In a complete binary tree, the number of levels, number of nodes in each level, and total number of nodes are as follows

|  |  |  |
| --- | --- | --- |
| 1 | 1 | 1 |
| 2 | 2 | 3 |
| 3 | 4 | 7 |
| 4 | 8 | 15 |
| 5 | 16 | 31 |

The number in the last column would be the total number of nodes in a complete tree.

The formula for levels to total number of nodes is (2^L)-1

|  |  |  |
| --- | --- | --- |
| 1 | 2^1 – 1 | 1 |
| 2 | 2^2 – 1 | 3 |
| 3 | 2^3 – 1 | 7 |
| 4 | 2^4 – 1 | 15 |
| 5 | 2^5 – 1 | 31 |

Assuming K is the total number of nodes(last column), the reverse formula is square root base 2 of (K+1)

|  |  |  |
| --- | --- | --- |
| Number of nodes | K+1 | Sqrt base 2 |
| 1 | 2 | 1 |
| 3 | 4 | 2 |
| 7 | 8 | 3 |
| 15 | 16 | 4 |
| 31 | 32 | 5 |

Time complexity for binary tree is

O(2n)

For the number of children and drop the constant for

O(n)