

First Semester - Question Bank
Department of Computer Science
Advanced Data Structures and Algorithms

Q1) What are some of the applications for the tree data structure?

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Q2) There are 8, 15, 13, and 14 nodes in 4 different trees. Which one of them can form a full binary tree?

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Q3) Draw the expression tree of the following infix expression. Convert it in to Prefix and Postfix expressions.

The expression is:

$((a+b)+c*(d+e)+f)*(g+h)$

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Q4) Assume that a queue is available for pushing and popping elements. Given an input sequence **a, b, c**, give the output sequence of elements if the rightmost element given above is the first to be popped from the queue.

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Q5) A queue is a,

- (A) FIFO (First In First Out) list. (B) LIFO (Last In First Out) list.
(C) Ordered array. (D) Linear tree.

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Q6) How many nodes in a tree have no ancestors.

- (A) 0 (B) 1
(C) 2 (D) n

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Q7) What is an algorithm? What are the characteristics of a good algorithm?

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Q8) What is a Binary Search Tree (BST)? Make a BST for the following sequence of numbers.

45, 36, 76, 23, 89, 115, 98, 39, 41, 56, 69, 48

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Q9) What are expression trees? Represent the following expression using a tree.
 $(a - b) / ((c * d) + e)$

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Q10) Taking a suitable example explains how a general tree can be represented as a Binary Tree.

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Q11) Reverse the order of elements on a stack S by using two additional stacks.

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Q12) Explain how to implement two stacks in one array A[1..n] in such a way that neither stack overflows unless the total number of elements in both stacks together is n. The PUSH and POP operations should run in O(1) time.

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Q.13) Two Binary Trees are similar if they are both empty or if they are both nonempty and left and right sub trees are similar. Write an algorithm to determine if two Binary Trees are similar.

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Q.14) Construct a binary tree whose nodes in inorder and preorder are given as follows:
Inorder : 10, 15, 17, 18, 20, 25, 30, 35, 38, 40, 50
Preorder: 20, 15, 10, 18, 17, 30, 25, 40, 35, 38, 50

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Q15). Define a stack. Describe ways to implement stack.

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Q16). Consider the algebraic expression $E = (5x+z) (3a-b)^2$, Draw the expression tree corresponding to E.

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Q17) Consider the following eight numbers 50, 33, 44, 22, 77, 35, 60 and 40. Display the construction of the binary by inserting the above numbers in the given order.

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Q18) Consider the following sixteen numbers 9, 5, 13, 3, 7, 11, 15, 2, 4, 6, 8, 10, 12, 14, 16 and 1. Display the construction of the binary by inserting the above numbers in the given order.

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Q19). What is a Binary Search Tree (BST)?

- a) Make a BST for the following sequence of numbers: 45, 32, 90, 21, 78, 65, 87, 132, 90, 96, 41, 74, 92
- b) Traverse the created Binary Search Tree above in Preorder, Inorder and Postorder.

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20) Which data structure is used to perform recursion?

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21) In this question, we consider logic expressions with the following operands and operators:

Operands: 0 and 1, which represents false and true, respectively.

Operators: & (and), | (or), and ! (not).

The precedences of the three operators are: $! > \& > |$.

Draw the logical expression tree of the expression $!(((0\&!1)\&0)|0)\&0$. Since ! (not) is an unary operator, we ask you to put its only operand to its right child.

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22) A stack is to be implemented using an array. The associated declarations are:

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int stack [100];
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int top = 0;
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Give the statement to perform push operation.

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23) What is the maximum possible number of nodes in a binary tree at level 6?

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24) What is the prefix form of $A-B / (C * D ^ E)$,

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25) What is the equivalent prefix expression for the following infix expression

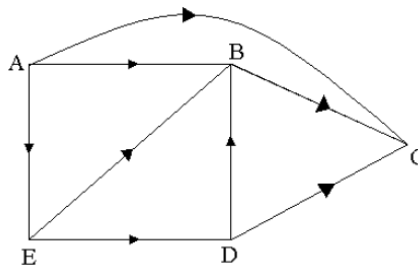
$(A+B)-(C+D*E)/F*G$

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26) Given a set of input representing the nodes of a binary tree, write a non recursive algorithm that must be able to output the three traversal orders. Write an algorithm for checking validity of the input, i.e., the program must know if the input is disjoint, duplicated and has a loop.

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27) What are the different ways of representing a graph? Represent the following graph using those ways.



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28) Reverse the order of elements on a stack S

(i) using two additional stacks.

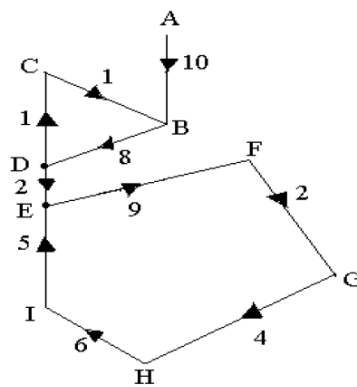
(ii) using one additional queue.

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29) Write an algorithm to test whether a Binary Tree is a Binary Search Tree.

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Q30) Give the adjacency matrix for the following graph:



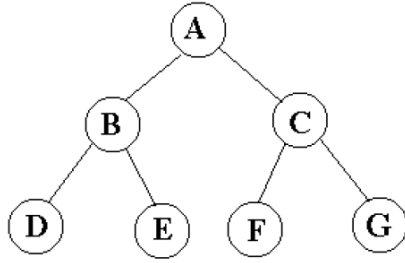
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Q31) Given the following inorder and preorder traversal reconstruct a binary tree.

Inorder sequence D, G, B, H, E, A, F, I, C

Preorder sequence A, B, D, G, E, H, C, F, I

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Q32) What do you understand by tree traversal? Write a procedure for traversing a binary tree in preorder and execute it on the following tree.



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Q33) Define adjacency matrix and make the same for the following undirected graph.

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Q34) Construct the binary tree for the following sequence of nodes in preorder and inorder respectively.

Preorder : G, B, Q, A, C, K, F, P, D, E, R, H
 Inorder: Q, B, K, C, F, A, G, P, E, D, H, R (4)

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Q35) Draw a picture of the directed graph specified below:

$G = (V, E)$
 $V(G) = \{1, 2, 3, 4, 5, 6\}$
 $E(G) = \{(1,2), (2, 3), (3, 4), (5,1), (5, 6), (2, 6), (1, 6), (4, 6), (2, 4)\}$

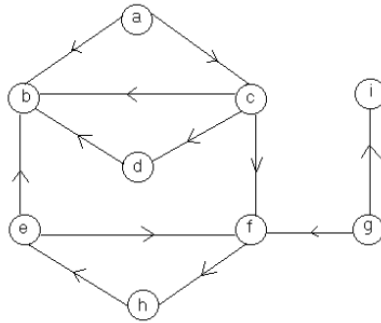
Obtain adjacency matrix for the above graph:

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Q36) Consider the following eight numbers 50, 33, 44, 22, 77, 35, 60 and 40. Display the construction of the binary by inserting the above numbers in the given order.

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Q37) Give the adjacency matrix and adjacency list of the following graphs.

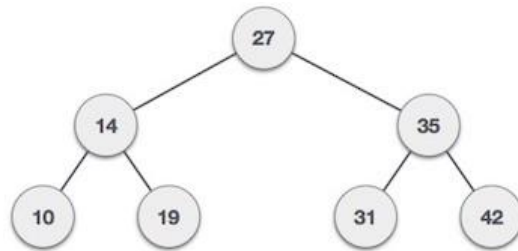


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Q38) What are common operations that can be performed on a data-structure?

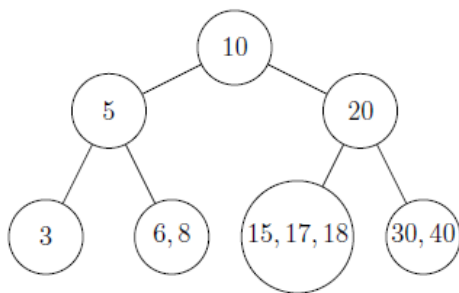
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Q39) See the below image of a binary search tree, and traverse it using all available methods –



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Q40) Consider the following 2-3 tree. Draw the modified tree resulting in inserting 14.



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Please read all questions carefully before answering them.

Good luck!