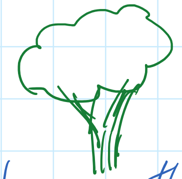
The Abstract Data Type Tree

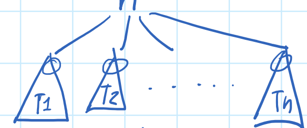
Friday, November 1, 2019 4:59 PM



- A tree is a collection of elements together with a hierarchical relationship between the elements

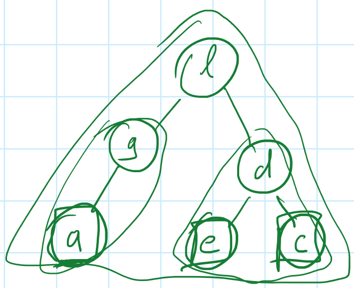
DEF:

- A single element (node) is a tree
- If n is a node and $T_1, T_2, \dots T_n$ are trees then n related to $T_1, \dots T_n$ drawn as



is a tree

Example



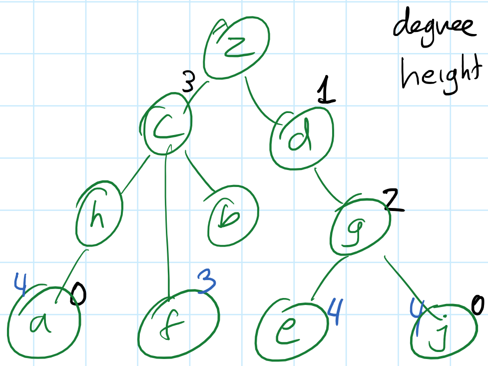
n is called the root of the tree

T_1 to T_n are called the subtrees of n

Every tree has a root

- The root of each subtree $T_1, T_2, \dots T_n$ is called a child of n
- n is called the parent of the roots of each $T_1, \dots T_n$
- nodes with the same parent are called siblings.
- nodes with no children are called leaves

- the degree of a node is the number of children a node has.
- The degree of a tree is the highest degree of a node in the tree



degree = 3

height = 4

"Ternary tree"

$\langle a, b, c \rangle$ ⊗

$\langle a, h, c, f \rangle$ ⊗

$\langle e, g, d, z \rangle$ ✓

- A path in a tree is a sequence of nodes $\langle n_0, n_1, n_2, \dots n_n \rangle$ where n_{i+1} is the parent of n_i

- the depth of a node is the lengh of the path from that node to the root.
  - NOTE: there is exactly one path from every node to the root.

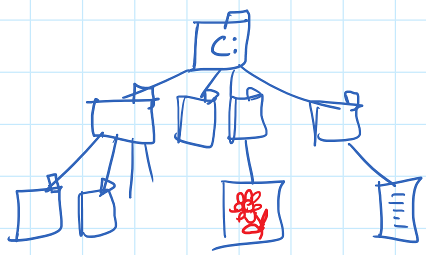
- the height of a tree the lenght of the longest path from any node to the root.

- Given 2 nodes a and b.
  - a is called an ancestor of b if there is a path from b to a
  - b is called a descendant of a if there is a path from b to a

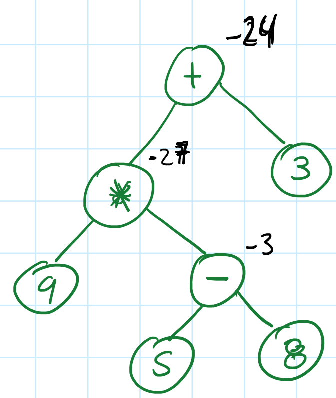
  NOTE: the root of a tree is every nodes ancestor.

Applications in Comp. Sci.

File system.

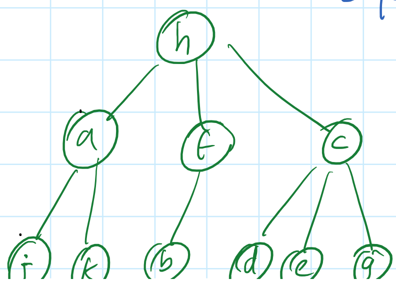


Expressions: "3 + 9 * (5 - 8)"



- Tree Traversals.

sequentialy do something with every element of a tree



pre-order (T)
{
print root of T
for every subtree T' of T

post-order (T)
{
for every subtree T' of T
post_order(T')

print root of T
for every subtree T' of T
    pre-order (T')
}

for every subtree T' of T
    post_order(T')
print root of T
}

pre-order = h, a, i, k, f, b, c, d, e, g

post-order = i, k, a, b, f, d, e, g, c, h