CS 112

Week11: Trees

General Trees

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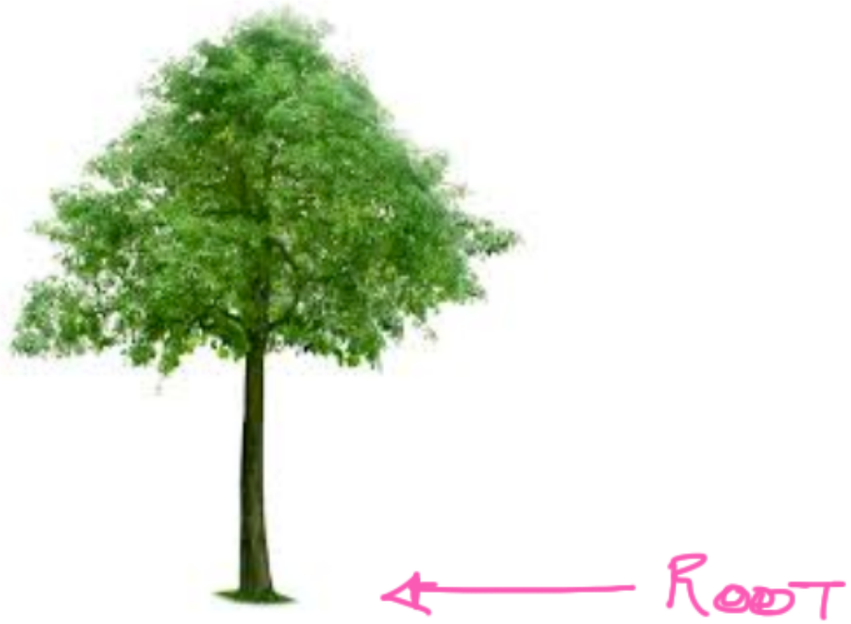
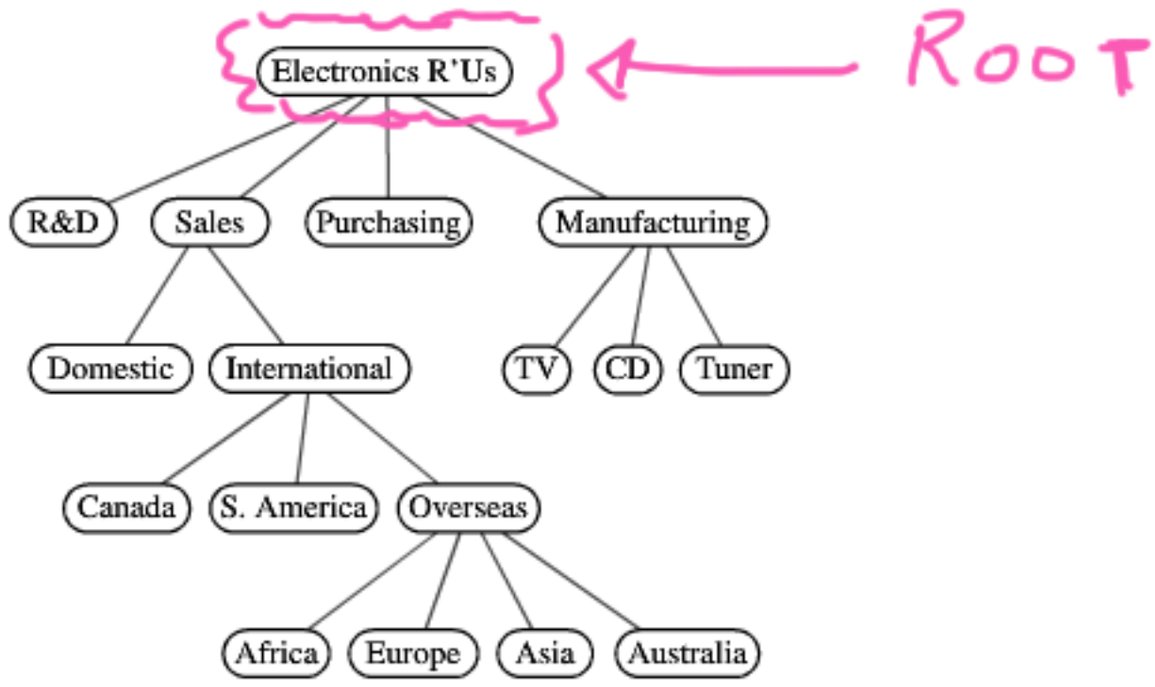
- The relationships in tree are hierarchical, with some objects being “above” and some “below” others.

- Actually the main terminology for tree data structures comes from family trees, with the terms “parent”, “child”, “ancestor” and “descendants” being the most common words used to describe relationships.

Tree


Root


Electronics R'Us
Root
R&D
Sales
Purchasing
Manufacturing
Domestic
International
TV
CD
Tuner
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S. America
Overseas
Africa
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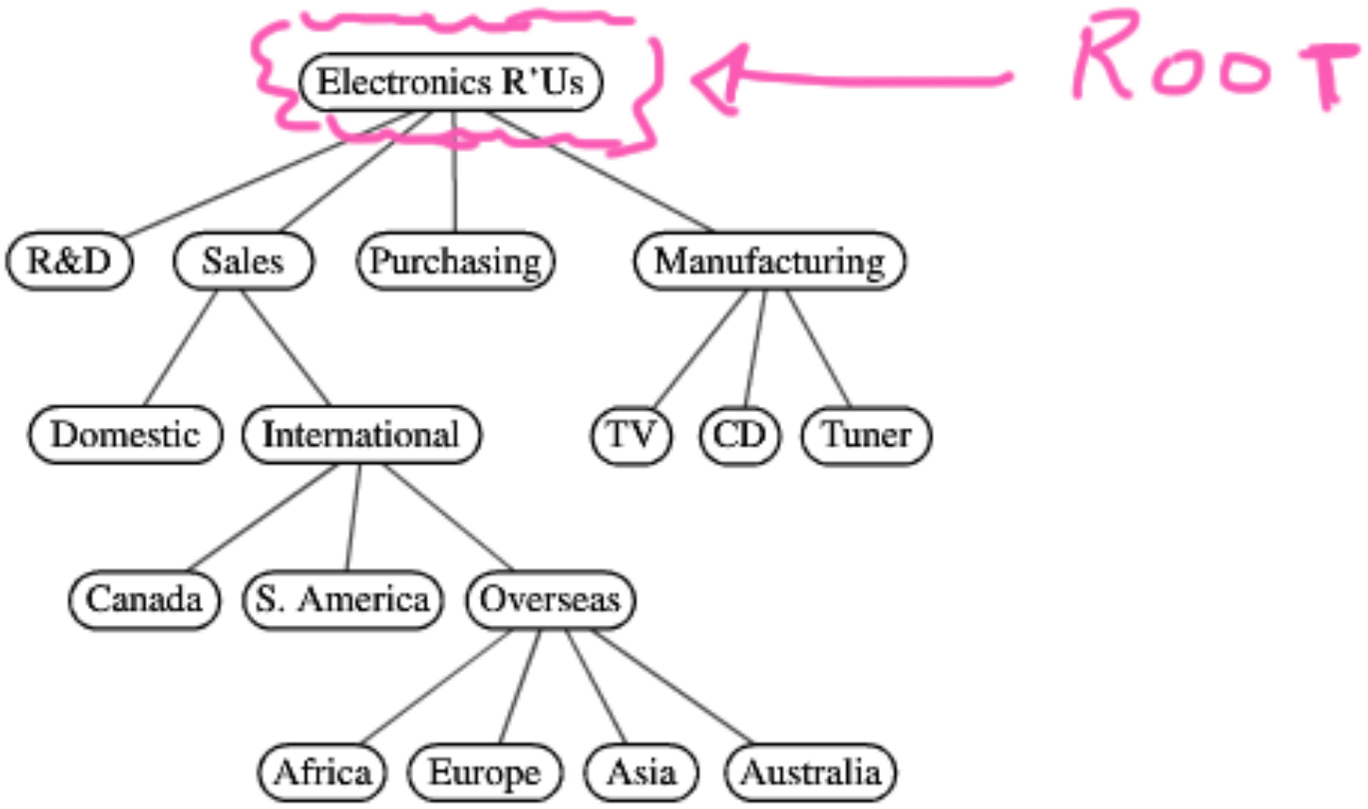
- A tree is usually visualized by placing elements inside ovals or rectangles and by drawing the connections between parents and children with straight lines.

- We typically call the top element the root of the tree, but it is drawn as the highest element, with the other elements being connected below (just the opposite of the real tree picture shown on the previous slide).

Tree definitions and properties



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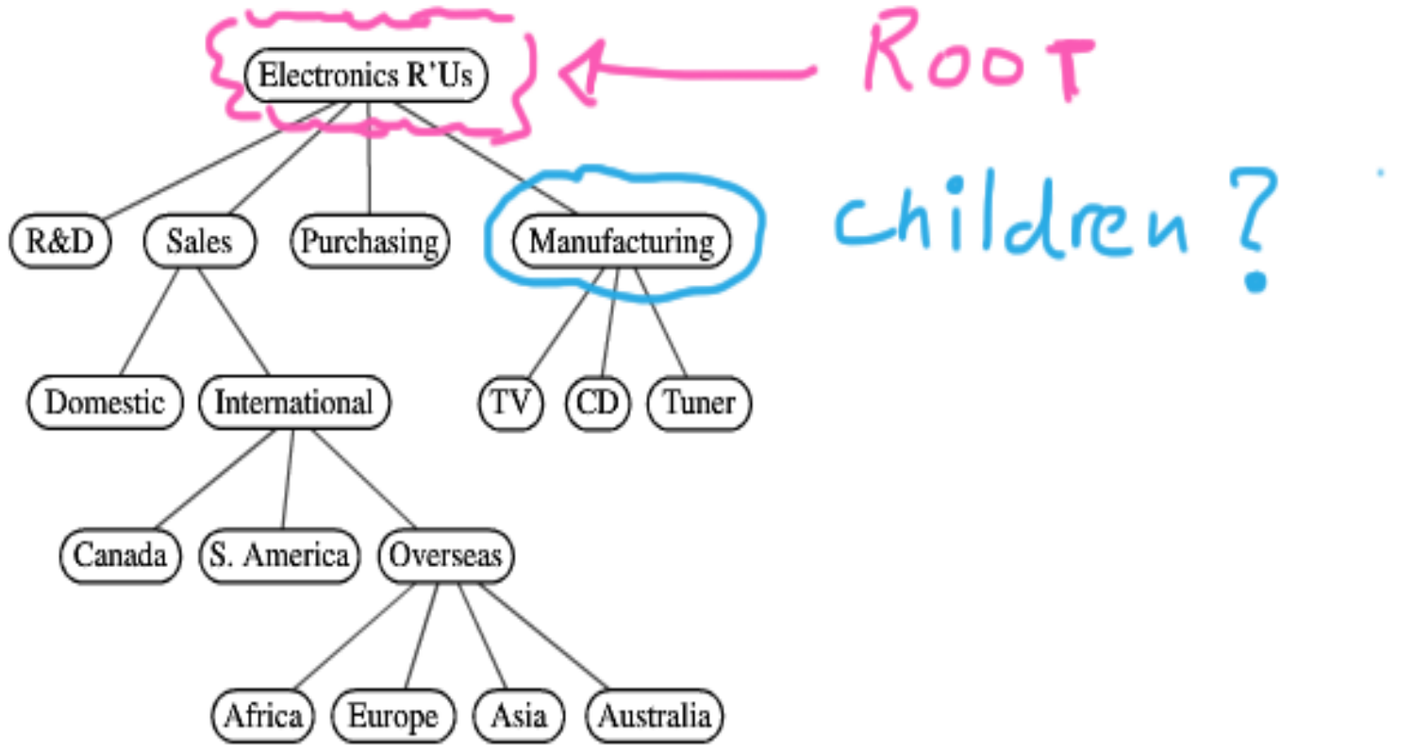

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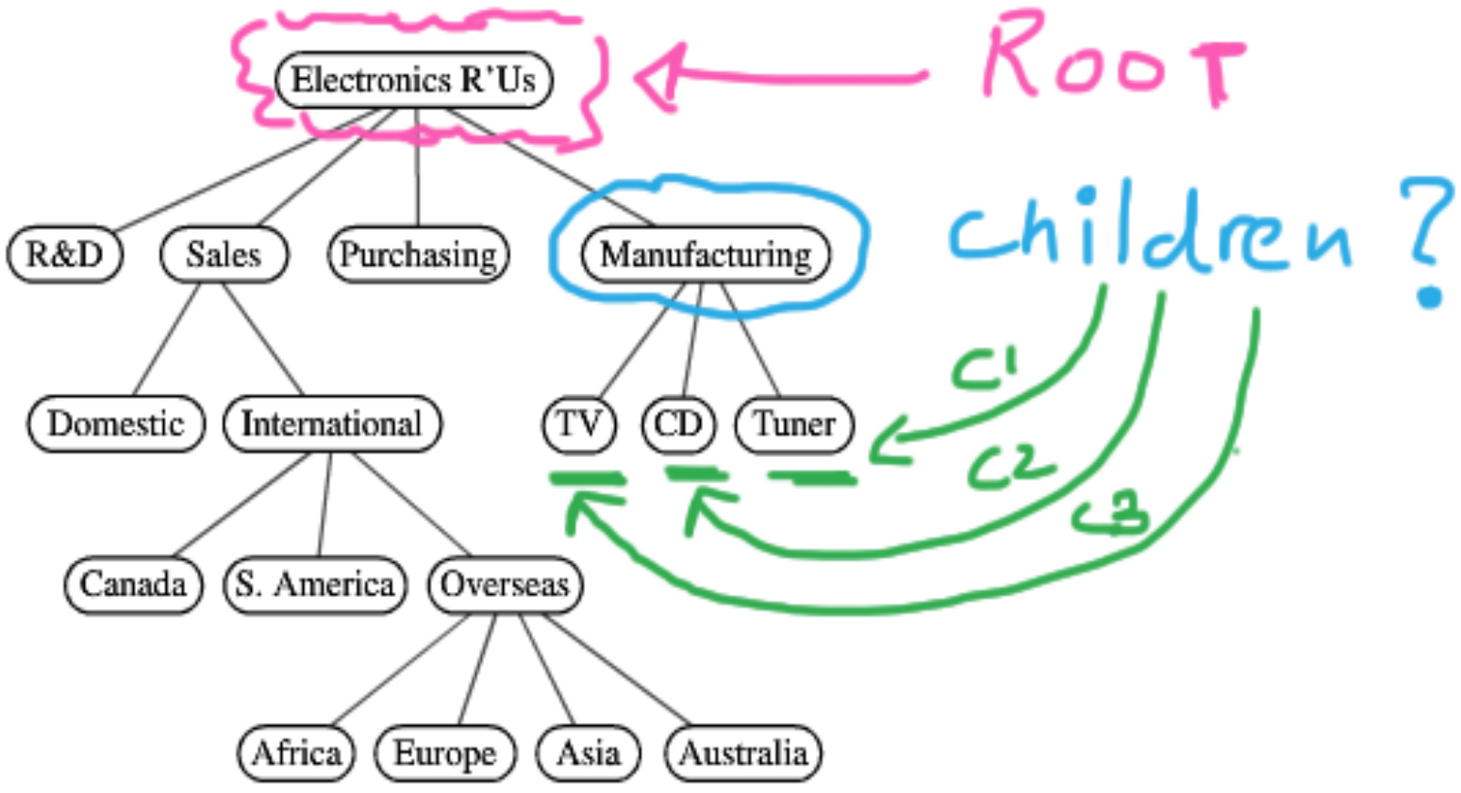

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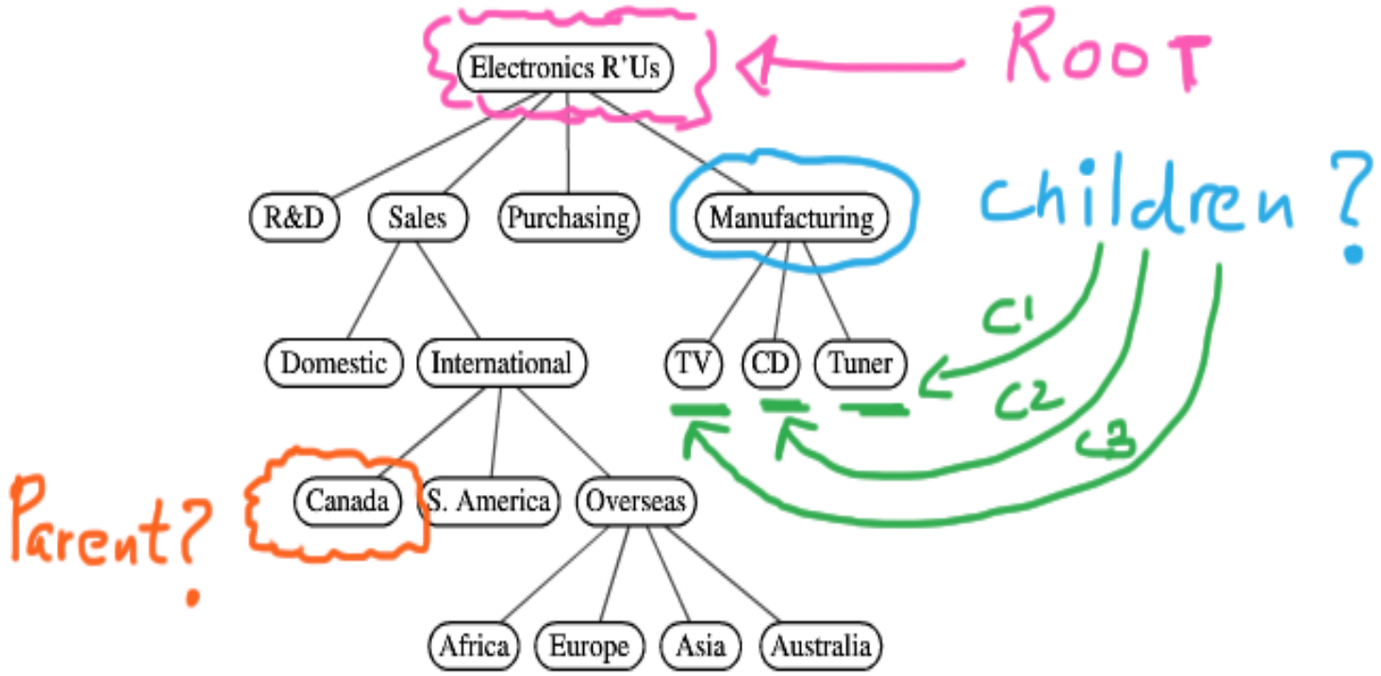

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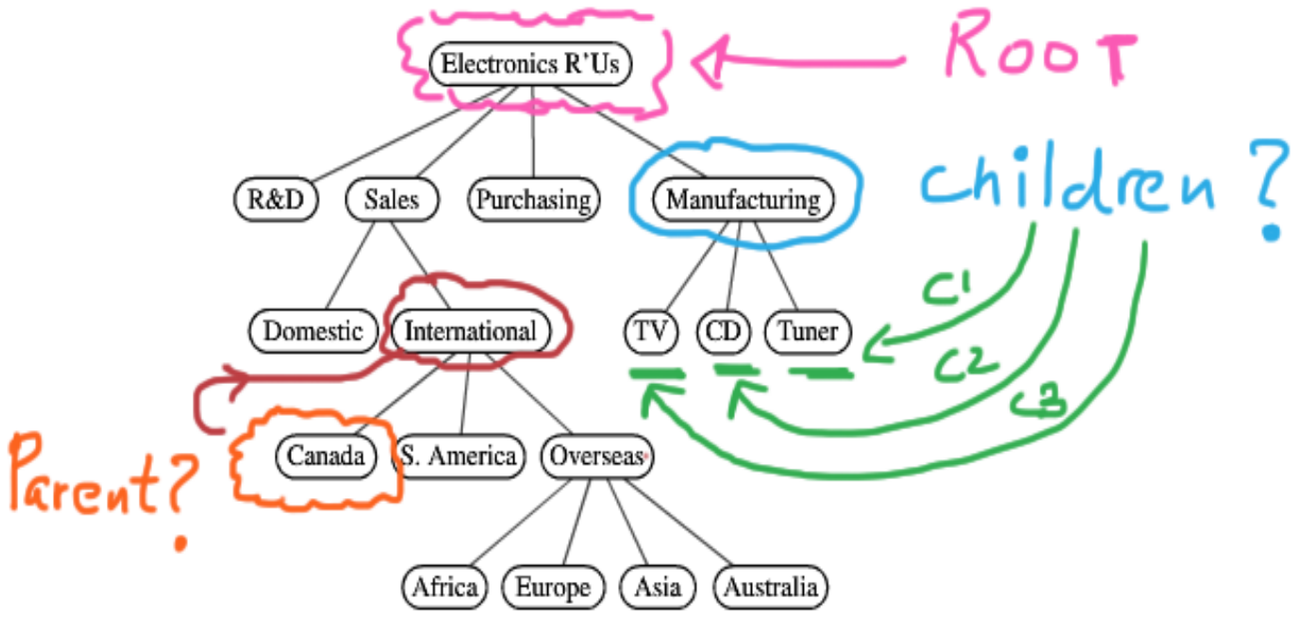
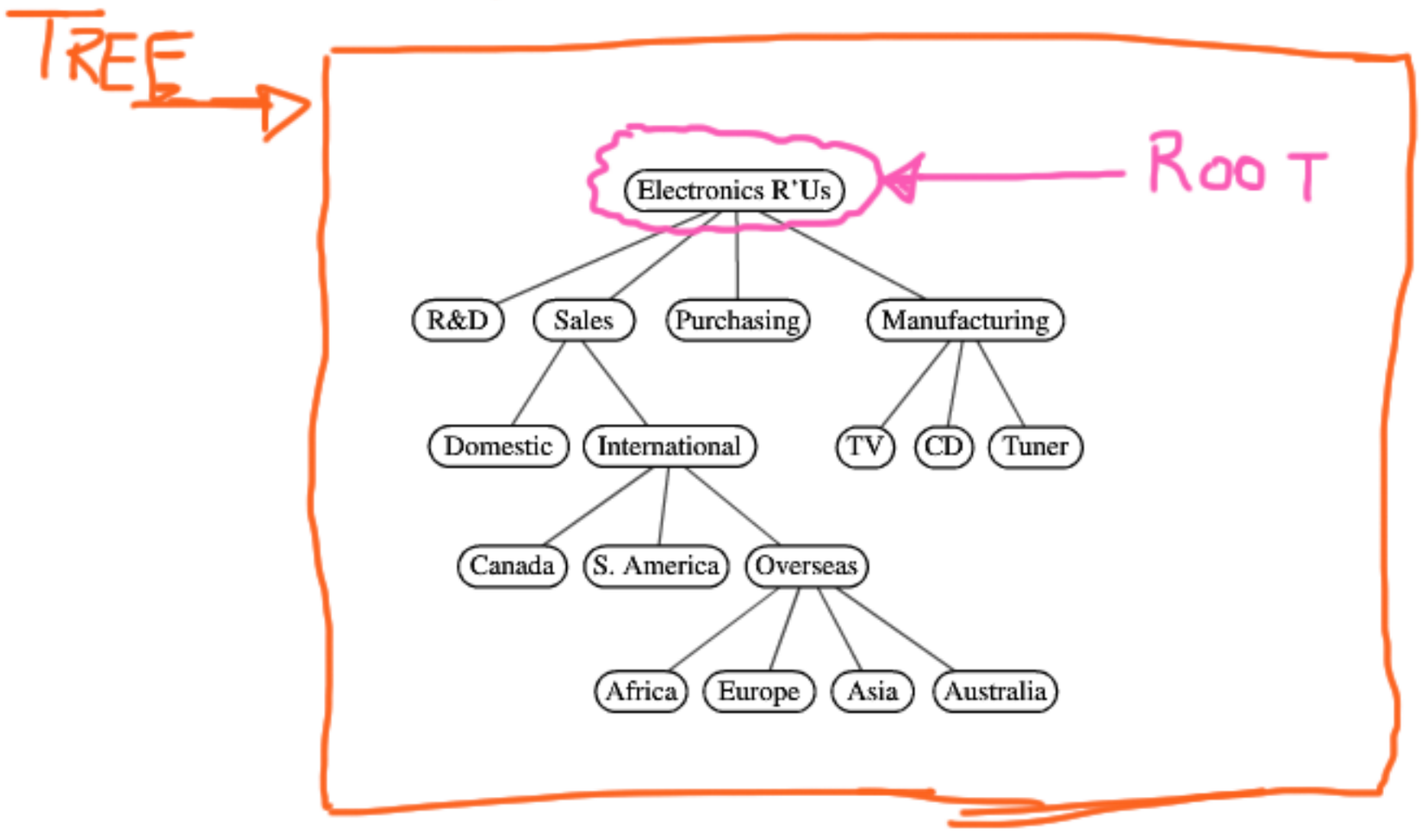


Tree is a recursive data structure.



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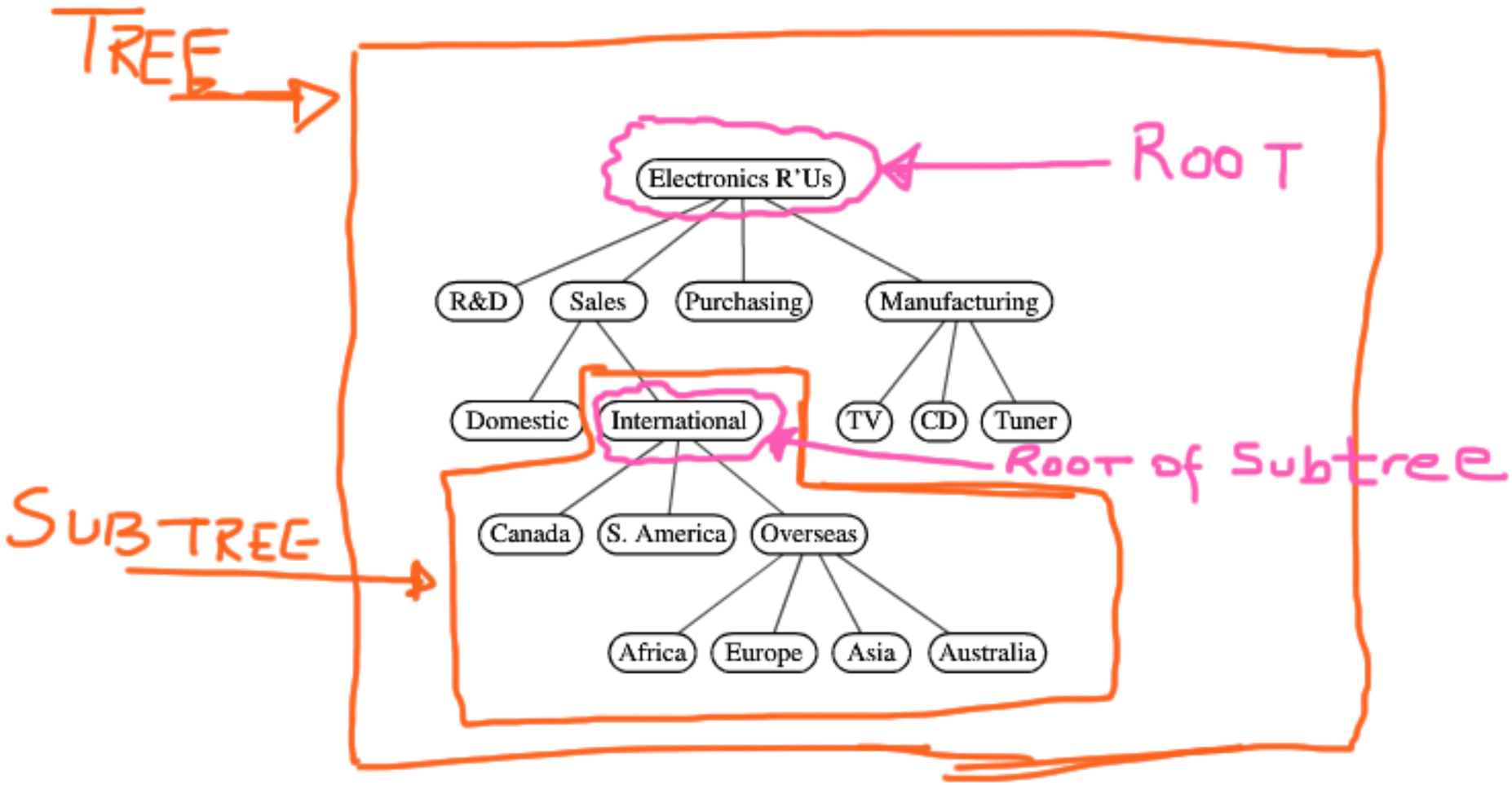
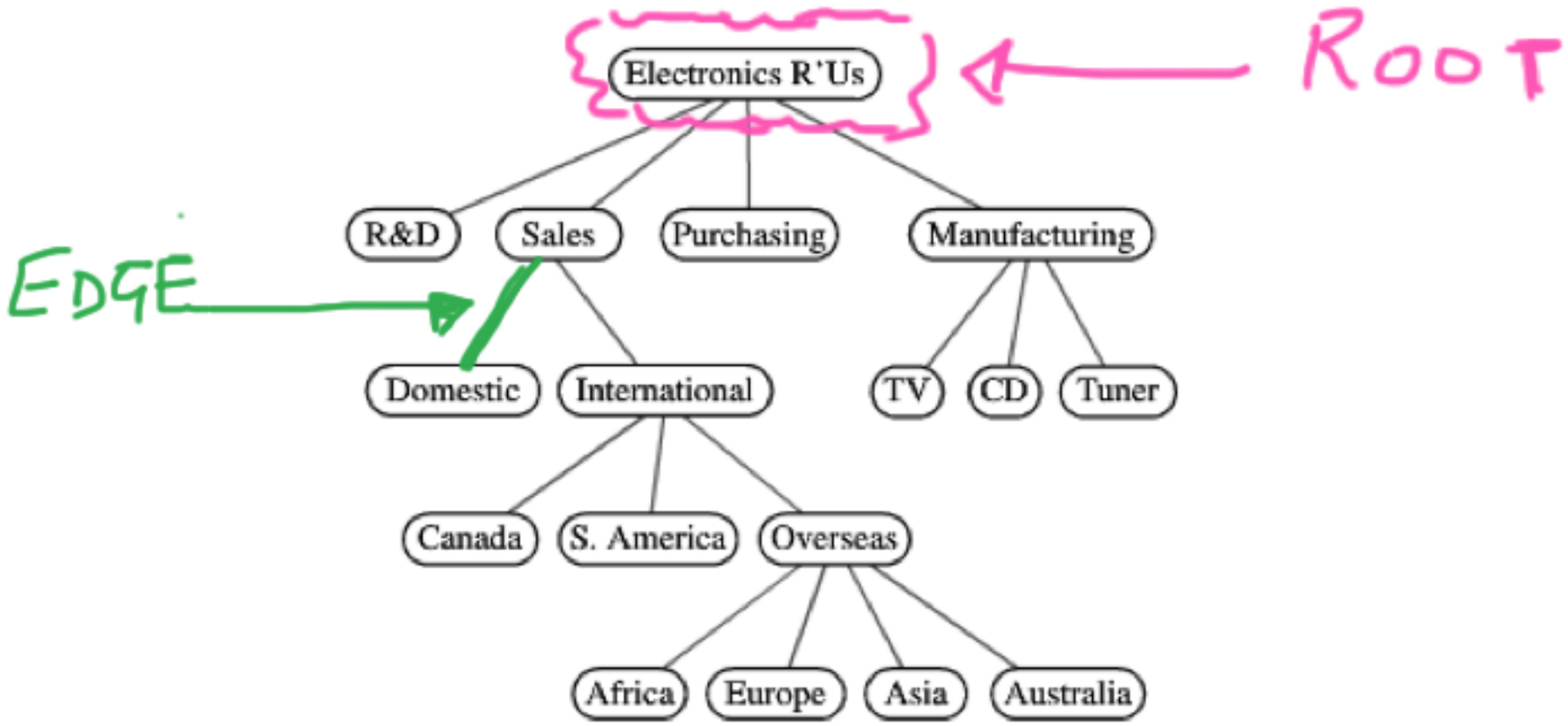


Edge


Electronics R'Us
ROOT
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CD
Tuner
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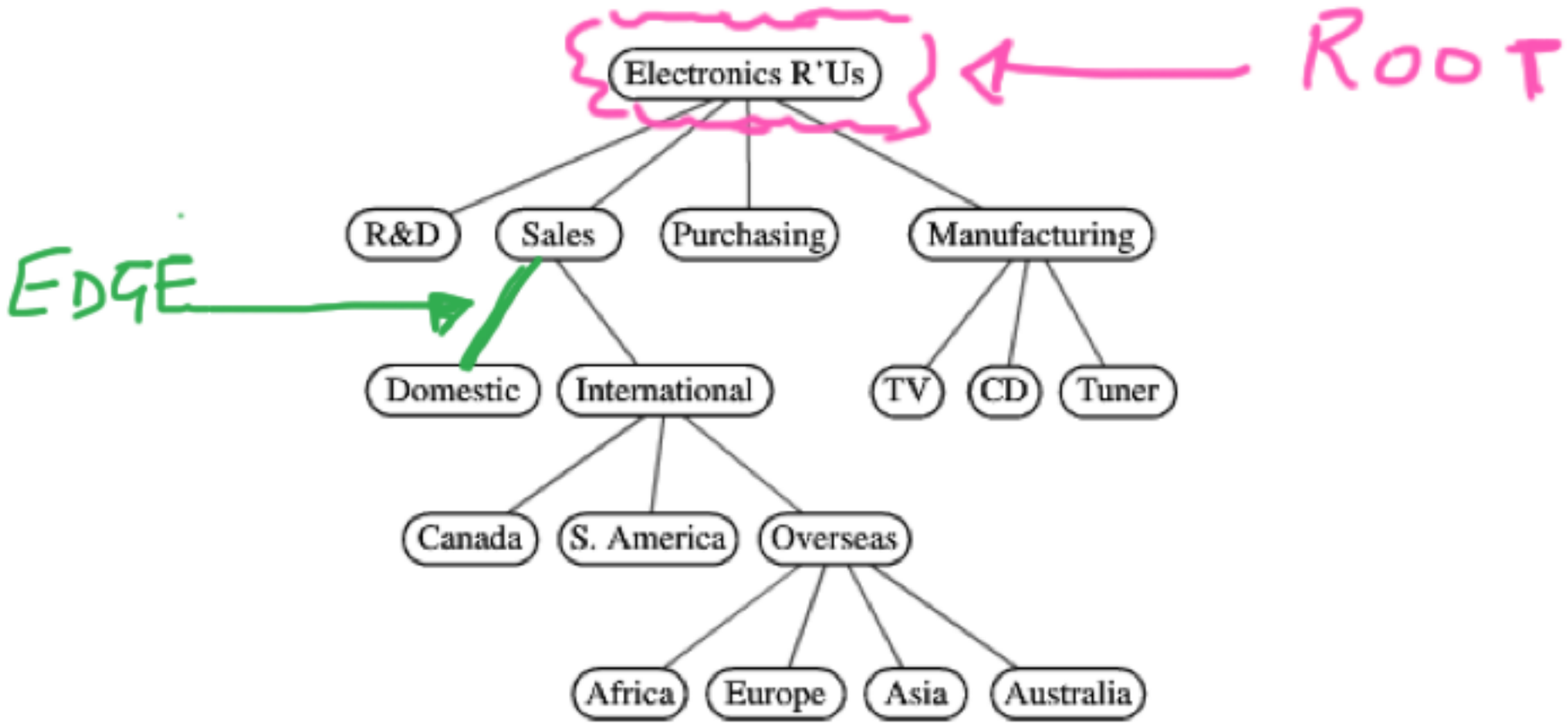
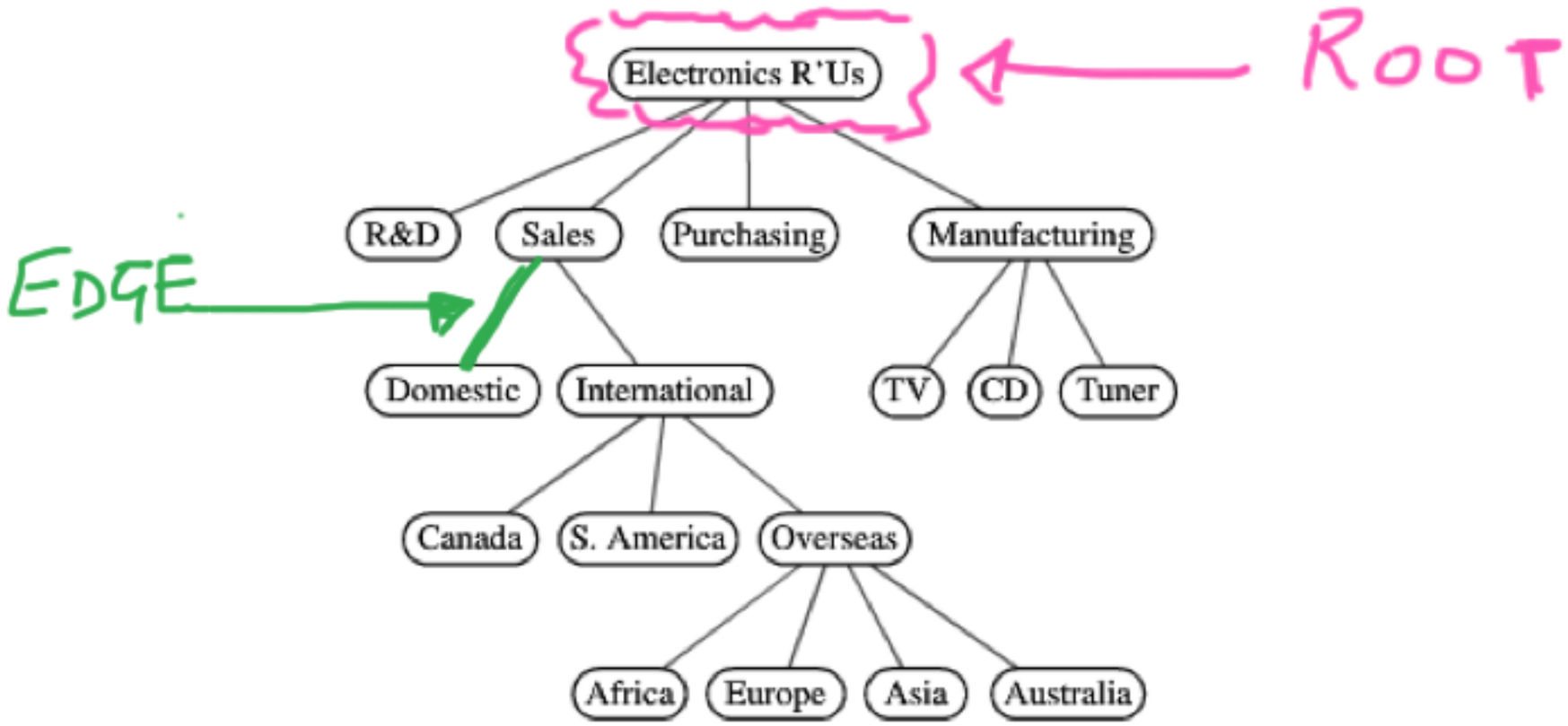
S. America
Overseas
Africa
Europe
Asia
Australia

Edge



- An edge of a tree is a pair of nodes (u,v) such that u is the parent of v or vice versa. In the above example, the green line is an edge.

Edge



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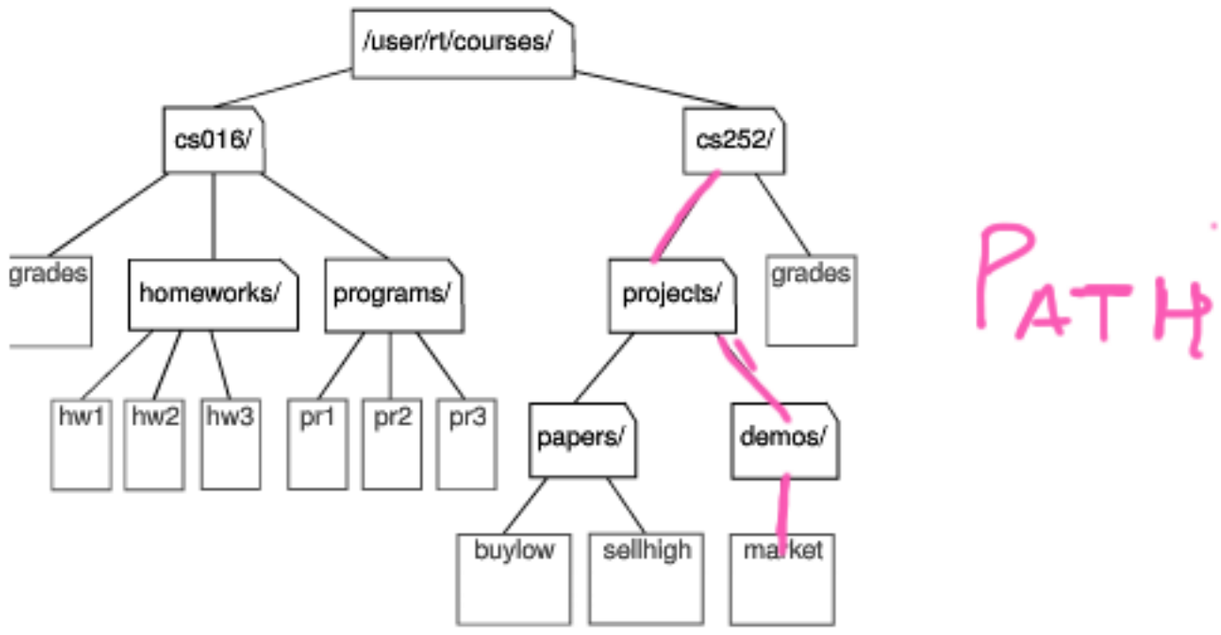
- It is an edge between (Sales, Domestic)

Path



PATH

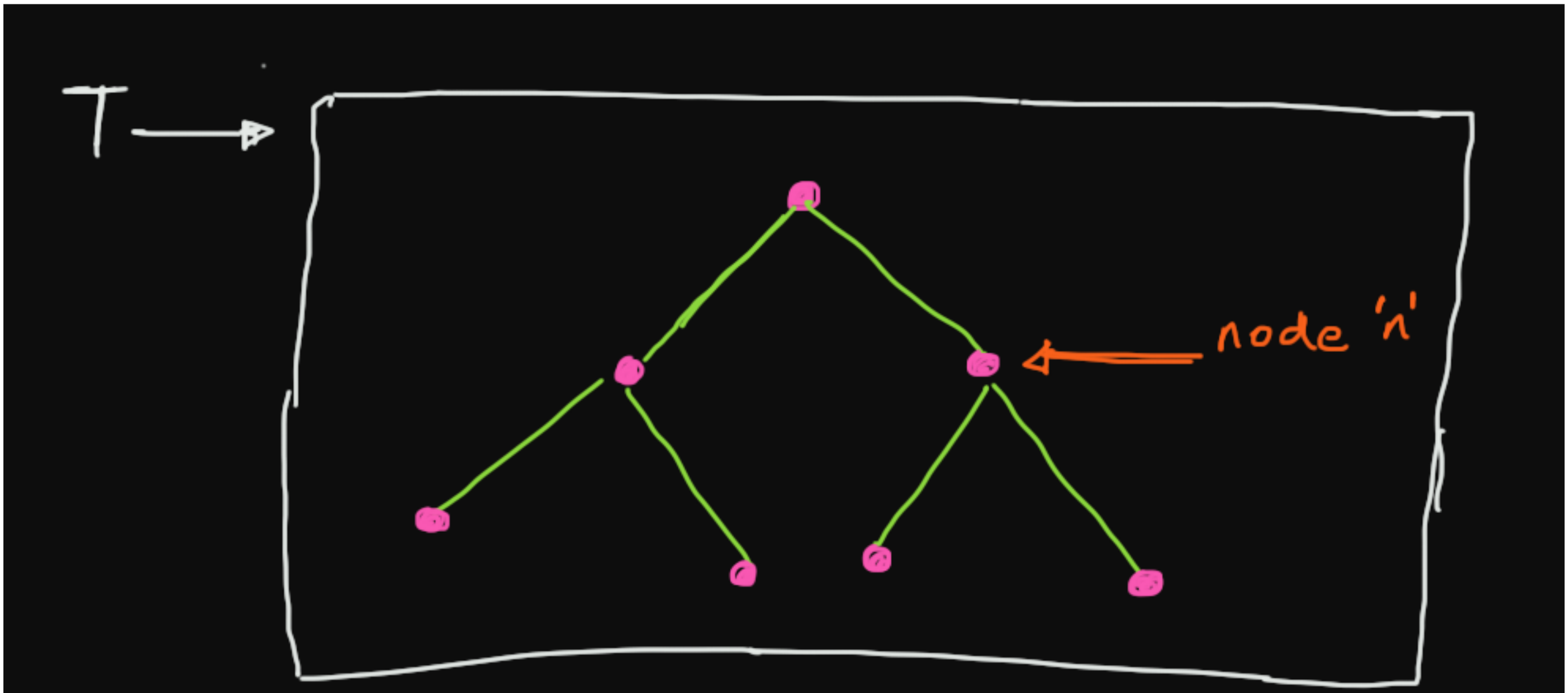
- A path of a tree is a sequence of nodes such that any two consecutive nodes in the sequence form an edge. For example in the picture above, the path in pink is highlighted.

- (CS252/,projects/,demos/,market).

Tree Abstract Data Type

- Lets assume that ’T’ refers to some Tree.

- Lets assume that ’n’ refers to some node in the Tree ’T’.



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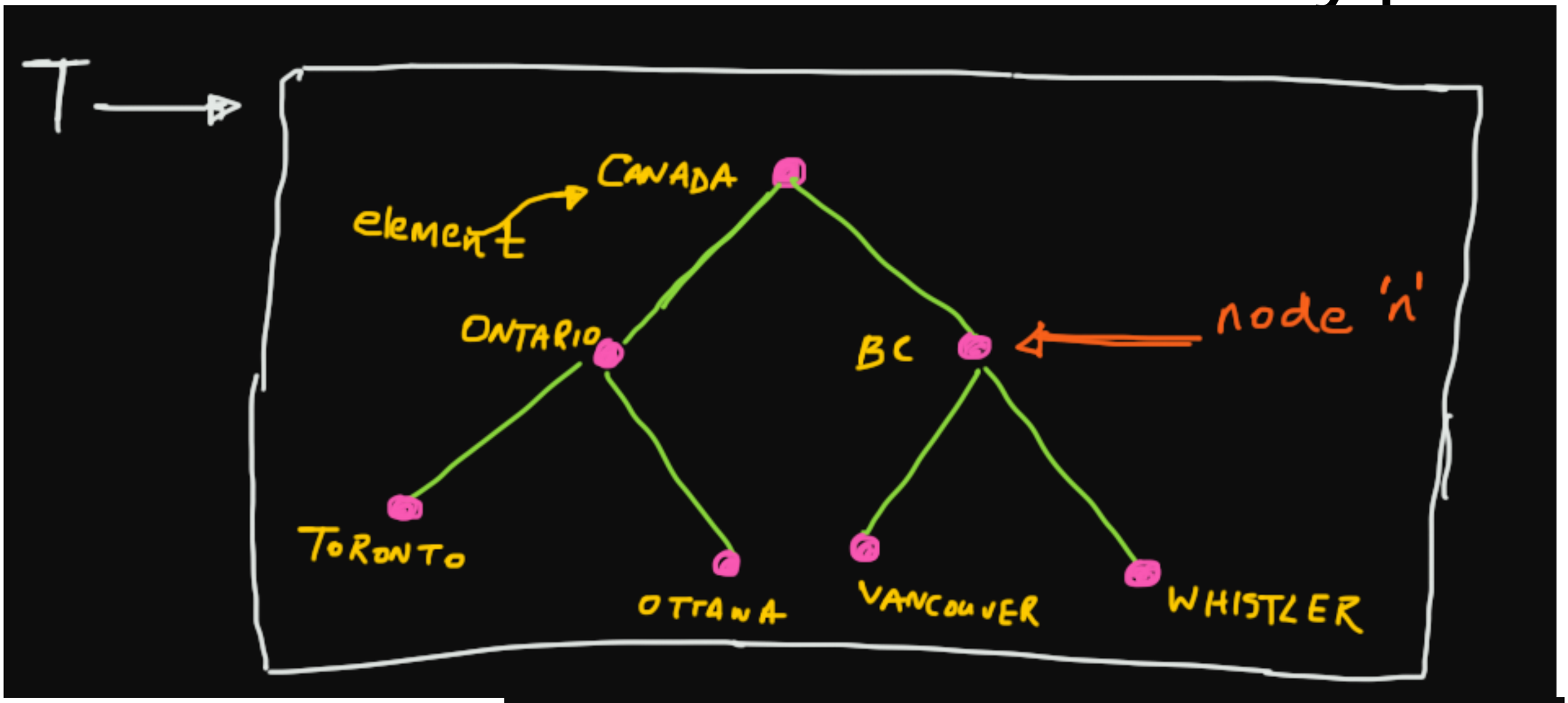
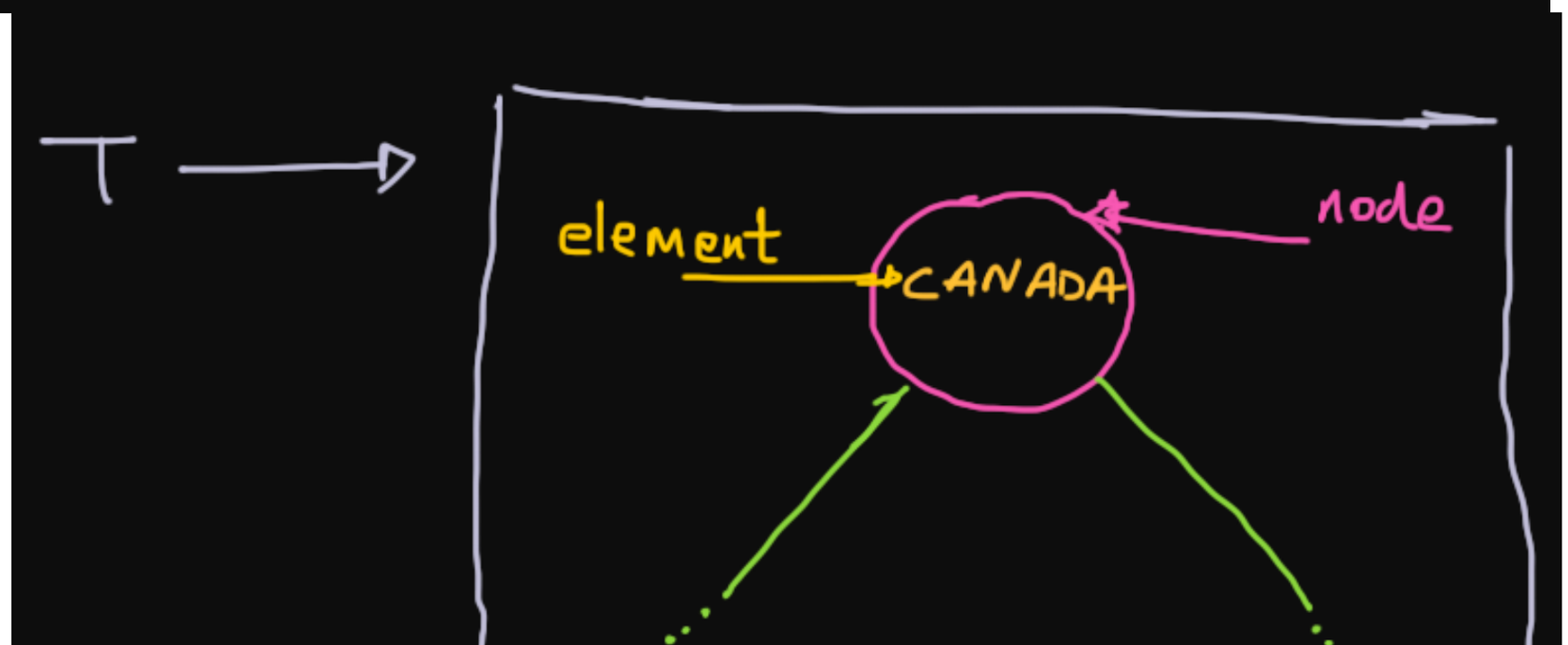
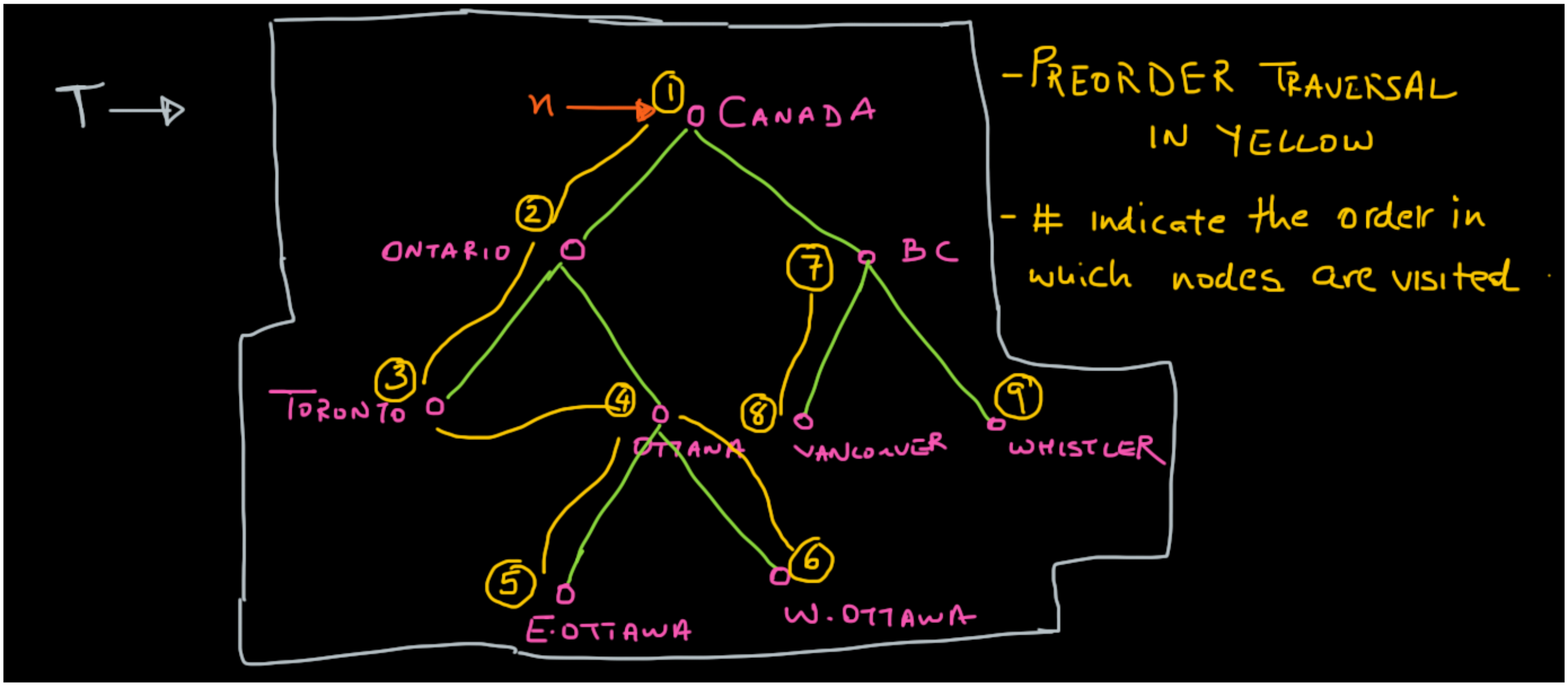


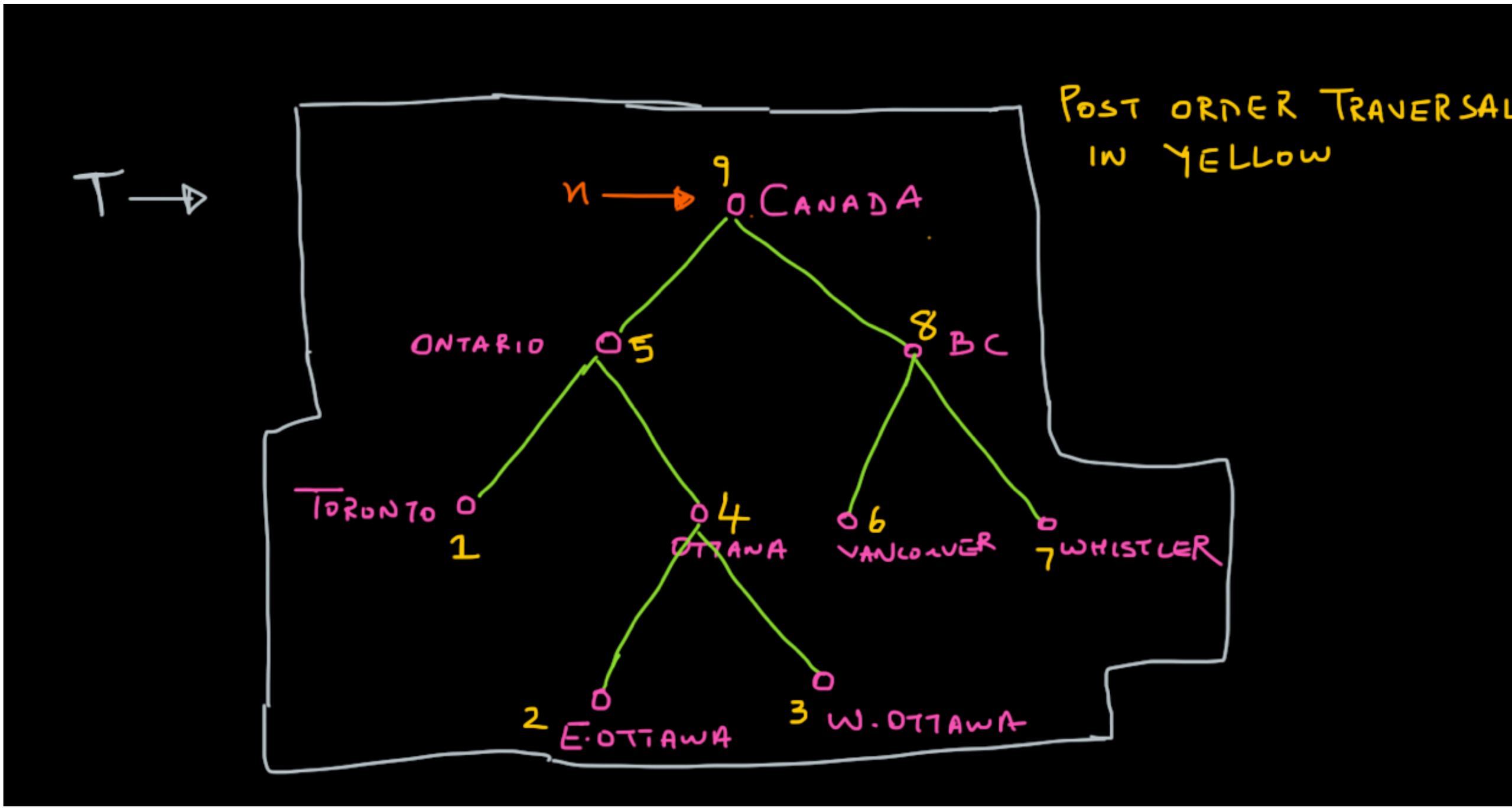
ZOOM IN VERSION



Preorder on binary tree



Post-order on binary tree that is represented as list of list.



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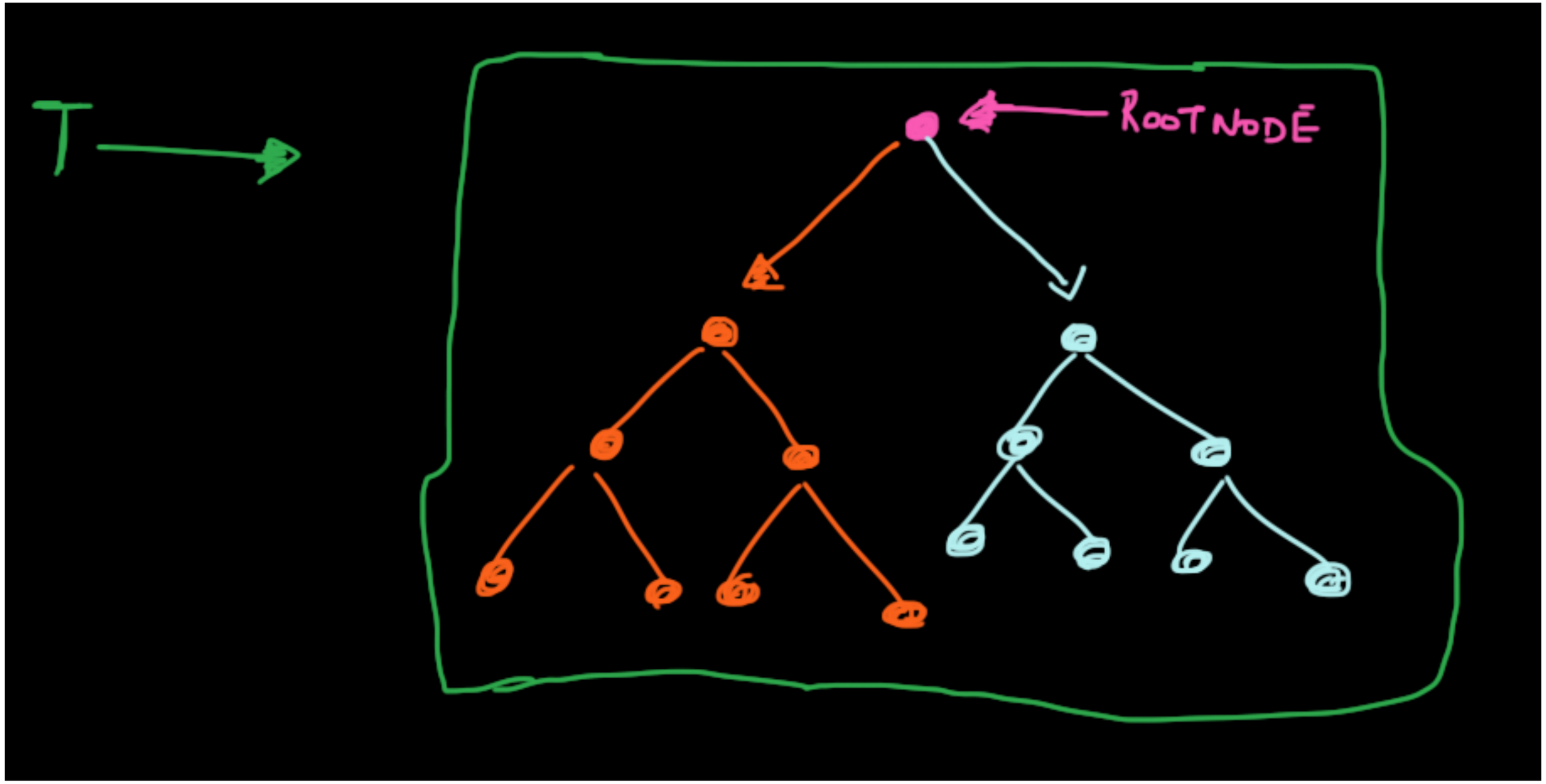

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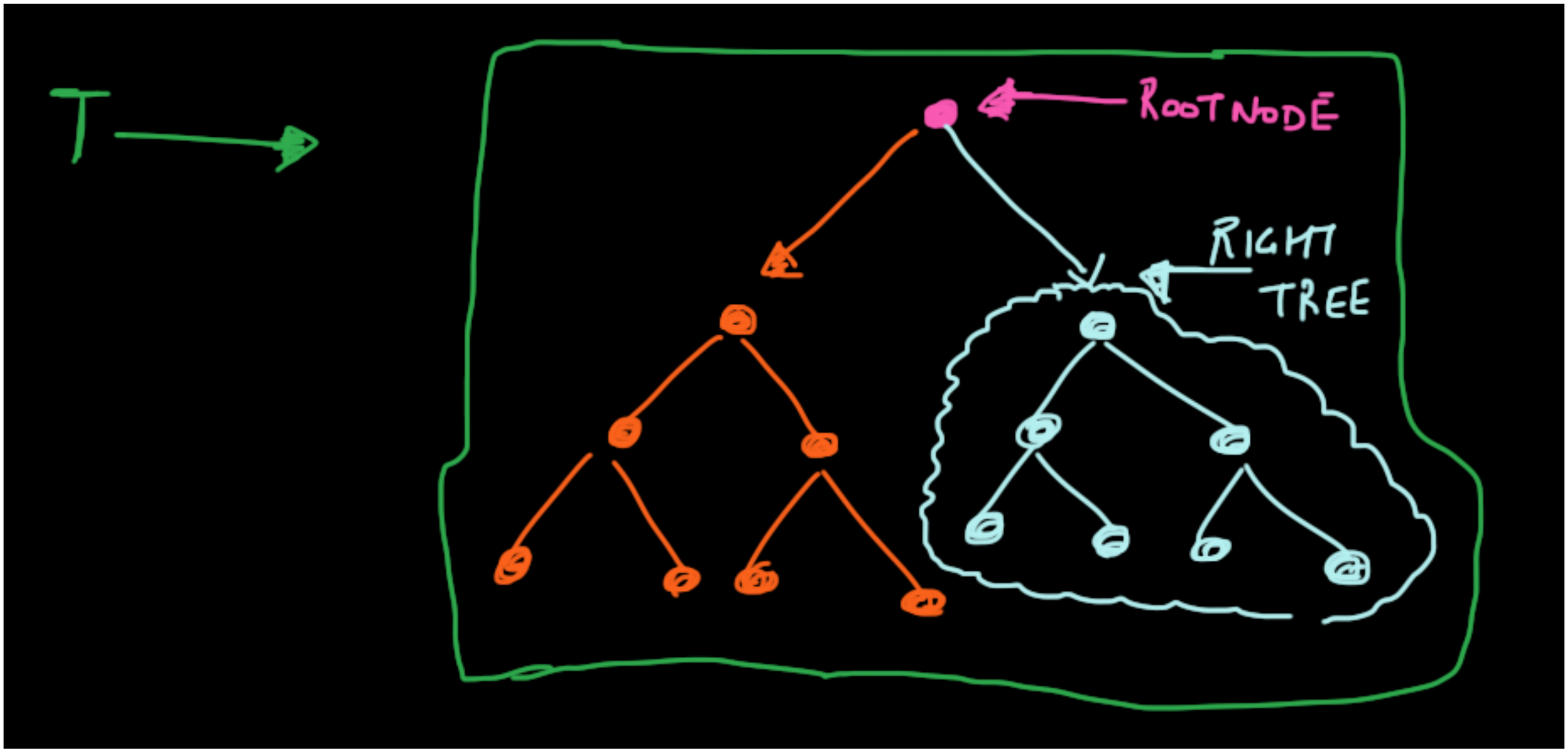

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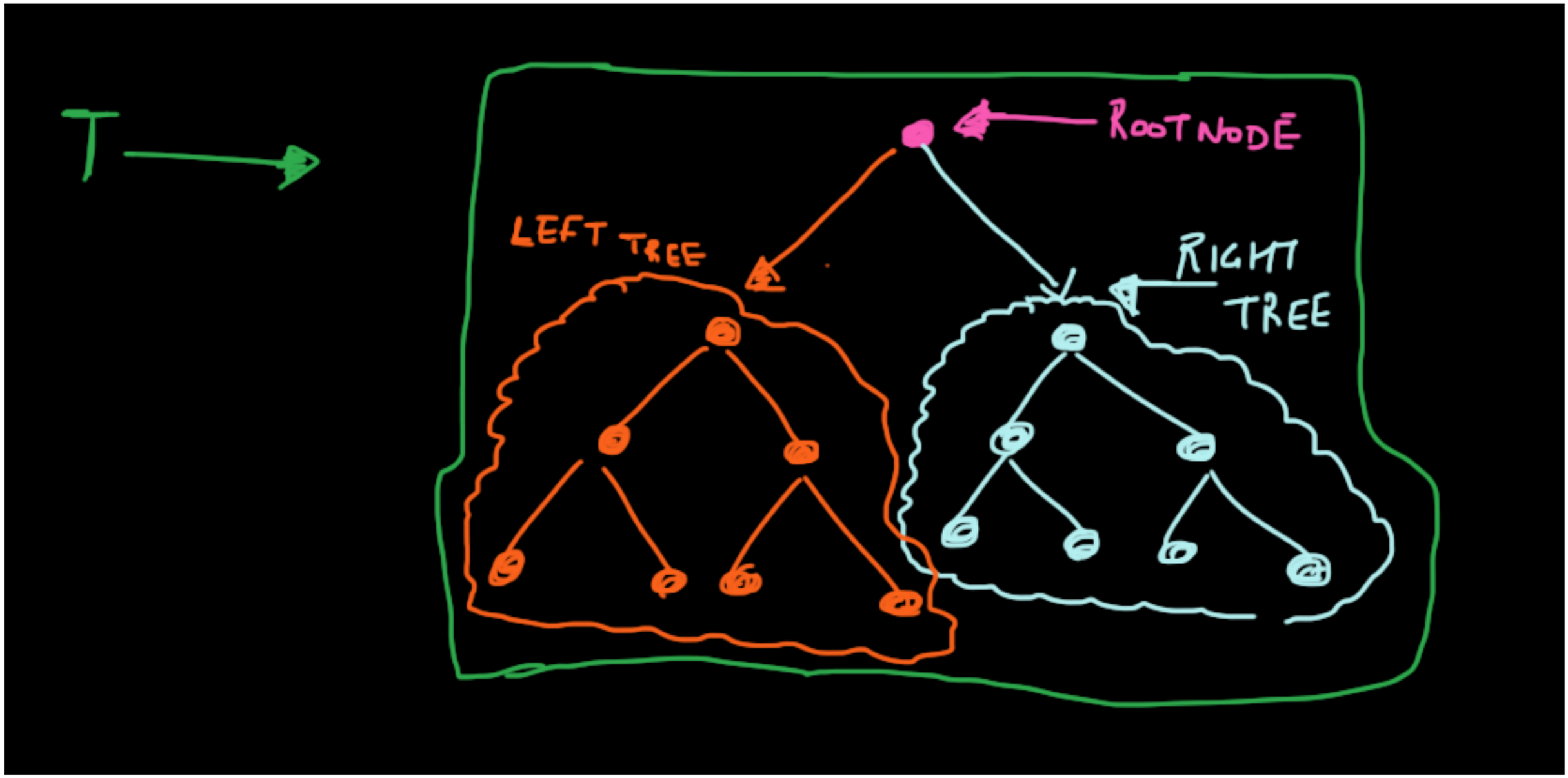

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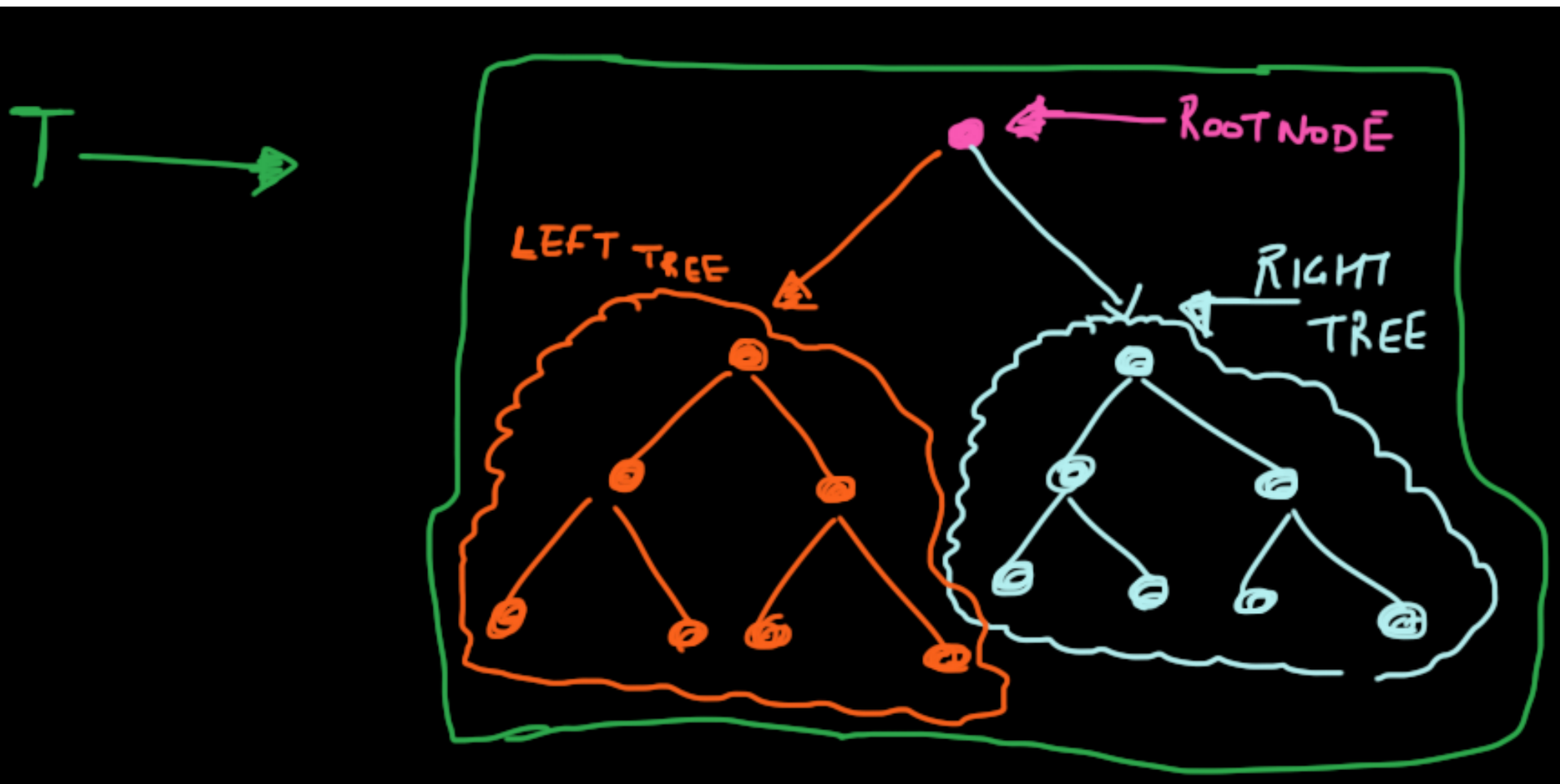


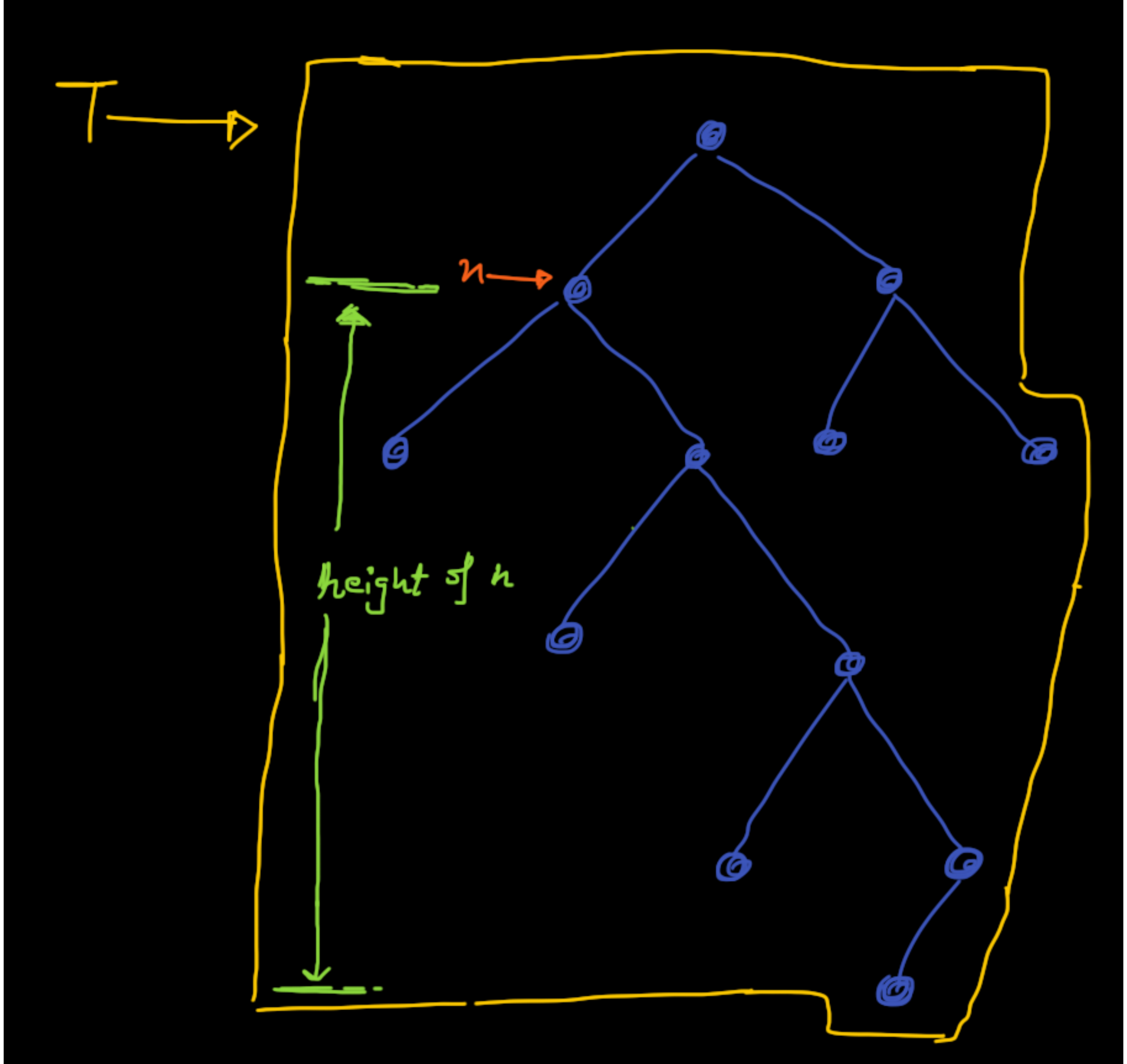
T. RootNode ⟵ refers to the rootnode of T

T. LEFT TREE ⟵ refers to the leftTREE of T

T. RIGHT TREE ⟵ refers to the rightTREE of T

Height of a node ’n'

- The height of a node ’n’ in a tree T is defined as:
  - If ’n’ is a leaf node, then the height of ’n’ is 0.
  - Otherwise the height of ’n’ is one more than the maximum of the heights of ’n’s’ children.

- 
T
n
height of n