Fibonacci Series – Space Complexity
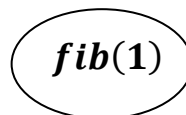
If we take the each recursive tree:

1) *When fibonacci*(0), *we get a single node i. e.*:
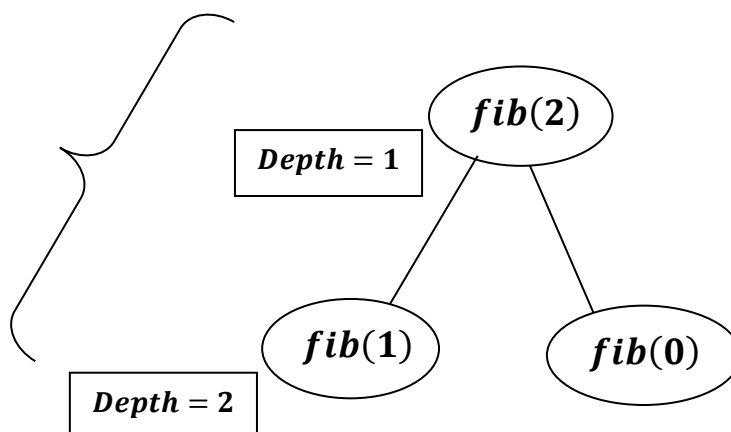
$$fib(0)$$

Depth of the node is 1, *hence space complexity is* $O(1)$.

2) *When fibonacci*(1), *we get a single node i. e.*:
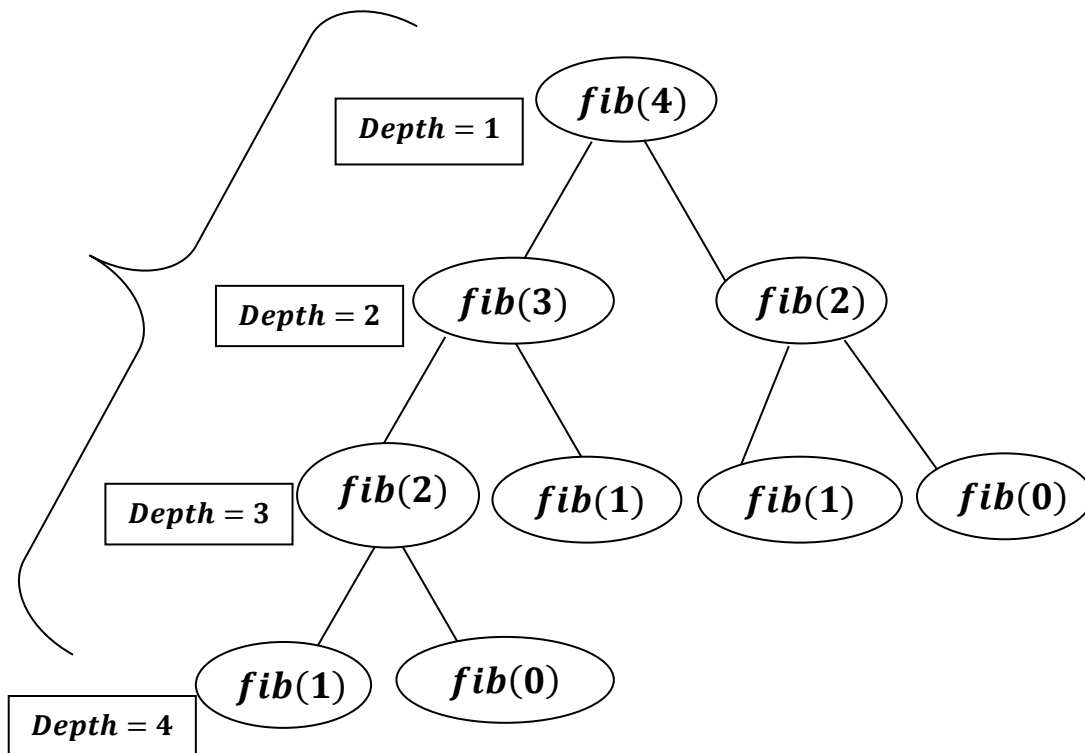
$$fib(1)$$

Depth of the node is 1, *hence space complexity is* $O(1)$.
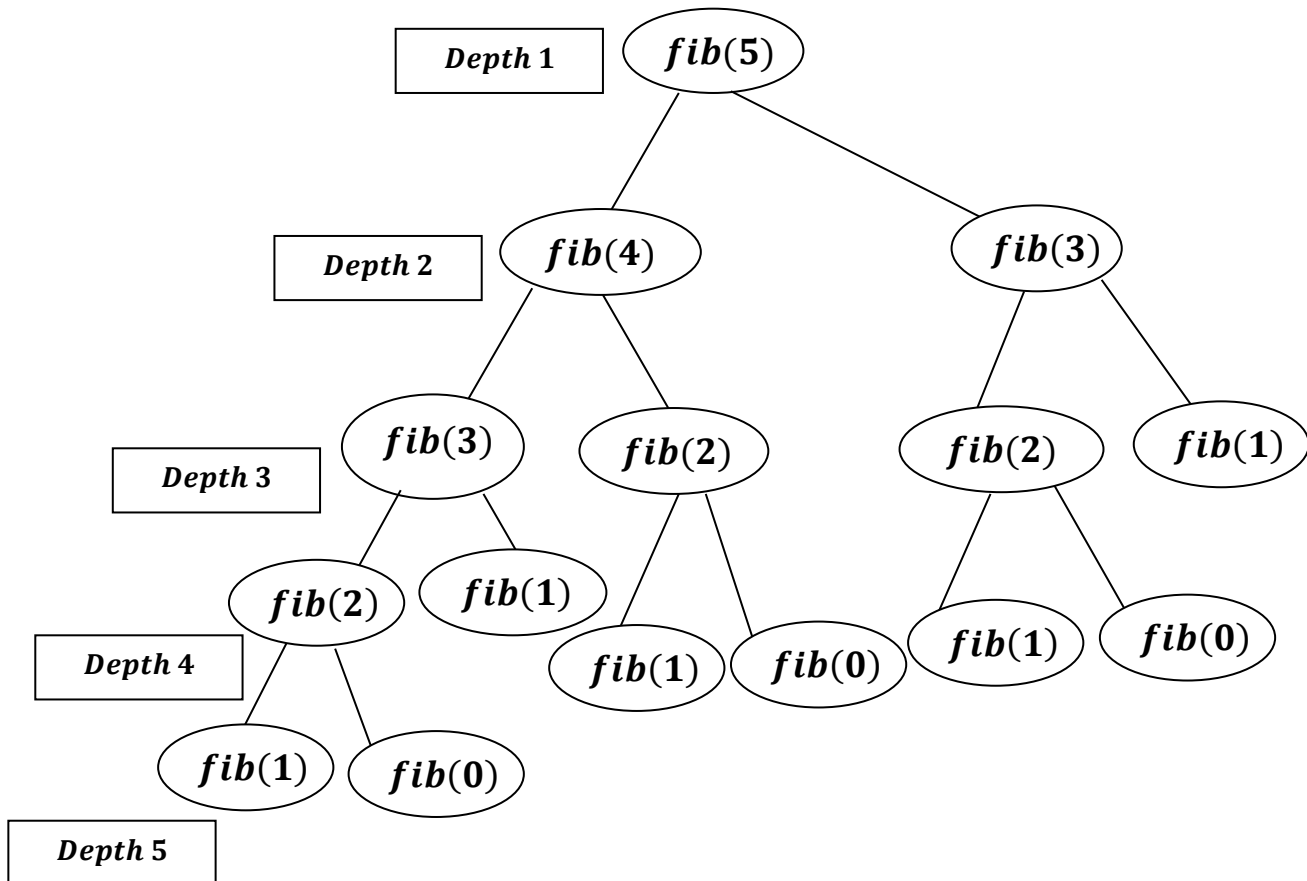
3) *When fibonacci*(2), *we get recursion tree* :

Maximum Depth of the tree is 2, *hence space complexity is* $O(2)$.

4) *When* $fibonacci(4)$, *we get recursion tree* :

$fib(4)$

Depth = 1

$fib(3)$ $fib(2)$

Depth = 2

$fib(2)$ $fib(1)$ $fib(1)$ $fib(0)$

Depth = 3

$fib(1)$ $fib(0)$

Depth = 4

Maximum Depth of the tree is 4, *hence space complexity is* $O(4)$.

In Addition: $fibonacci(5)$, *we get recursion tree* →

| Depth 1 | $fib(5)$ |

| Depth 2 | $fib(4)$ | $fib(3)$ |

| Depth 3 | $fib(3)$ | $fib(2)$ | $fib(2)$ | $fib(1)$ |

| Depth 4 | $fib(2)$ | $fib(1)$ | $fib(1)$ | $fib(0)$ | $fib(1)$ | $fib(0)$ |

| Depth 5 | $fib(1)$ | $fib(0)$ |

Maximum Depth of the tree is 5, *hence space complexity is* $O(5)$.

Hence if it starts from n, the maximum depth(height)of the tree will be n, hence space complexity will be $O(n)$.

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