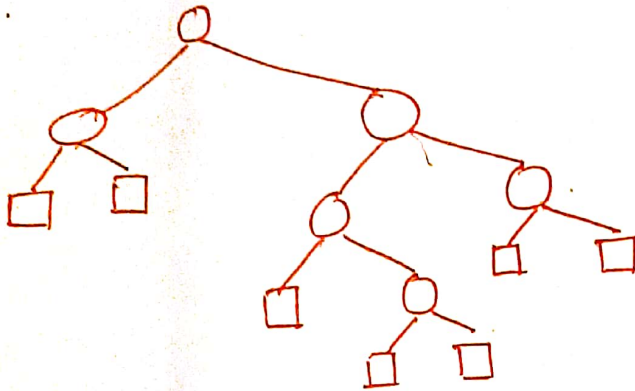


Huffman's ALGORITHM :- we have studied earlier

(EBT) extended Binary Tree in which each node has either 0 or 2 children. nodes with 0 child are called external nodes & represented by  $\square$ . nodes with 2 children are called internal node and are denoted by  $\circ$ . In any EBT

$$N_E = N_I + 1$$

for e.g.



on this diagram

$$N_E(\square) = 7$$

$$N_I(\circ) = 6.$$

$$\therefore N_E = 6 + 1 = 7$$

we can also calculate the length of external and internal nodes. (Each square has a vertical line starting from the top).

$$L_E = 2 + 2 + 3 + 4 + 4 + 3 + 3 = 21$$

$$L_I = 0 + 1 + 1 + 2 + 3 + 2 = 9.$$

$$\therefore L_E = L_I + 2n \text{ where } n = \text{internal nodes}$$

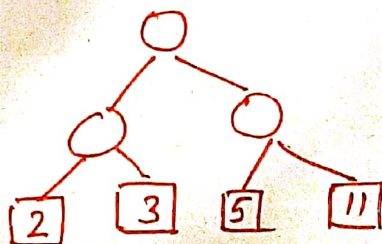
$$= 9 + 2 \times 6 = 21$$

$L_E = L_I + 2n$  is true for any EBT.

Suppose  $T$  is a EBT with  $n$  external nodes and each external node has been assigned a weight. Then Weighted Path length  $P$  of tree  $T$  is defined as sum of the weighted path length.

$$P = w_1 L_1 + w_2 L_2 + \dots + w_n L_n.$$

for e.g.



$$P = 2 \times 2 + 3 \times 2 + 5 \times 2 + 11 \times 2$$

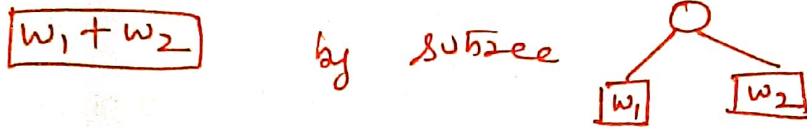
$$P = 42$$

# Huffman's Algorithm ;

Suppose  $w_1$  and  $w_2$  are two minimum weights among  $n$  given weights  $w_1, w_2, \dots, w_n$ . Find a tree  $T'$  which gives a sol<sup>n</sup> for  $n-1$  weights.

$w_1 + w_2, w_3, w_4, \dots, w_n$

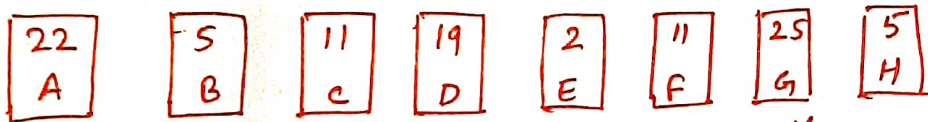
Then, in the tree  $T'$ , replace external node



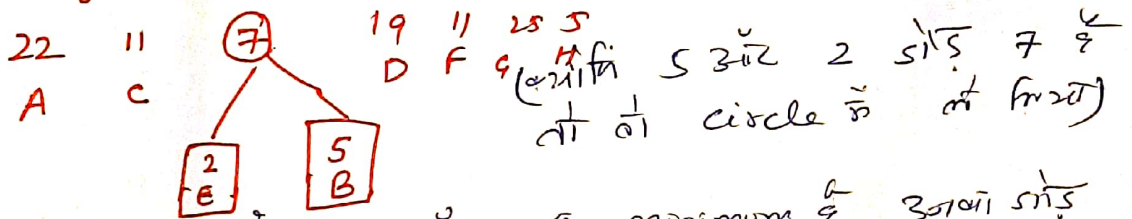
The new 2-tree or EBT is the desired solution.

Ques :- How to build a Huffman tree ?

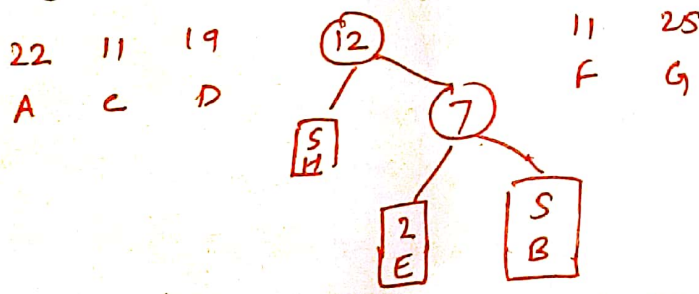
Suppose we are given 8 nodes.



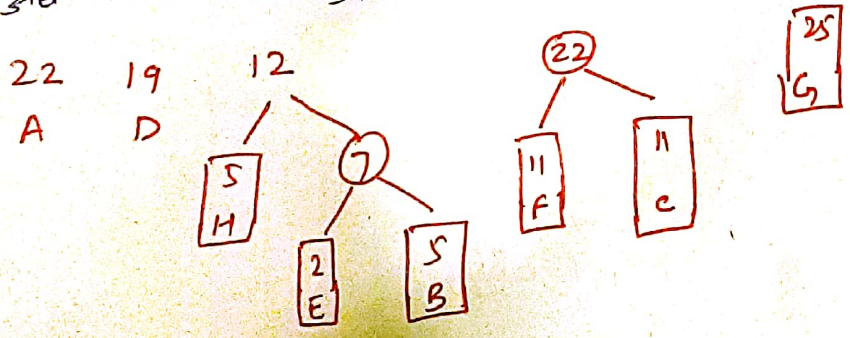
Scan from L to R. 2 minimum weights  $\underline{E}$  &  $\underline{B}$  are  $\underline{2}$ .  
 नौ सिद्ध Algo. के अनुसार E और B को जोड़ें



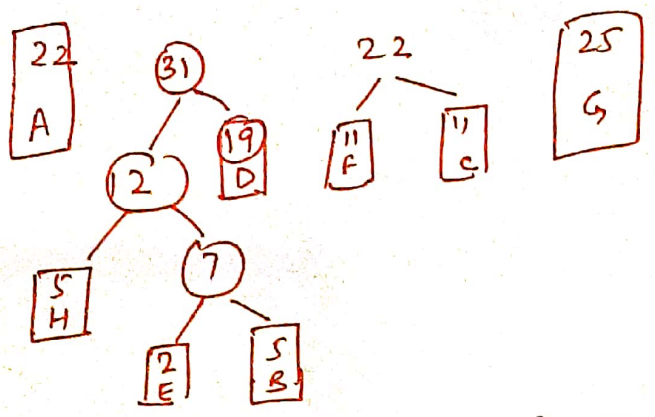
अब फिर 12 और 7 जोड़ें circle में न न मंजूर



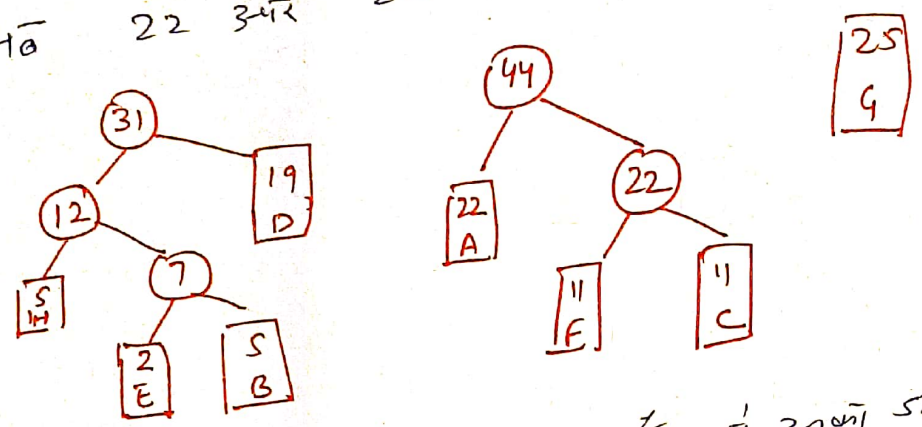
अब फिर 11 और 11 minimum के साथ जोड़ें साथ साथ 22.



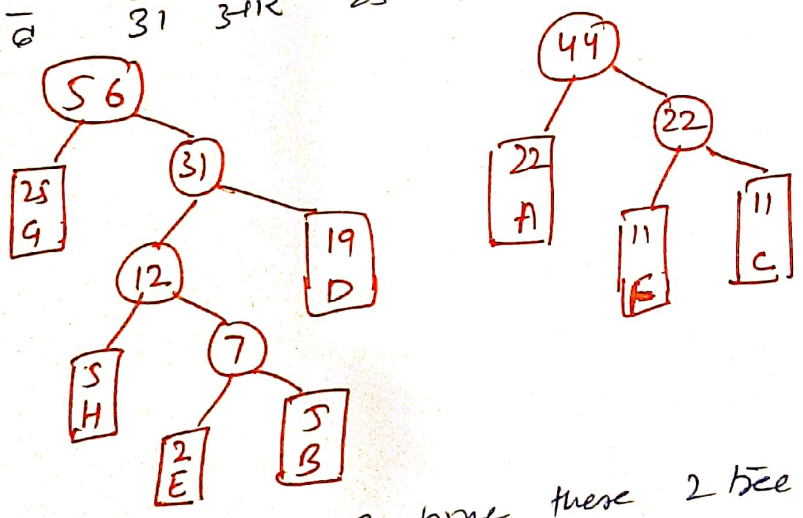
31 19 31 12 minimum weight 31



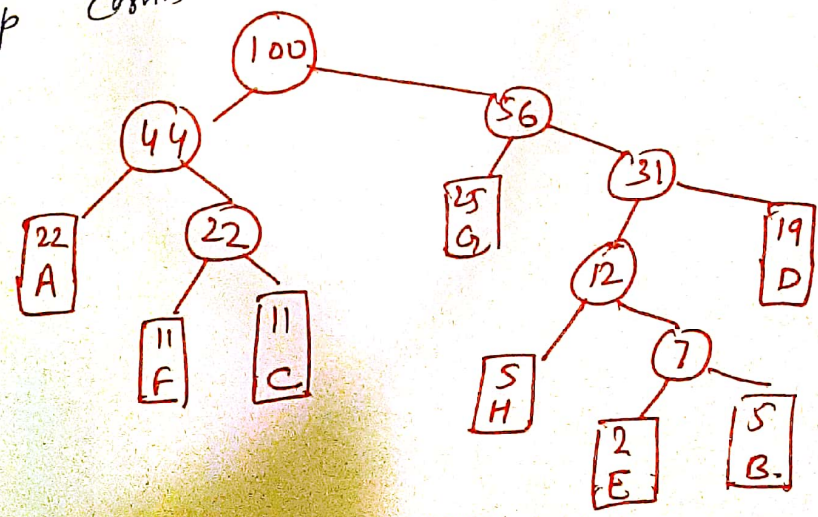
31 22 31 22 minimum weight 44



31 31 31 25 minimum weight 56



Now last step Combine these 2 tree having 56 & 44 min. weights



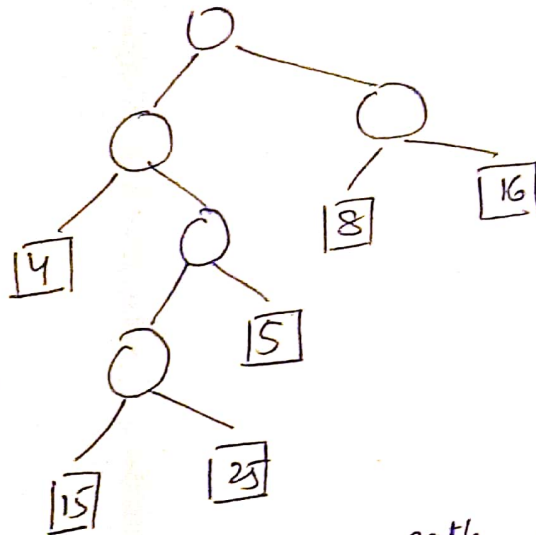
FINAL HUFFMAN TREE

(4)

Ques:- Suppose six weights  
A B C D E F  
4 15 25 5 8 16

are given. find a Huffman tree T and also  
find minimum weighted path length P.

Ques.



find the weighted path length.