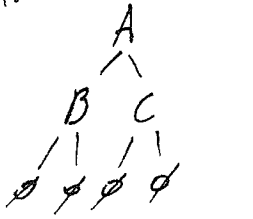
Example Trees

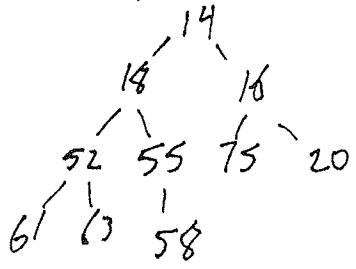
1.



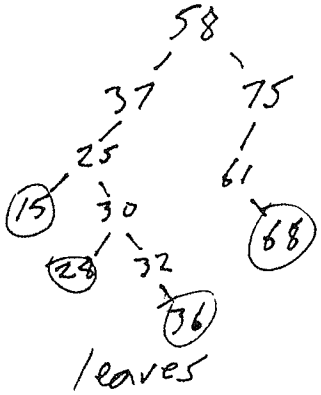
How many trees are here? (7)

2.

3.



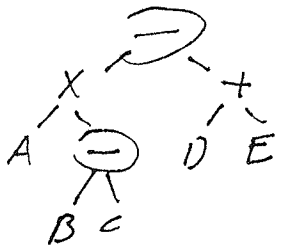
4.



leaves

path 37-3
37, 25, 30, 32

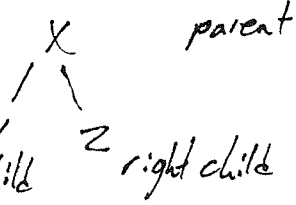
5.



element value = "=" at root(t)

element value = "-" at root(rightTree(leftTree(t)))

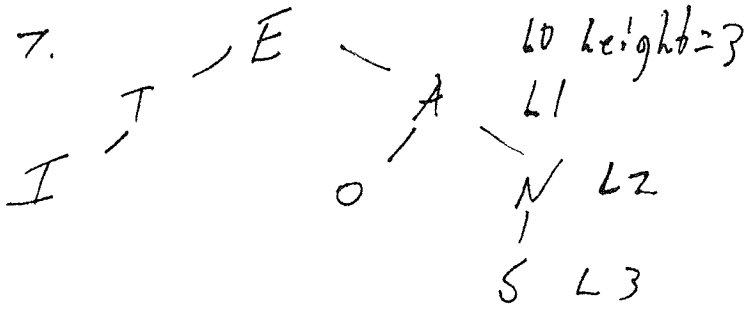
6.



parent

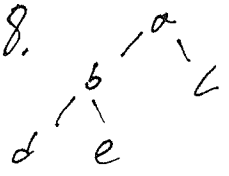
left child right child

7.

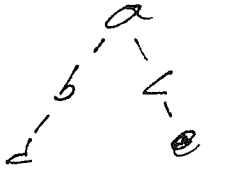


L0 height = 3

8.

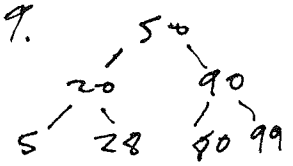


2-tree

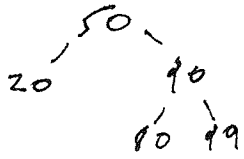


non two-tree

9.

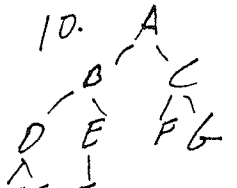


full



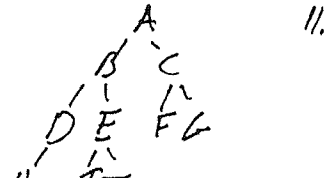
not full

10.



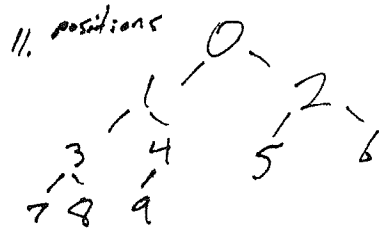
complete, not full

not full or complete

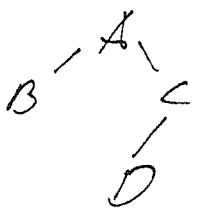


not full or complete

11. positions



12.



$n(t) = 4$

+ision → $floor\left(\frac{4+1}{2}\right) = 2 = leaves(t)$

∴

t is a two tree? NO!

instead

ored vision → $\frac{4+1}{2.0} = 2.5 \geq leaves(t)$

True

$\frac{n(t)+1}{2.0} <= 2^{height(t)}$

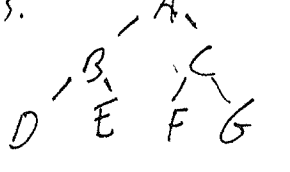
$height(t) = 2$

$\frac{4+1}{2.0} <= 2^2$

$2.5 \leq 4$

True

13.



$n(t) = 7$

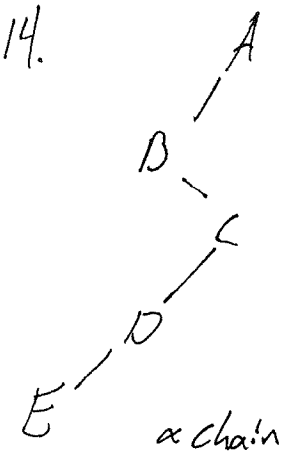
$leaves(t) = 4$

$height(t) = 2$

1,3) $4 = \frac{7+1}{2}$ = True

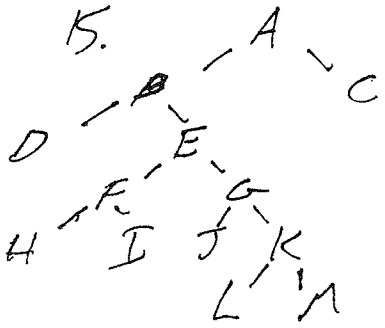
2,4) $\frac{7+1}{2} = 4 = 2^2$ = True

14.



a chain

15.

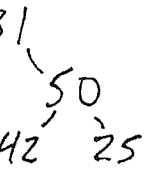


$2+4+4+4+5+5+1 = 25$

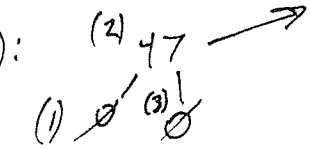
inOrder(t)

16. Tree t has n elements
Each element has 2 subtrees
∴ There will be 2n recursive calls for inOrder(t)
∴ O(n)

Tree t:

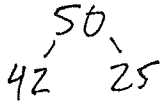


leftTree(t):



Back to where we were before
process root:
31 →

rightTree(t):

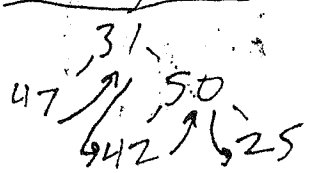


leftTree(rightTree(t))
42 →
root(rightTree(t)) →
50
rightTree(rightTree(t))
25 →

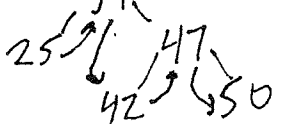
Output

47
31
42
50
25

processing order



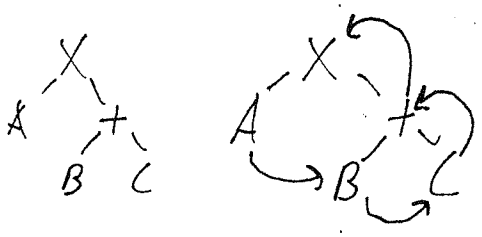
17. BST



Output

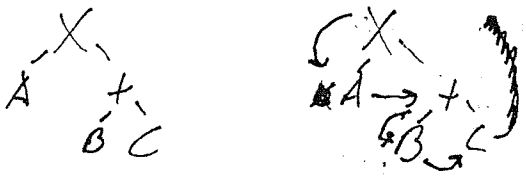
25
31
42
47
50

18. postOrder(t)
O(n)



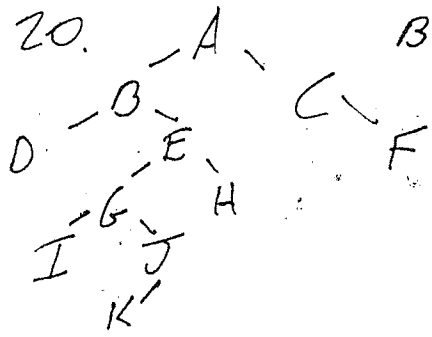
Output
A
B
C
+
X

19. preOrder(t)
O(n)



Output
X
A
+
B
C

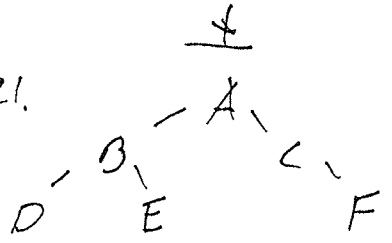
20.



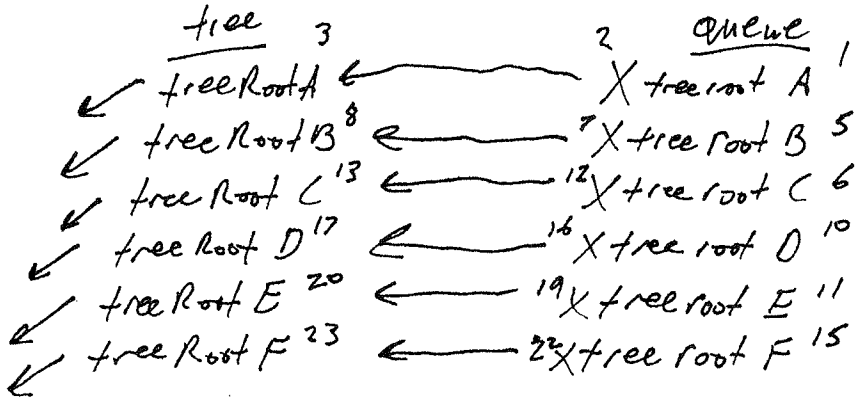
Breadth-First

Output
A
B
C
D
E
F
G
H
I
J
K

21.



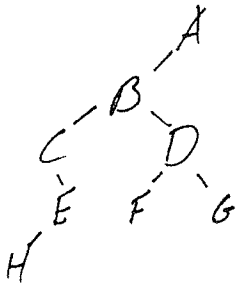
steps are ordered in numbers
X = sequence



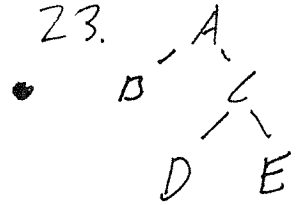
Output	
A	4
B	9
C	14
D	18
E	21
F	24

22.

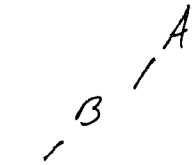
a. A
b. 8
c. 3
d. 4
e. 4
f. -1
g. 3
h. 2
i. 1
j. D
k. C, D, E, F, G, H
L. D, B, A
m. CHEBFDGA
n. HECFGDBA
o. ABCEHDFG
P. ABCDEFGH



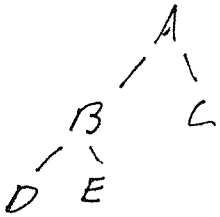
23.



2-tree, not complete



complete, not 2-tree



complete 2-tree, not full

$$\text{leaves}(t) = \frac{17+1}{2} = 9$$

$$\text{leaves}(t) = \frac{731+1}{2} = 366$$

Each level will have an even # of elements except the root level.