 UNIT 5 – TREES

(Questions 1–40)

Q1. A tree is a _____ data structure.
a) Linear
b) Hierarchical
c) Network
d) Graph

Q2. The topmost node of a tree is called _____.
a) Leaf node
b) Root node
c) Parent node
d) Child node

Q3. Fill in the blank: The nodes with no children are called _____.
a) Parent nodes
b) Root nodes
c) Leaf nodes
d) Internal nodes

Q4. In a binary tree, the maximum number of nodes at level ‘l’ is _____.
a) 2^l
b) 2^(l−1)
c) l^2
d) $\log l$

Q5. A binary tree of height h has a maximum of _____ nodes.
a) 2^h
b) 2^(h+1) − 1
c) h^2
d) h × 2

Q6. Fill in the blank: In a binary tree, the degree of any node is at most _____.
a) 3
b) 2
c) 1
d) n

Q7. Which of the following traversals visits nodes in the order “Left → Root → Right”?
a) Preorder
b) Inorder
c) Postorder
d) Level order

Q8. Preorder traversal order is _____.
a) Left → Root → Right
b) Right → Left → Root
c) Root → Left → Right
d) Left → Right → Root

Q9. Postorder traversal order is _____.
a) Root → Left → Right
b) Left → Root → Right
c) Left → Right → Root
d) Right → Root → Left

Q10. Fill in the blank: The number of edges in a tree with n nodes is _____.
a) n
b) n − 1
c) n + 1
d) n^2

Q11. A binary tree is said to be **complete** when _____.
a) Every level is completely filled except possibly the last

b) All nodes have two children
c) It has no leaf nodes
d) None of the above

Q12. A **full binary tree** is one in which _____.
a) Each node has at most one child
b) Each node has either 0 or 2 children
c) All nodes are at the same level
d) None of these

Q13. Fill in the blank: The height of a tree with a single node is _____.
a) 0
b) 1
c) 2
d) Undefined

Q14. The inorder traversal of a binary search tree gives elements in _____ order.
a) Ascending
b) Descending
c) Random
d) Spiral

Q15. Which of the following is NOT a valid tree traversal method?
a) Inorder
b) Postorder
c) Crossorder
d) Preorder

Q16. Fill in the blank: The left child of a node at index i in array representation is stored at _____.
a) 2i
b) 2i + 1
c) i + 1
d) i − 1

Q17. In array representation, the right child of a node at index i is stored at _____.
a) 2i
b) 2i + 1
c) 2i + 2
d) i + 2

Q18. Fill in the blank: The parent of node at index i in array representation is at index _____.
a) (i − 1) / 2
b) (i + 1) / 2
c) i / 2
d) 2 / i

Q19. A tree with all leaves at the same level is called a _____ tree.
a) Skewed
b) Perfect binary
c) Complete
d) Full

Q20. What is the maximum number of nodes in a binary tree of depth 4?
a) 8
b) 15
c) 16
d) 31

Q21. Fill in the blank: The **degree** of a tree is the maximum number of _____ of any node.
a) Parents
b) Children
c) Leaves
d) Levels

Q22. A **binary search tree (BST)** stores values such that:
a) Left < Root < Right

b) Left > Root < Right
c) Root < Left < Right
d) None

Q23. The process of visiting each node exactly once in a tree is called _____.
a) Traversal
b) Searching
c) Insertion
d) Deletion

Q24. Fill in the blank: A binary tree can be efficiently represented using _____.
a) Stack
b) Array or linked list
c) Queue
d) Graph

Q25. Which traversal technique is best for expression evaluation?
a) Preorder
b) Postorder
c) Inorder
d) Level order

Q26. The total number of binary trees possible with 3 nodes is _____.
a) 3
b) 5
c) 7
d) 15

Q27. Fill in the blank: In a **skewed binary tree**, every parent has only _____.
a) Left child
b) Right child
c) One child
d) Two children

Q28. Which of the following operations cannot be performed directly on array representation of binary trees?
a) Traversal
b) Insertion
c) Deletion of arbitrary node
d) Access by index

Q29. The space complexity of a recursive traversal of a binary tree is _____.
a) O(1)
b) O(n)
c) O(h)
d) $O(n^2)$

Q30. Fill in the blank: The time complexity for traversal of a binary tree is _____.
a) O(log n)
b) O(n)
c) O(n log n)
d) $O(n^2)$

Q31. In which traversal method is the root node visited first?
a) Inorder
b) Preorder
c) Postorder
d) None

Q32. Which traversal of a binary tree is used to **copy** the tree?
a) Preorder
b) Inorder
c) Postorder
d) Level order

Q33. Fill in the blank: Threaded binary trees are used to make traversal _____.
a) Faster

b) Slower
c) Random
d) Level-based

Q34. Which type of binary tree allows traversal without using recursion or stack?
a) Full tree
b) Threaded tree
c) Skewed tree
d) Complete tree

Q35. The time complexity of searching in a balanced BST is _____.
a) O(n)
b) O(log n)
c) O(n log n)
d) O(1)

Q36. Fill in the blank: The maximum number of nodes at height h is _____.
a) 2^(h+1) − 1
b) h + 1
c) 2h
d) h^2

Q37. Which traversal gives prefix expression for an expression tree?
a) Postorder
b) Inorder
c) Preorder
d) Level order

Q38. Which traversal gives postfix expression for an expression tree?
a) Inorder
b) Postorder
c) Preorder
d) Reverse inorder

Q39. Fill in the blank: In a binary search tree, all values in the right subtree are _____ than the root.
a) Greater
b) Smaller
c) Equal
d) Random

Q40. The height of a binary tree with 15 nodes (perfect binary tree) is _____.
a) 2
b) 3
c) 4
d) 5

 ANSWER KEY – UNIT 5 (Q1–40)

---

1. b — Tree is hierarchical.
2. b — Topmost = root.
3. c — Leaf nodes have no children.
4. a — Max nodes at level l = 2^l.
5. b — Max = 2^(h+1) − 1.
6. b — Max degree = 2.
7. b — Inorder = Left Root Right.
8. c — Preorder = Root Left Right.
9. c — Postorder = Left Right Root.
10. b — Edges = n − 1.
11. a — Complete = all levels filled except possibly last.
12. b — Full = 0 or 2 children.
13. a — Single node height 0.
14. a — BST inorder = ascending order.
15. c — Crossorder doesn't exist.
16. a — Left child = 2i.

17. c — Right child = 2i + 2.
18. a — Parent = (i − 1)/2.
19. b — Perfect = all leaves same level.
20. b — Depth 4 ⇒ 2^(4+1) − 1 = 31.
21. b — Degree = max children.
22. a — BST property: Left < Root < Right.
23. a — Traversal = visit all nodes once.
24. b — Array or linked representation.
25. b — Postorder used in expression evaluation.
26. b — 5 unique binary trees for 3 nodes.
27. c — Skewed ⇒ every node has one child.
28. c — Deletion arbitrary node complex in array.
29. c — Depends on height ⇒ O(h).
30. b — Traversal = O(n).
31. b — Preorder visits root first.
32. a — Preorder used to copy tree.
33. a — Threaded trees make traversal faster.
34. b — Threaded trees avoid recursion/stack.
35. b — Balanced BST = O(log n) search.
36. a — Max nodes = 2^(h+1) − 1.
37. c — Preorder ⇒ prefix expression.
38. b — Postorder ⇒ postfix expression.
39. a — Right subtree > root.
40. c — 15 nodes ⇒ height = 4.

⇒ END OF UNIT 5 – TREES (SET 1: Q1–40)

⇒ UNIT 5 – TREES

(Questions 41–60)

Q41. Which property of BST ensures that searching can be done in O(log n) time (in best case)?
a) Tree is complete
b) Tree is balanced
c) Tree is full
d) Tree is skewed

Q42. Fill in the blank: The left child of a node in a BST always has a value _____ the node's value.
a) Greater than
b) Equal to
c) Less than
d) Random

Q43. Which of the following traversals of BST gives sorted order?
a) Preorder
b) Postorder
c) Inorder
d) Level order

Q44. If elements are inserted in increasing order into a BST, the resulting tree will be _____.
a) Balanced
b) Left-skewed
c) Right-skewed
d) Perfect

Q45. Fill in the blank: Insertion in BST takes _____ time on average.
a) O(1)
b) O(n)
c) O(log n)
d) $O(n^2)$

Q46. What happens to the height of BST when data is inserted in sorted order?
a) Decreases
b) Increases (becomes skewed)

c) Remains balanced
d) Randomly changes

Q47. The inorder predecessor of a node in BST is the _____.
a) Largest value in its left subtree
b) Smallest value in its right subtree
c) Parent node
d) Root node

Q48. The inorder successor of a node in BST is _____.
a) Smallest value in right subtree
b) Largest in left subtree
c) Parent node
d) None

Q49. Fill in the blank: Deletion of a node with two children in BST is done by replacing it with its _____.
a) Root
b) Successor or predecessor
c) Child node
d) Random node

Q50. Which operation requires re-linking of pointers in BST?
a) Searching
b) Traversal
c) Deletion
d) Printing

Q51. What is the time complexity of searching an element in an unbalanced BST?
a) O(n)
b) O(log n)
c) $O(n^2)$
d) O(1)

Q52. Fill in the blank: A **balanced BST** ensures that difference in height between left and right subtrees is at most _____.
a) 0
b) 1
c) 2
d) n

Q53. Which traversal is used for non-recursive tree traversal using stack?
a) Preorder
b) Inorder
c) Level order
d) Postorder

Q54. The maximum height of a BST with 7 nodes (worst case) is _____.
a) 2
b) 3
c) 6
d) 7

Q55. Fill in the blank: A **threaded binary tree** replaces NULL pointers with _____.
a) Child links
b) Parent links
c) Inorder predecessor/successor links
d) Random pointers

Q56. The purpose of threading in binary trees is to _____.
a) Make traversal faster
b) Reduce memory
c) Eliminate recursion and stack
d) Both (a) and (c)

Q57. In a right-threaded binary tree, the right null pointer points to _____.
a) Inorder successor
b) Inorder predecessor

c) Root
d) Leaf node

Q58. Fill in the blank: In a left-threaded tree, the left null pointer points to the node's _____.
a) Inorder predecessor
b) Inorder successor
c) Root
d) Leaf

Q59. Threaded binary trees are especially useful for _____.
a) Postorder traversal
b) Inorder traversal
c) Level order traversal
d) Preorder traversal

Q60. What is the time complexity of inorder traversal in a threaded binary tree?
a) O(1)
b) O(log n)
c) O(n)
d) O(n²)

 ANSWER KEY (Q41–60)

---

41. b — Balanced BST ensures O(log n) operations.
42. c — Left < Node < Right property.
43. c — Inorder traversal gives ascending order.
44. c — Sequential insertions right-skewed tree.
45. c — Average insertion = O(log n).
46. b — Becomes skewed; height increases.
47. a — Inorder predecessor = largest in left subtree.
48. a — Inorder successor = smallest in right subtree.
49. b — Replace with inorder successor/predecessor.

50. c — Deletion changes links.
51. a — Unbalanced tree □ O(n).
52. b — Balanced if height difference ≤ 1.
53. b — Inorder often implemented with stack.
54. d — Worst = skewed □ height = n = 7.
55. c — Threads replace nulls with inorder links.
56. d — Speeds traversal and avoids recursion.
57. a — Right-thread □ inorder successor.
58. a — Left-thread □ inorder predecessor.
59. b — Threaded trees optimize inorder traversal.
60. c — Visit each node once □ O(n).

(Questions 61–80)

Q61. Which traversal is best suited to generate an expression tree from postfix expression?
a) Preorder
b) Postorder
c) Level order
d) Inorder

Q62. Fill in the blank: In an **expression tree**, leaves represent _____.
a) Operators
b) Operands
c) Variables
d) None

Q63. Internal nodes of an expression tree are always _____.
a) Operands
b) Operators
c) Constants
d) Pointers

Q64. The inorder traversal of an expression tree gives _____.
a) Prefix expression
b) Postfix expression
c) Infix expression
d) Random order

Q65. Fill in the blank: Postorder traversal of an expression tree gives _____.
a) Infix expression
b) Prefix expression
c) Postfix expression
d) Level order expression

Q66. Which traversal gives prefix notation?
a) Postorder
b) Inorder
c) Preorder
d) Level order

Q67. Expression tree for (A + B) * (C − D) will have _____ as root.
a) +
b) *
c) −
d) D

Q68. The postorder traversal of expression tree of (A + B * C) is _____.
a) ABC*+
b) AB+C*
c) A+BC*
d) CBA*+

Q69. Fill in the blank: The height of an expression tree depends on the number of _____.
a) Operators

b) Operands
c) Variables
d) Parentheses

Q70. Evaluation of expression tree is done using _____ traversal.
a) Inorder
b) Preorder
c) Postorder
d) Level order

Q71. Which traversal of expression tree can be used to generate machine code?
a) Preorder
b) Inorder
c) Postorder
d) None

Q72. Fill in the blank: Expression trees help in converting infix to _____ or _____ forms.
a) Prefix, Postfix
b) Preorder, Level order
c) Postorder, Inorder
d) Left, Right

Q73. Expression tree nodes can store _____.
a) Numbers only
b) Operators and operands both
c) Only symbols
d) None

Q74. Fill in the blank: Evaluation of expression tree proceeds in _____ manner.
a) Bottom-up
b) Top-down
c) Random
d) Parallel

Q75. Which of the following is an application of binary trees?
a) Expression parsing
b) File system structure
c) Hierarchical data storage
d) All of the above

Q76. Fill in the blank: Binary search trees are used for implementing _____.
a) Dictionaries
b) Queues
c) Stacks
d) Heaps

Q77. A BST storing student roll numbers helps in _____.
a) Random insertion
b) Fast searching
c) Sequential traversal only
d) None

Q78. Fill in the blank: AVL trees are BSTs with additional balancing condition to maintain _____.
a) Order property
b) Height balance
c) Thread links
d) Symmetry

Q79. The balance factor of a node in AVL tree is calculated as _____.
a) LeftHeight + RightHeight
b) RightHeight − LeftHeight
c) LeftHeight − RightHeight
d) (Left + Right) / 2

Q80. Fill in the blank: A balance factor value of _____ indicates a balanced node.
a) 1

b) 0
c) −1
d) Both b and c

 ANSWER KEY (Q61–80)

---

61. b — Build tree from postfix via postorder.
62. b — Leaves = operands.
63. b — Internal = operators.
64. c — Inorder = infix form.
65. c — Postorder = postfix expression.
66. c — Preorder prefix notation.
67. b — Root operator = *.
68. a — Postorder ABC*+.
69. a — Depends on operators.
70. c — Postorder for evaluation.
71. c — Postorder gives execution order.
72. a — Converts infix prefix/postfix.
73. b — Both operators and operands.
74. a — Evaluation proceeds bottom-up.
75. d — All are applications.
76. a — BST implements dictionaries/maps.
77. b — BST = efficient search.
78. b — AVL ensures height balancing.
79. c — LeftHeight − RightHeight.
80. d — Balance = 0 or ±1 means balanced.

(Questions 81–100)

Q81. Fill in the blank: A node in a binary tree can have at most _____ children.

a) 1
b) 2
c) 3
d) n

Q82. In level order traversal, nodes are visited using which data structure?
a) Stack
b) Queue
c) Linked list
d) Array

Q83. Time complexity of inserting a node in BST (average case) is _____.
a) O(n)
b) O(log n)
c) O(1)
d) O(n²)

Q84. Fill in the blank: The number of nodes in a perfect binary tree of height h is _____.
a) 2h
b) 2^(h+1) − 1
c) h²
d) h × 2

Q85. Which traversal visits the nodes in breadth-first order?
a) Level order
b) Inorder
c) Postorder
d) Preorder

Q86. Fill in the blank: Recursive traversal requires _____ data structure internally.
a) Stack
b) Queue
c) Array

d) Graph

Q87. The time complexity of searching in a BST in worst case is _____.
a) O(1)
b) O(log n)
c) O(n)
d) O(n log n)

Q88. Fill in the blank: Height-balanced trees improve the _____ of search operation.
a) Accuracy
b) Time efficiency
c) Space
d) Randomness

Q89. Which tree traversal is suitable for deleting a tree safely (freeing memory)?
a) Inorder
b) Postorder
c) Preorder
d) Level order

Q90. Fill in the blank: In a BST, the smallest element is found by going to the _____.
a) Rightmost node
b) Leftmost node
c) Root
d) Any leaf

Q91. Maximum number of nodes in a binary tree with depth ‘d’ is _____.
a) 2d
b) 2^(d+1) − 1
c) 2^d
d) d × 2

Q92. Fill in the blank: The height of an empty binary tree is defined as _____.

a) −1
b) 0
c) 1
d) Undefined

Q93. In BST, deleting a node with one child requires _____.
a) Replacing node with child
b) Deleting entire subtree
c) Swapping values
d) None

Q94. Fill in the blank: The traversal which first visits the leftmost node and ends at rightmost node is _____.
a) Preorder
b) Inorder
c) Postorder
d) Level order

Q95. The space complexity of a recursive tree traversal depends on _____.
a) Degree
b) Height
c) Depth
d) Both b and c

Q96. Fill in the blank: A binary tree with all nodes having either 0 or 2 children is called _____.
a) Full binary tree
b) Perfect binary tree
c) Complete binary tree
d) AVL tree

Q97. In a threaded binary tree, traversal does not need _____.
a) Stack
b) Queue
c) Root

d) Pointers

Q98. Fill in the blank: The number of possible binary trees with 4 nodes is _____.
a) 8
b) 14
c) 16
d) 24

Q99. The time complexity of all traversal operations in a binary tree is _____.
a) O(n)
b) O(log n)
c) O(n log n)
d) O(n²)

Q100. Fill in the blank: The primary application of expression trees is in _____.
a) Compilers
b) Networking
c) Memory allocation
d) Database indexing

 ANSWER KEY (Q81–Q100)

---

81. b — Binary = 2 children max.
82. b — Queue used in level order.
83. b — Average insertion/search = O(log n).
84. b — Perfect tree = 2^(h+1) − 1.
85. a — Level order = breadth-first.
86. a — Recursion uses call stack.
87. c — Worst case = skewed tree O(n).
88. b — Balanced tree improves time efficiency.
89. b — Postorder deletes children before parent.
90. b — Minimum = leftmost node.

91. b — Max nodes = 2^(d+1) − 1.
92. a — Empty tree height = −1.
93. a — Replace with its child link.
94. b — Left to right order inorder.
95. d — Depends on height/depth.
96. a — Full binary = 0 or 2 children.
97. a — No recursion/stack required.
98. b — 14 trees possible (Catalan number).
99. a — Traversal visits each node O(n).
100. a — Expression trees used in compiler parsing.

 END OF UNIT 5 – TREES (Q1–100)
