S_2 is not correct.
(D) S_1 is correct and S_2 is correct.

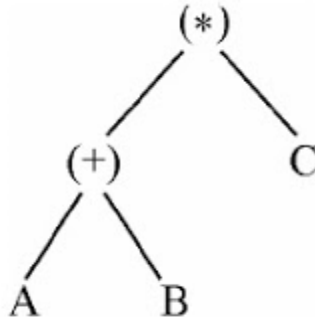
Answer: C

15. Which of the following is true while converting CFG to LL(1) grammar ?

- (A) Remove left recursion alone
(B) Factoring grammar alone
(C) Both of the above
(D) None of the above

Answer: C

16. Which of the following expression is represented by the parse tree?



- (A) $(A + B) * C$
- (B) $A + * BC$
- (C) $A + B * C$
- (D) $A * C + B$

Answer: A

17. A shift-reduce parser carries out the actions specified within braces immediately after reducing with the corresponding rule of the grammar.

$S \rightarrow xW$ [print "1"]

$S \rightarrow y$ [print "2"]

$W \rightarrow S_2$ [print "3"], what is the translation of "x x x x y z z"?

- (A) 1 1 2 3 1
- (B) 1 1 2 3 3
- (C) 2 3 1 3 1
- (D) 2 3 3 2 1

Answer: C

18. Context-free Grammar (CFG) can be recognized by

- (A) Finite state automata
- (B) 2-way linear bounded automata
- (C) push down automata
- (D) both (B) and (C)

Answer: D

19. Synthesized attribute can be easily simulated by a

- (A) LL grammar
- (B) Ambiguous grammar
- (C) LR grammar
- (D) None of the above

Answer: C

20. Which of the following is the most general phase-structured grammar ?

- (A) Regular
- (B) Context-sensitive
- (C) Context free
- (D) Syntax tree

Answer: B

21. A compiler for a high level language that runs on one machine and produces code for a different machine is called:

- (A) Optimizing
- (B) One pass compiler
- (C) Cross compiler
- (D) Multipass compiler

Answer: C

22. The 'K' in LR (K) cannot be:

- (A) 0 (B) 1 (C) 2 (D) None of these

Answer: D

23. Peep-hole optimization is a form of:

- (A) loop optimization (B) local optimization
(C) constant folding (D) data flow analysis

Answer: C

24. Which of the following regular expressions, each describing a language of binary numbers (MSB to LSB) that represents non-negative decimal values, does not include even values?

- (1) $0^*1^+0^*1^*$
(2) $0^*1^*0^+1^*$
(3) $0^*1^*0^*1^+$
(4) $0^+1^*0^*1^*$

Where $\{+, *\}$ are quantification characters.

Answer: 3

25. The number of strings of length 4 that are generated by the regular expression $(0^+1^+|2^+3^+)^*$, where $|$ is an alternation character and $\{+, *\}$ are quantification characters, is:

- (A) 08 (B) 09
(C) 10 (D) 12

Answer: C

26. In compiler optimization, operator strength reduction uses mathematical identities to replace slow math operations with faster operations. Which of the following code replacements is an illustration of operator strength reduction?

- (A) Replace $P + P$ by $2 * P$ or Replace $3 + 4$ by 7.
(B) Replace $P * 32$ by $P \ll 5$
(C) Replace $P * 0$ by 0
(D) Replace $(P \ll 4) - P$ by $P * 15$

Answer: B

27. Which of the following is FALSE?

- (A) The grammar $S \rightarrow aS|aSbS|\square$, where S is the only non-terminal symbol, and \square is the null string, is ambiguous.
(B) An unambiguous grammar has same left most and right most derivation.
(C) An ambiguous grammar can never be LR(k) for any k.
(D) Recursive descent parser is a top-down parser.

Answer: B

28. The number of strings of length 4 that are generated by the regular expression $(0|\epsilon)1^+2^*(3|\epsilon)$, where $|$ is an alternation character, $\{+, *\}$ are quantification characters, and ϵ is the null string, is:

- (A) 08 (B) 10
(C) 11 (D) 12

Answer: D

29. Let $G = (V, T, S, P)$ be a context-free grammar such that every one of its productions is of the form $A \rightarrow v$, with $|v| = K > 1$. The derivation tree for any $W \in L(G)$ has a height h such that

$$(1) \log_K |W| \leq h \leq \log_K \left(\frac{|W| - 1}{K - 1} \right)$$

$$(2) \log_K |W| \leq h \leq \log_K (K|W|)$$

$$(3) \log_K |W| \leq h \leq K \log_K |W|$$

$$(4) \log_K |W| \leq h \leq \left(\frac{|W| - 1}{K - 1} \right)$$

Answer: 4

30. Given the following two languages:

$$L1 = \{a^n b^n | n \geq 0, n \neq 100\}$$

$$L2 = \{w \in \{a, b, c\}^* | n_a(w) = n_b(w) = n_c(w)\}$$

Which of the following options is correct?

- (1) Both L1 and L2 are not context free language.
- (2) Both L1 and L2 are context free language.
- (3) L1 is context free language, L2 is not context free language.
- (4) L1 is not context free language, L2 is context free language.

Answer: 3

31. Given the following two statements:

A. $L = \{w | n_a(w) = n_b(w)\}$ is deterministic context free language, but not linear.

B. $L = \{a^n b^n\} \cup \{a^n b^{2n}\}$ is linear, but not deterministic context free language.

Which of the following options is correct?

- (1) Both (A) and (B) are false.
- (2) Both (A) and (B) are true.
- (3) (A) is true, (B) is false.
- (4) (A) is false, (B) is true.

Answer: 2

32. Let $G = (V, T, S, P)$ be a context-free grammar such that every one of its productions is of the form $A \rightarrow n$, with $|v| = k > 1$. The derivation tree for any string $W \in L(G)$ has a height such that

$$(A) \quad h < \frac{(|W| - 1)}{k - 1}$$

$$(B) \quad \log_k |W| \leq h$$

$$(C) \quad \log_k |W| < h < \frac{(|W| - 1)}{k - 1}$$

$$(D) \quad \log_k |W| \leq h \leq \frac{(|W| - 1)}{k - 1}$$

Answer: D

33. How many tokens will be generated by the scanner for the following statement ?

$$x = x * (a + b) - 5;$$

- (A) 12 (B) 11
- (C) 10 (D) 07

Answer: A

34. Loop unrolling is a code optimization technique:

- (A) that avoids tests at every iteration of the loop
- (B) that improves performance by decreasing the number of instructions in a basic block.
- (C) that exchanges inner loops with outer loops
- (D) that reorders operations to allow multiple computations to happen in parallel.

Answer: A

35. Which of the following is true ?

- (A) Canonical LR parser is LR (1) parser with single look ahead terminal
- (B) All LR(K) parsers with $K > 1$ can be transformed into LR(1) parsers.
- (C) Both (A) and (B)
- (D) None of the above

Answer: C

36. The following Context-Free Grammar (CFG) :

$S \rightarrow aB \mid bA$

$A \rightarrow a \mid as \mid bAA$

$B \rightarrow b \mid bs \mid aBB$

will generate

- (A) odd numbers of a's and odd numbers of b's
- (B) even numbers of a's and even numbers of b's
- (C) equal numbers of a's and b's
- (D) different numbers of a's and b's

Answer: A,B,C,D

37. A shift reduce parser suffers from

- (A) shift reduce conflict only
- (B) reduce reduce conflict only
- (C) both shift reduce conflict and reduce reduce conflict
- (D) shift handle and reduce handle conflicts

Answer: C

38. LL grammar for the language $L = \{a^n b^m c^{n+m} \mid m \geq 0, n \geq 0\}$ is

(A) $S \rightarrow aSc \mid S_1 ; S_1 \rightarrow bS_1c \mid \lambda$

(B) $S \rightarrow aSc \mid S_1 \mid \lambda ; S_1 \rightarrow bS_1c$

(C) $S \rightarrow aSc \mid S_1 \mid \lambda ; S_1 \rightarrow bS_1c \mid \lambda$

(D) $S \rightarrow aSc \mid \lambda ; S_1 \rightarrow bS_1c \mid \lambda$

Answer: C

39. Assume the statements S_1 and S_2 given as:

S_1 : Given a context free grammar G , there exists an algorithm for determining whether $L(G)$ is infinite.

S_2 : There exists an algorithm to determine whether two context free grammars generate the same language.

Which of the following is true?

- (A) S_1 is correct and S_2 is not correct.
- (B) Both S_1 and S_2 are correct.
- (C) Both S_1 and S_2 are not correct.
- (D) S_1 is not correct and S_2 is correct.

Answer: A

40. In compiler design 'reducing the strength' refers to
- (A) reducing the range of values of input variables.
 - (B) code optimization using cheaper machine instructions.
 - (C) reducing efficiency of program.
 - (D) None of the above

Answer: B

41. Which of the following is the most powerful parsing method ?
- (A) LL(I)
 - (B) Canonical LR
 - (C) SLR
 - (D) LALR

Answer: B

42. Grammar of the programming is checked at phase of compiler.
- (A) semantic analysis
 - (B) code generation
 - (C) syntax analysis
 - (D) code optimization

Answer: C

43. Which of the following is the most general phase structured grammar?
- (A) Regular
 - (B) Context-sensitive
 - (C) Context free
 - (D) None of the above

Answer: B

44. Which of the following grammar is LR (1)?
- (A) $A \rightarrow aAb, A \rightarrow bAb, A \rightarrow a, A \rightarrow b$
 - (B) $A \rightarrow aAa, A \rightarrow aAb, A \rightarrow c$
 - (C) $A \rightarrow A+A, A \rightarrow a$
 - (D) Both (A) and (B)

Answer: D

45. A compiler that runs on one machine and produces code for a different machine is called:
- (A) Cross compilation
 - (B) One pass compilation
 - (C) Two pass compilation
 - (D) None of the above

Answer: A

46. Any syntactic construct that can be described by a regular expression can also be described by a:
- (A) Context sensitive grammar
 - (B) Non context free grammar
 - (C) Context free grammar
 - (D) None of the above

Answer: C

47. YACC builds up parsing table.
- (A) LALR

- (B) LR
- (C) SLR
- (D) LLR

Answer: A

48. Which of the statements related to Compilers is wrong ?

- (A) Lexical analysis is breaking the input into tokens
- (B) Syntax analysis is for parsing the phrase
- (C) Syntax analysis is for analyzing the semantic
- (D) None of these

Answer: C

49. Which of the following is the most general phase - structured grammar ?

- (A) Regular
- (B) Context – Sensitive
- (C) Context free
- (D) None of these

Answer: B

50. The dynamic binding occurs during the:

- (A) Compile time
- (B) Run time
- (C) Linking time
- (D) Pre-processing time.

Answer: B

51. Symbol Table can be used for:

- (A) Checking type compatibility
- (B) Suppressing duplication of error message
- (C) Storage allocation
- (D) All of these

Answer: D

52. Shift-Reduce parsers perform the following :

- (A) Shift step that advances in the input stream by $K(K > 1)$ symbols and Reduce step that applies a completed grammar rule to some recent parse trees, joining them together as one tree with a new root symbol.
- (B) Shift step that advances in the input stream by one symbol and Reduce step that applies a completed grammar rule to some recent parse trees, joining them together as one tree with a new root symbol.
- (C) Shift step that advances in the input stream by $K(K = 2)$ symbols and Reduce step that applies a completed grammar rule to form a single tree.
- (D) Shift step that does not advance in the input stream and Reduce step that applies a completed grammar rule to form a single tree.

Answer: B

Answer: D

53. Which one of the following statement is false?

- (A) Context-free languages are closed under union.
- (B) Context-free languages are closed under concatenation.
- (C) Context-free languages are closed under intersection.
- (D) Context-free languages are closed under Kleene closure.

Answer: D

54. A parse tree is an annotated parse tree if:

- (A) it shows attribute values at each node.

- (B) there are no inherited attributes.
- (C) it has synthesized nodes as terminal nodes.
- (D) every non-terminal nodes is an inherited attribute.

Answer: A

55. In a two pass compiler, during the first pass:

- (A) user defined address symbols are correlated with their binary equivalent
- (B) the syntax of the statement is checked and mistakes, if any, are listed
- (C) object program is generated
- (D) semantic of the source program is elucidated.

Answer: A

56. Top-down parsers are predictive parsers, because:

- (A) next tokens are predicted
- (B) length of the parse tree is predicted before hand
- (C) lowest node in the parse tree is predicted
- (D) next lower level of the parse tree is predicted

Answer: A

57. In the context of compiler design, “reduction in strength” refers to:

- (A) code optimization obtained by the use of cheaper machine instructions
- (B) reduction in accuracy of the output
- (C) reduction in the range of values of input variables
- (D) reduction in efficiency of the program

Answer: A

58. The parsing technique that avoids back tracking is:

- (A) Top-down parsing
- (B) Recursive-descent parsing
- (C) Predictive
- (D) Syntax tree

Answer: C

59. A Top-down Parse generates:

- (A) Right-most derivation
- (B) Right-most derivation in reverse
- (C) Left-most derivation
- (D) Left-most derivation in reverse

Answer: C

60. In an absolute loading scheme, which loader function is accomplished by programmer?

- (A) Allocation
- (B) Linking
- (C) Reallocation
- (D) Both (A) and (B)

Answer: D

61. Symbol table can be used for:

- (A) Checking type compatibility
- (B) Suppressing duplication of error message
- (C) Storage allocation
- (D) All of these above

Answer: D

62. Tasks done in parsing are:

- (A) Check the validity of a source string
- (B) Determine the syntactic structure of a source string
- (C) Both (A) and (B)
- (D) None of these

Answer: C

63. The action of passing the source program into the proper syntactic class is known as:

- (A) Syntax analysis
- (B) Lexical analysis
- (C) Interpretation analysis
- (D) Uniform symbol generation

Answer: B

64. The dynamic binding occurs during the:

- (A) Compile time
- (B) Run time
- (C) Linking time
- (D) Pre-processing time

Answer: B

65. A Top-down Parse generates:

- (A) Left-most derivation
- (B) Right-most derivation
- (C) Right-most derivation in reverse
- (D) Left-most derivation in reverse

Answer: A

66. Code optimization is responsibility of:

- (A) Application programmer
- (B) System programmer
- (C) Operating system
- (D) All of the above

Answer: B

67. The translator which performs macro calls expansion is called :

- (A) Macro processor
- (B) Micro pre-processor
- (C) Macro pre-processor
- (D) Dynamic linker

Answer: C

68. The process of assigning load addresses to the various parts of the program and adjusting the code and data in the program to reflect the assigned addresses is called

- (A) Symbol resolution
- (B) Parsing
- (C) Assembly
- (D) Relocation

Answer: D

69. Which of the following derivations does a top-down parser use while parsing an input string ?

The input is scanned from left to right.

- (A) Leftmost derivation
- (B) Leftmost derivation traced out in reverse
- (C) Rightmost derivation traced out in reverse

(D) Rightmost derivation

Answer: A

70. Which of the following is used for grouping of characters into tokens (in a computer)?

(A) A parser

(B) Code optimizer

(C) Code generator

(D) Scanner

Answer: D

71. At the end of parsing,

(A) tokens are identified.

(B) set of instructions are identified.

(C) the syntactic groups are identified.

(D) machine instructions are identified.

Answer: A

72. Dead-code elimination in machine code optimization refers to:

(A) removal of all labels.

(B) removal of values that never get used.

(C) removal of function which are not involved.

(D) removal of a module after its use.

Answer: B