Assignment NO: 5

Page No. :
Date :

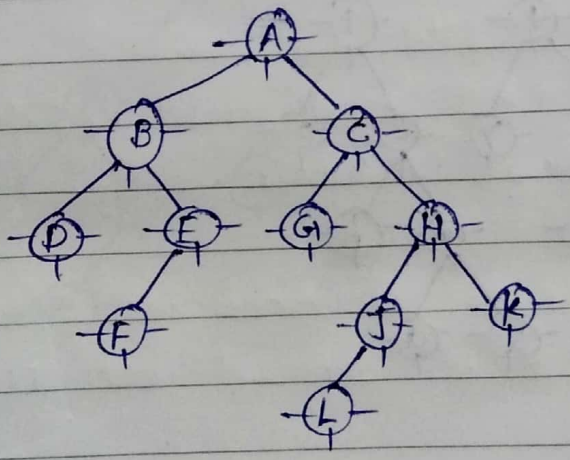
Q.1? A binary tree T has 9 nodes. The inorder and postorder traversal of T yield the following sequence of nodes:

Inorder:- D B F E A G C L J H K
Postorder:- D F E B G L J K H C A

Draw the tree T.

→ Inorder: D B F E (A) G C L J H K (A: root node)

Postorder: D F E B G L J K H C (A)



Preorder: A B D E F C G H J L K

Q.2) Consider the algebraic Expression
$E = (2x+y)(5a-b)^3$

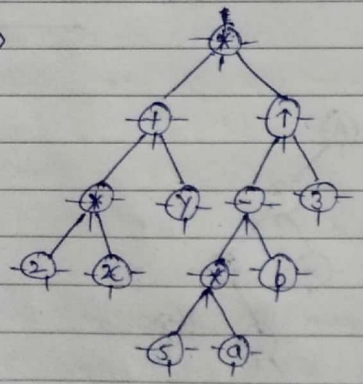
→ Given: $E = (2x+y)(5a-b)^3$

a) Draw the tree T which corresponds to the expression E.

b) Find Inorder, Preorder, Postorder.

→ Given: $E = (2x+y)(5a-b)^3$

a)



b) Inorder: 2 * x + y * 5 * a - b ↑ 3

Preorder: * + * 2 x y ↑ - * 5 a b 3

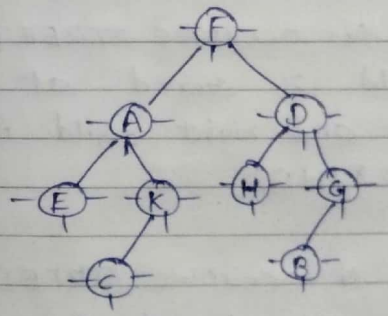
Postorder: 2 x * y + 5 a * b - 3 ↑ *

Q.5) A binary tree T has 9 nodes. The inorder and preorder traversal of T yield the following sequence of nodes.

Inorder: E A C K F H D B G
Preorder: F A E K C D H G B
Draw the tree T.

→ Given:

Inorder: E A C K (F) H D B G ← Root node
Preorder:- (F) A E K C D H G B



Postorder:- E C K A H B G D F

Q.4) Explain the sequential representation of Binary tree in brif.

→ Suppose 'T' is a binary tree then this can be maintained in computers memory using a single linear array say TREE.

The array representation of tree has the following properties.

1) The root of 'T' is stored at TREE[1].

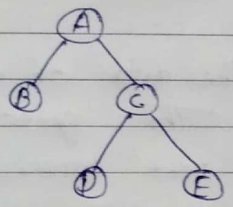
2) If a node N occupies TREE[K] then its left child is stored at TREE[2*K] and right child is stored at TREE[2*K+1].

3) If a node N occupies TREE[K] then its parent is stored at TREE[K/2].

4) If the maximum size of TREE is MAX then up to MAX/2 elements are internal nodes of the TREE and remaining are external or leaf nodes of TREE.

Again NULL is used to indicate an empty sub tree. If TREE[1] = NULL then tree is empty. In the sequential representation of tree with depth 'd' will require an array with maximum size $2^{d+1}-1$.

Example:



1	2	3	4	5	6	7
A	B	C			D	E

Q.5) Write and explain an algorithm for post-order traversal of trees.

→ The post order traversal of non-empty binary tree is defined as follows,

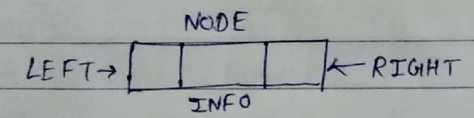
1. Traverse the left sub tree in post order
2. Traverse the right sub tree in post order
3. Visit or process the root node.

2023.10.24 23:46

That is, in a post order traversal the left and right sub tree are recursively processed before visiting the root node the left sub tree is taken up first and is sub tree is traversed in post order. Then the right sub tree is taken up is traversed into post order.

Finally the data of root node is displayed. The systematic procedure for a post traversal is as follows.

Here, every node of tree contain three fields as LEFT, INFO, RIGHT.



~~Algorithm:-~~

~~POSTORD (INFO, LEFT)~~

Algorithm:-

POSTORD (INFO, LEFT, RIGHT, ROOT)

1. Set TOP := 1, STACK[1] := NULL and PTR := ROOT.
2. Repeat steps 3 to 5 while PTR ≠ NULL:
3. Set TOP := TOP + 1 and STACK[TOP] := PTR
4. If RIGHT[PTR] ≠ NULL, then:
   Set TOP := TOP + 1 and
   STACK[TOP] := -RIGHT[PTR]
   [End of IF structure]
5. Set PTR := LEFT[PTR]
   Updates pointer[PTR]
   [End of step 2 loop.]
6. Set PTR := STACK[TOP] and TOP := TOP - 1
7. Repeat while PTR > 0
   a) Apply PROCESS to INFO[PTR]
   b) Set PTR := STACK[TOP] and TOP := TOP - 1
   [End of loop]
8. If PTR < 0 then:
   a) Set PTR := -PTR
   b) Go to step 2.
   [End of IF structure]
9. Return.

Q.6) Suppose A, B, C, D, E, F, G, H are 8 data items, and suppose they are assigned weights as follows:

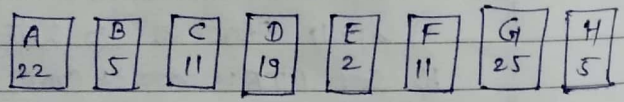
Data item:	A	B	C	D	E	F	G	H
Weights :	22	5	11	19	2	11	25	5

→ Given:-

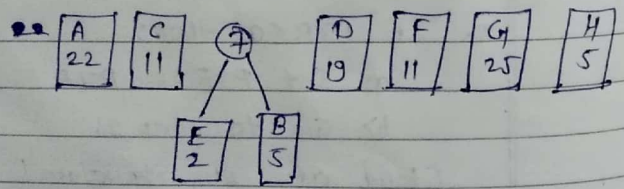
Data item:	A	B	C	D	E	F	G	H
Weights :	22	5	11	19	2	11	25	5

Construct tree T with minimum weighted path length using the above data and Huffman's algorithms

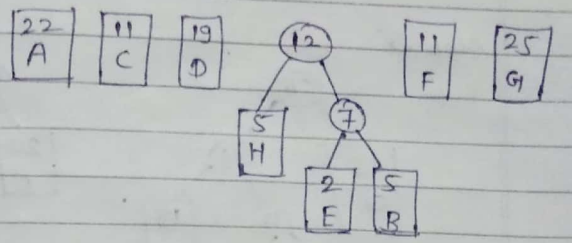
Step 1>



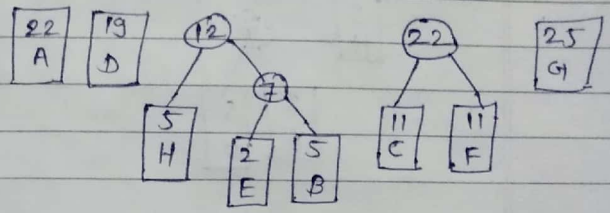
Step 2>



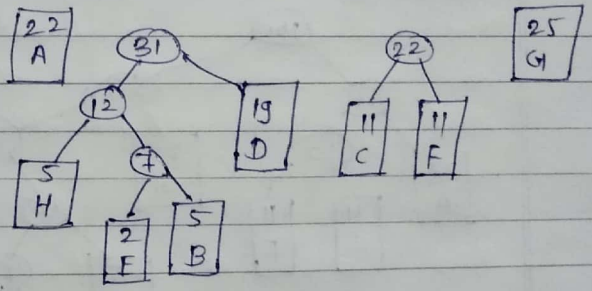
Step 3>



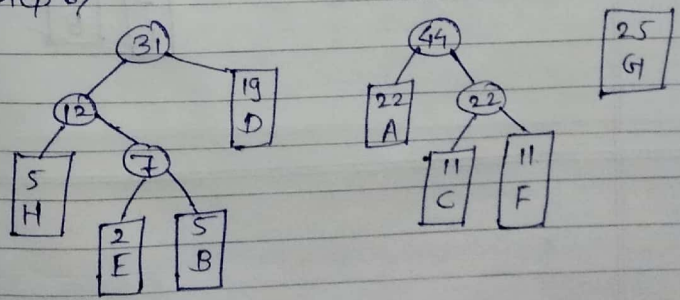
Step 4>



Step 5>

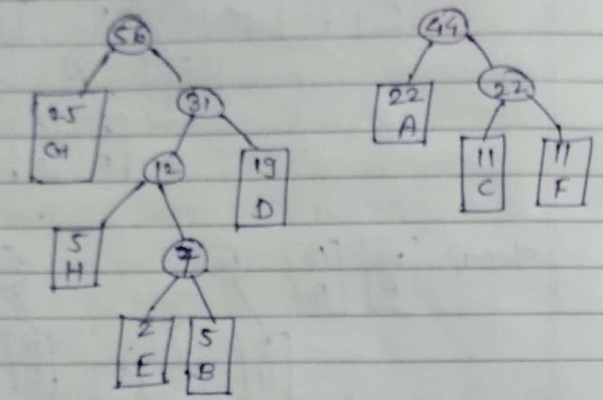


Step 6>

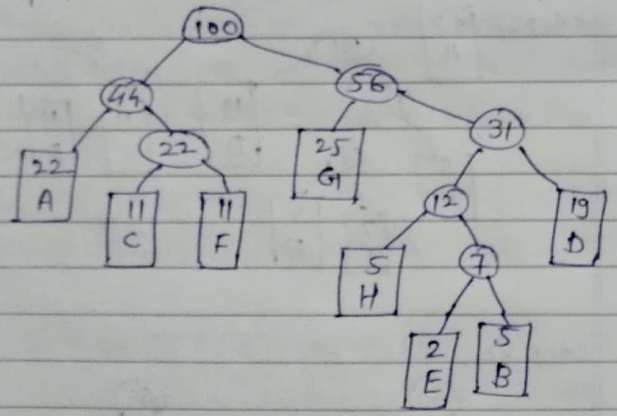


2023.10.24 23:46

Step 7)

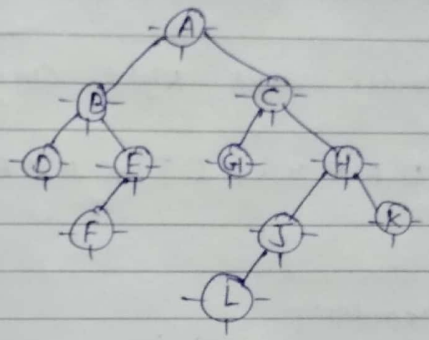


Step 8)



Q.7) From the following tree T. Write down Inorder, Preorder, Postorder and explained it.

→



• Inorder :-

→ In an inorder traversal, you first visit the left subtree, then the current node, and finally the right subtree.

Inorder: Left, Current(node), Right

D B F E A G C L J H K

•

• Postorder :-

→ In a postorder traversal, you first visit the left subtree, then

2023.10.24 23:46

the right subtree, and finally the current node.

~~Preorder :- Current , Left, Right~~

Postorder: Left , Right, Current

D F E B G L J K H C A

• Preorder:-

→ In a preorder traversal, you first visit the current node, then the left subtree and finally the right subtree.

Preorder:- Current, Left, Right

A B D E F C G H J L K

Q.8) Explain the following with example
a) One-way in order threading
b) Two way in order threading
c) Two-way threading with header node.

→ There are many ways to thread a binary tree, but each threading will corresponds to a particular traversal OF T. But default (generally) threading is correspond to the In-order traversal of the tree T. According to this RIGHT pointer will point to the next node in the In-order traversal of T and LEFT pointer will point to the previous node. In-order traversal of T as shown in the fig. We show each step one by one, so first figure represents one way in order threading.

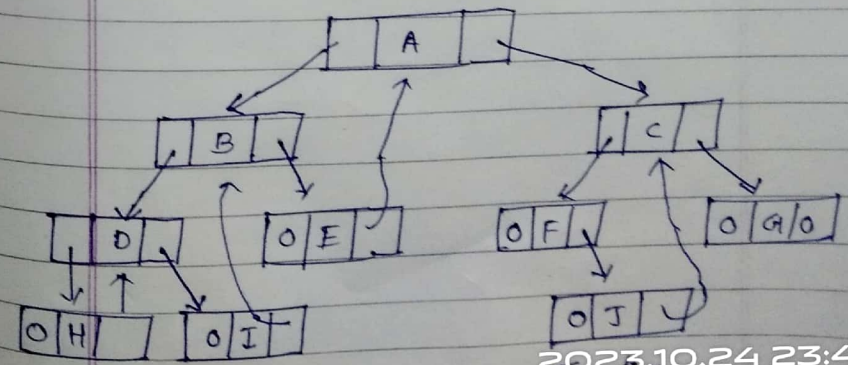


Fig. One-Way In-order Threading

Next figures represents two way in-order threading

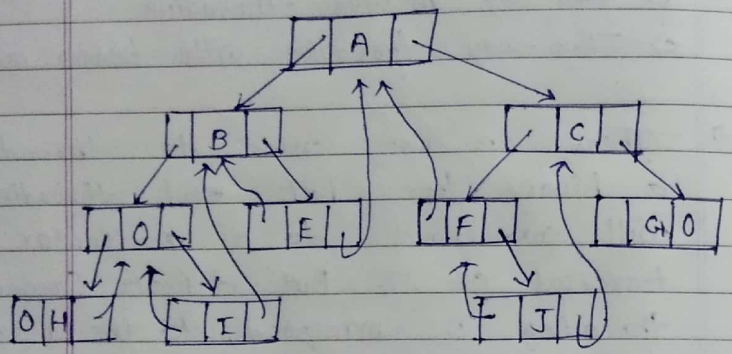


Fig. Two Way In-order Threading

Sometimes an extra special node called a HEAD node or header node is added to the beginning of T. If we have binary tree with header node the threaded binary tree will look like.

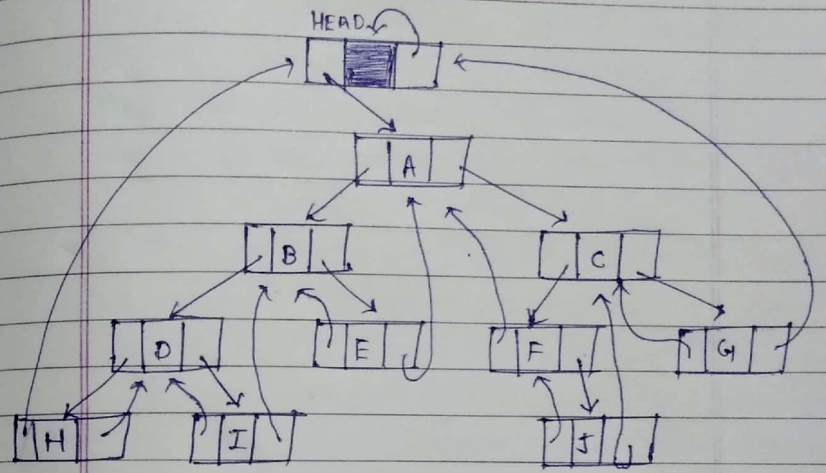


Fig. Two Way In-order Threading with Header Node