



Data Science & Artificial Intelligence

Data Structures Through Python

Trees

DPP - 01

Discussion Notes

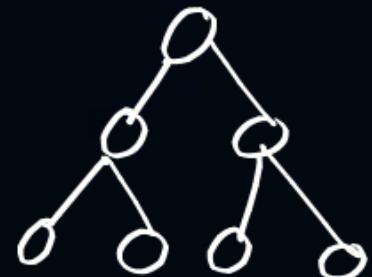


By- Satya sir

#Q. Which of the below statement is/are Invalid?

Ans: B,C,D

- A Every Perfect Binary Tree is a Complete Binary Tree
- B X Every Complete Binary Tree is a Full Binary Tree
- C X Every Full Binary Tree is a Complete Binary Tree
- D X Every Full Binary Tree is a Perfect Binary Tree



PBT, CBT, FBT

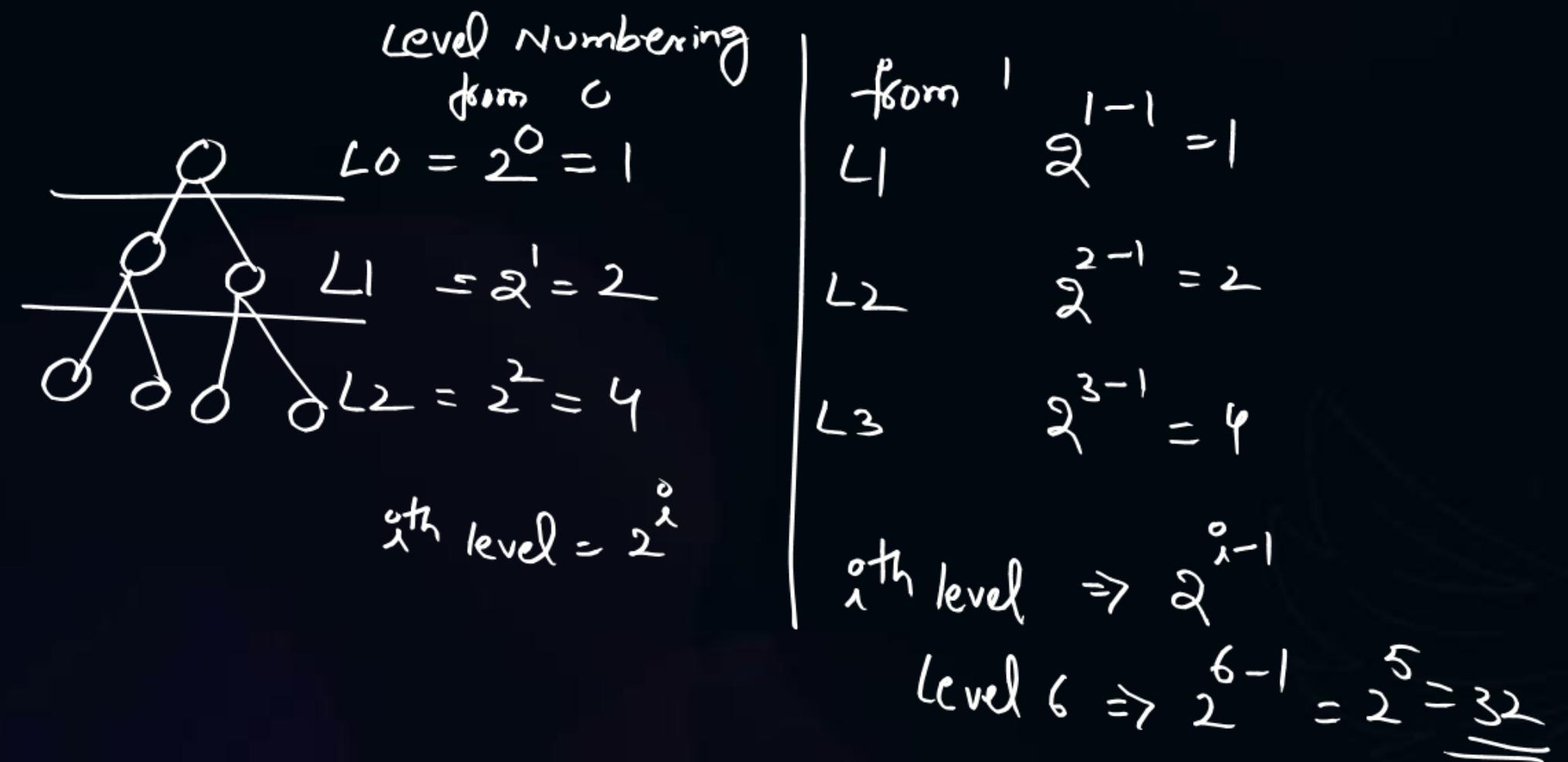


CBT, Not FBT



FBT, Not CBT,
Not PBT

#Q. The Number Of Nodes in a Perfect binary tree at level 6 will be 32
 (NOTE: Level Numbering started from 1)



#Q. The number of leaf nodes in a binary tree, if there are 6 nodes with 2 children is

' i ' Leaf Nodes, No of Nodes with degree 2 = $i-1$

$$i-1 = 6$$

$$\Rightarrow i = 6 + 1 = \underline{\underline{7 \text{ Leaf Nodes}}}$$

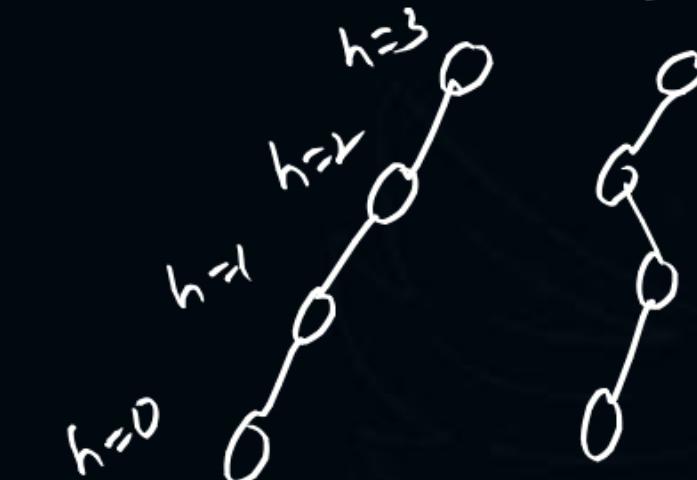
Ans: 7

#Q. The Minimum number of nodes with height $2n$ in a binary tree will be _____

- A n
- B $\checkmark 2^{n+1}$
- C $n - 1$
- D 2^n

$$\text{min. No. of Nodes with height } h \Rightarrow 2^{h+1}$$

$$2n \Rightarrow \boxed{2^{n+1}}$$



#Q. The number of labelled binary trees with 4 nodes is __

- A 14
- B 24
- C 336 ✓
- D 70

$$\frac{2^n c_n}{n+1} * n!$$
$$n=4 \Rightarrow \frac{8c_4}{5} * 4!$$
$$= \frac{8 \times 7 \times 6 \times 5 \times 4!}{4! * 4!} * \frac{4!}{5}$$
$$= \underline{\underline{336}}$$

#Q. Identify False Statement(s) from below:

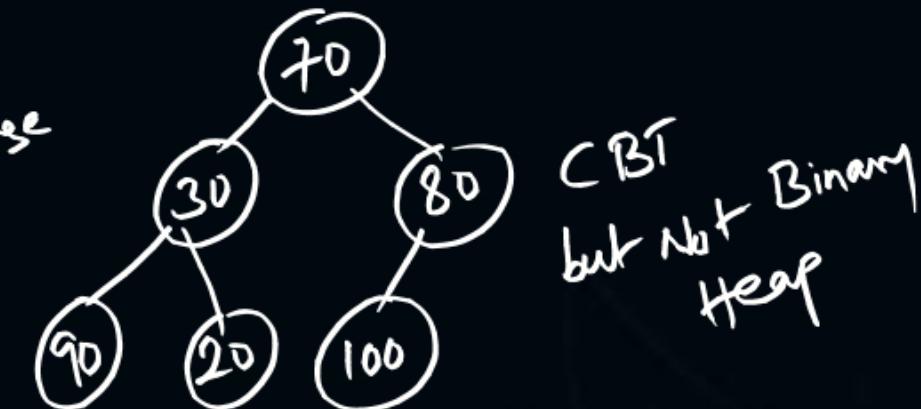
Ans: B, D



✓ Every Binary Heap is a CBT. *TRUE*



✗ Every CBT is a Binary Heap. *false*



✓ Every PBT is a CBT. *true*



✗ Every CBT is a PBT. *false*



CBT but Not FBT, Not PBT

[MCQ]

#Q. The number of Un labelled and Labelled binary trees possible with 5 elements is _____ and _____ respectively.

A 7,840

$$\text{Labelled} = \frac{2^{nc_n}}{n+1} * n_0!$$

B 42,840

$$= 42 * 5!$$

C 7,5040

$$= 42 * 120$$

D ✓ 42,5040

$$= 5040$$



$$\text{Unlabelled} = \frac{2^{nc_n}}{n+1}$$

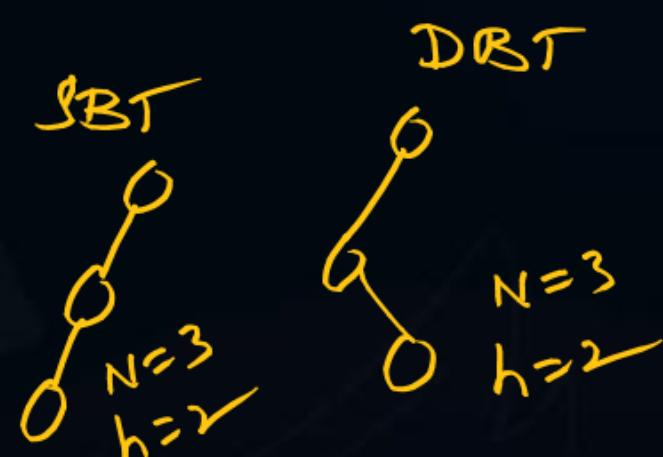
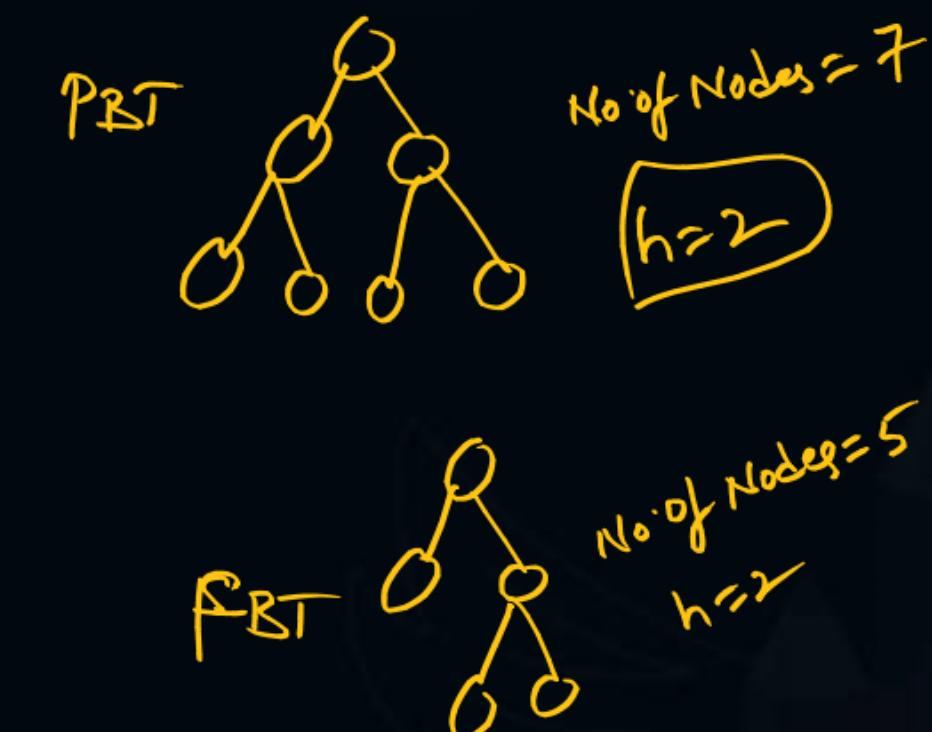
$$= \frac{10c_5}{6}$$

$$= \frac{10 \times 9 \times 8 \times 7 \times 6 \times 5!}{5! \times 5!} * \frac{1}{6}$$

$$= \frac{10^3 \times 9^2 \times 8 \times 7}{6^4 \times 5^4 \times 4 \times 3 \times 2 \times 1} = 3 \times 2 \times 7 \\ = 42$$

#Q. In _____ binary tree, the number of nodes will be maximum with minimum height.

- A Full binary Tree
- B Skewed binary tree
- C Perfect Binary Tree
- D Degenerated binary Tree



#Q. Consider a full binary tree with 15 leaf nodes. Then, the number of internal nodes and total nodes in tree are respectively _____ and _____

- A** 15, 30
- B** ✓ 14, 29
- C** 15, 31
- D** 16, 31

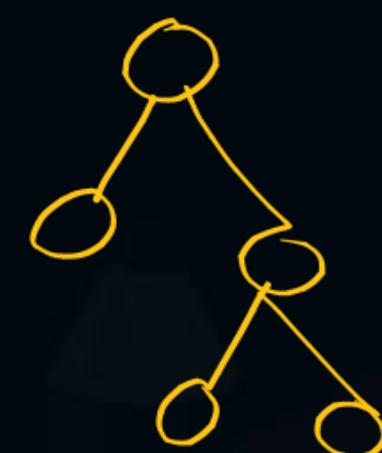
$$\text{Total Nodes} = 2^{\hat{\lambda}+1}$$

$\hat{\lambda}$ $\hat{\lambda}+1$

internal Nodes External leaf

$$\hat{\lambda}+1 = 15$$

$$\Rightarrow \hat{\lambda} = 14, \quad 2^{\hat{\lambda}+1} = 29$$



Total = 5
Internal = 2
External = 3

#Q. The minimum height of binary tree possible with 12 Nodes is _____

- A 2
- C 4

- B 3
- D 5

$$\begin{aligned}\text{minimum height with } N \text{ Nodes} &= \left\lceil \log_2^{N+1} \right\rceil - 1 \\ &= \left\lceil \log_2^{12+1} \right\rceil - 1 \\ &= \left\lceil \log_2^{13} \right\rceil - 1 = 4 - 1 = 3\end{aligned}$$



THANK - YOU