$$f(x) = \frac{x^2}{2} + x + 1 \longrightarrow O(n^2)$$



Time ↑ (y-axis)

input size (n) (x-axis)
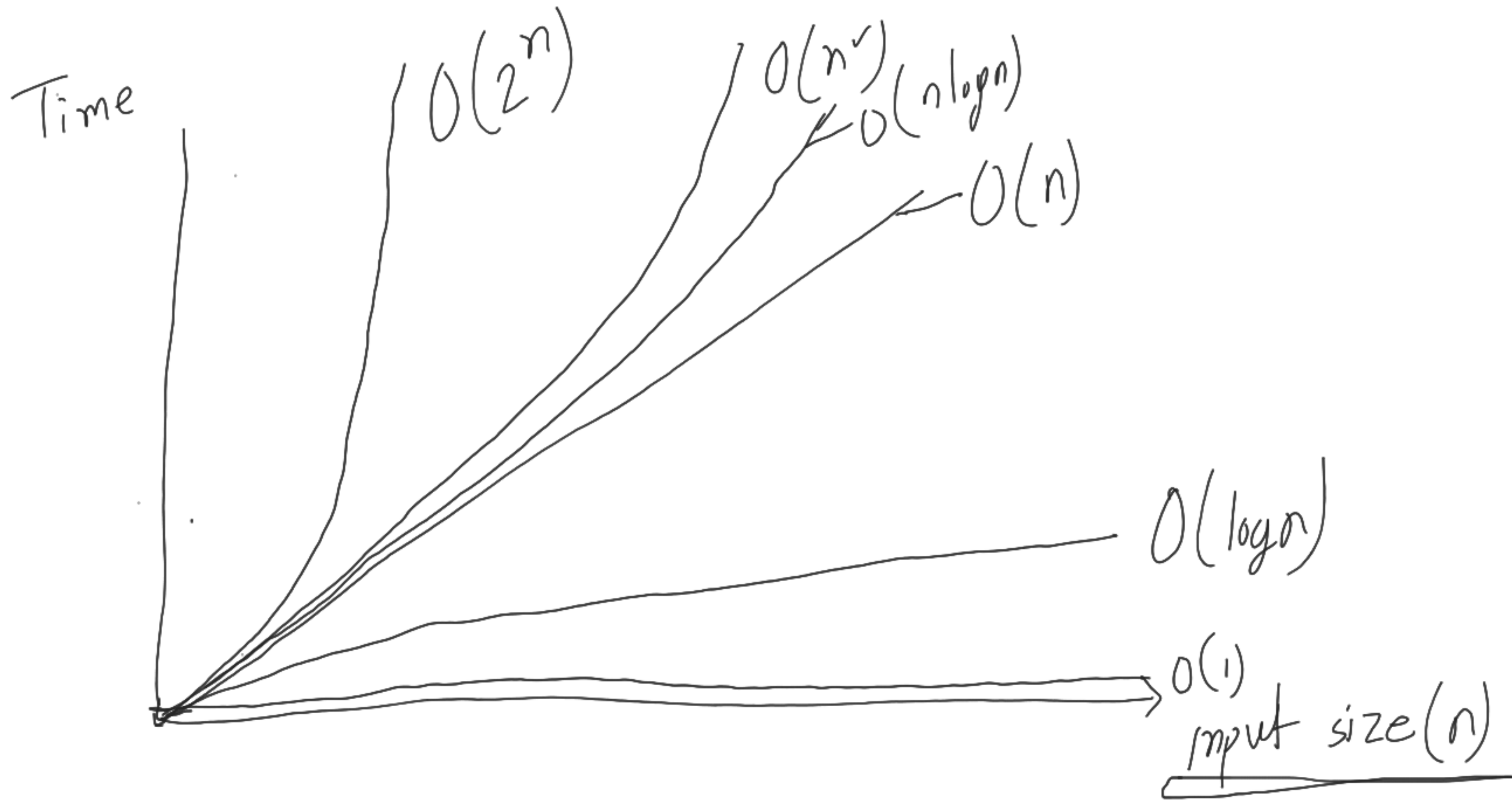
Big O notation spec.

1. Don't consider constants
2. Only consider the max power variable
3. Always consider worst case scenario

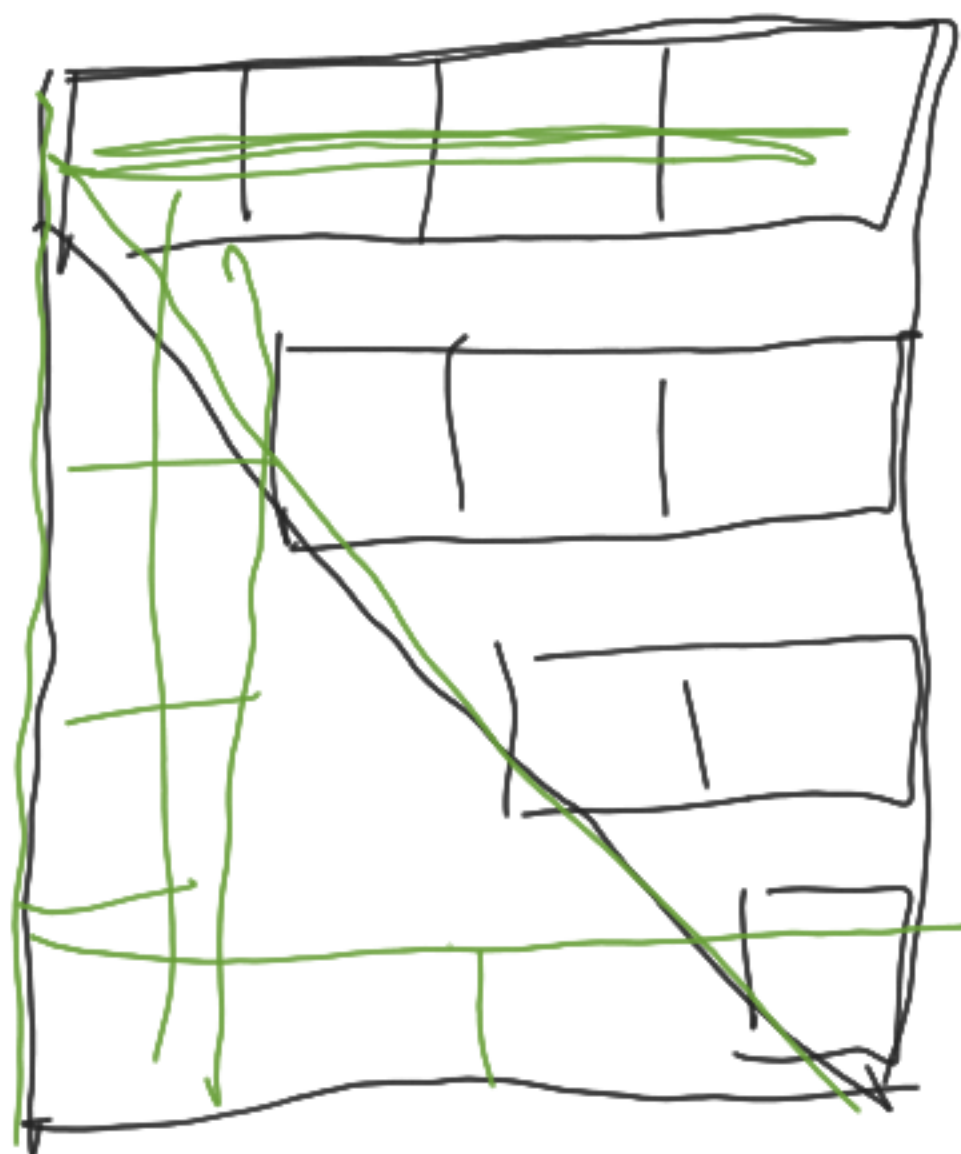$$f(x) = \left(\frac{x+3}{2}\right)^3 + x^2 + 3 \longrightarrow O(x^3)$$

$$f(n) = n\log n + \log n + 10 \rightarrow O(n\log n)$$

Time

$O(2^n)$

$O(n^r)$

$O(n\log n)$

$O(n)$

$O(\log n)$

$O(1)$

input size$(n)$

$$[1, 2, 3, 4]$$

$$\rightarrow [1, 2],$$
$$[1, 3],$$
$$[1, 4],$$
$$[2, 3],$$
$$[2, 4]$$
$$[3, 4]$$

$$c = n$$

$$n = R$$

$$n \cdot n = n^2$$

$$O(n^2)$$

$$\frac{n^2}{2} = O(n^2)$$

$$[\underset{\underset{1}{\downarrow}}{L} , 2, \underset{\underset{3}{\downarrow}}{|m} , 4, \underset{\underset{5}{\downarrow}}{R}] \qquad t = 4$$

$$\text{while}(L <= R)$$

$$m = (L + R \; // \; 2)$$

$$= 0 + 4 \; // \; 2$$

$$= 2$$

$$t == m \rightarrow \text{return } m$$

$$t > m \rightarrow L = m + 1$$

$$t < m \rightarrow R = m - 1$$

$n = [1, 2, \overset{L}{3}, \boxed{\overset{}{4}, \overset{R}{5}}]$

$L = 0$

$R = n.length - 1$

$m = L + R // 2$

if $(t == m)$

    return $m$

if $(t < m)$

$\log n$

$n = \boxed{50} / 2$

$\log 50 = \boxed{5}$

$25/2$

$12/2$

$6/2$

$3/2 \rightarrow 1$

0   1   1   2   3   5   8

|   |   |   |   |   |   |

0   1   2   3   4   5   6

$f(0)$   $f(1)$   $f(2)$   $f(3)$   $f(4)$   $f(5)$   $f(6)$

$f(3)$

$f(2)$        $f(1)$
                ↑

$f(1)$        $f(0)$
  ↑             ↑
  1      +      0              + 1 = 2

$n = 10$

$2 \times 2 \times 2 \times 2 \cdots$

$2^{10} = \boxed{2^n}$

$\checkmark$ [ 1   2   3   4   ⑤   6 ]

$\cancel{y}$          0   1   2   3   4   5

$\cancel{X}$       $\cancel{M}$  L   m   R

$$m = \frac{L+R}{0+5} // 2$$

$$= 2$$

$$3 + \cancel{5} \not{/} 2$$

$$= 4$$

$$n/2 = 1$$
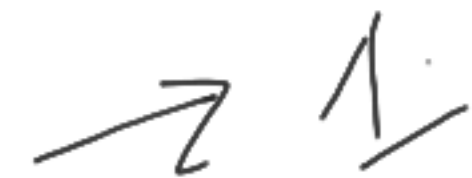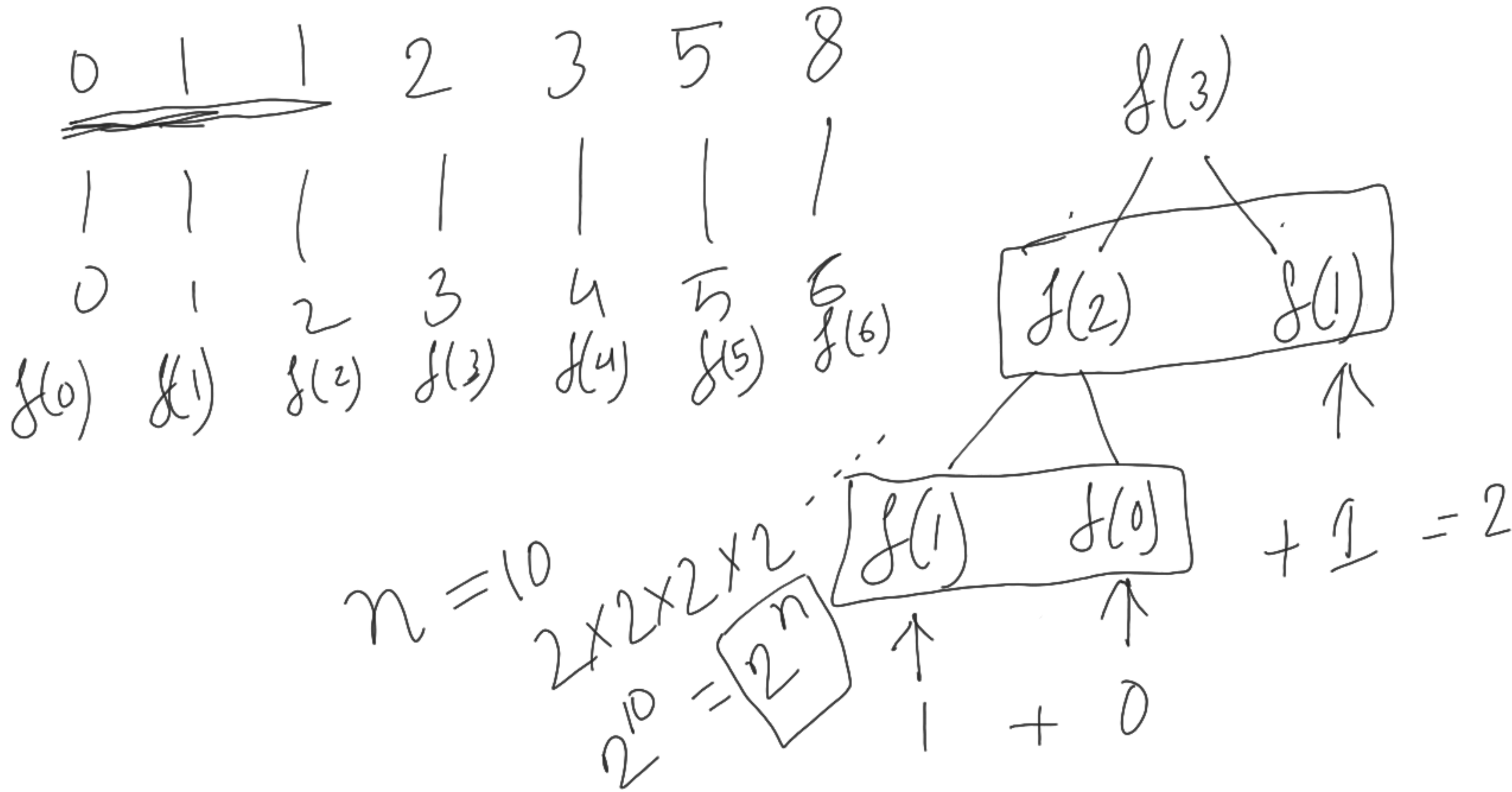
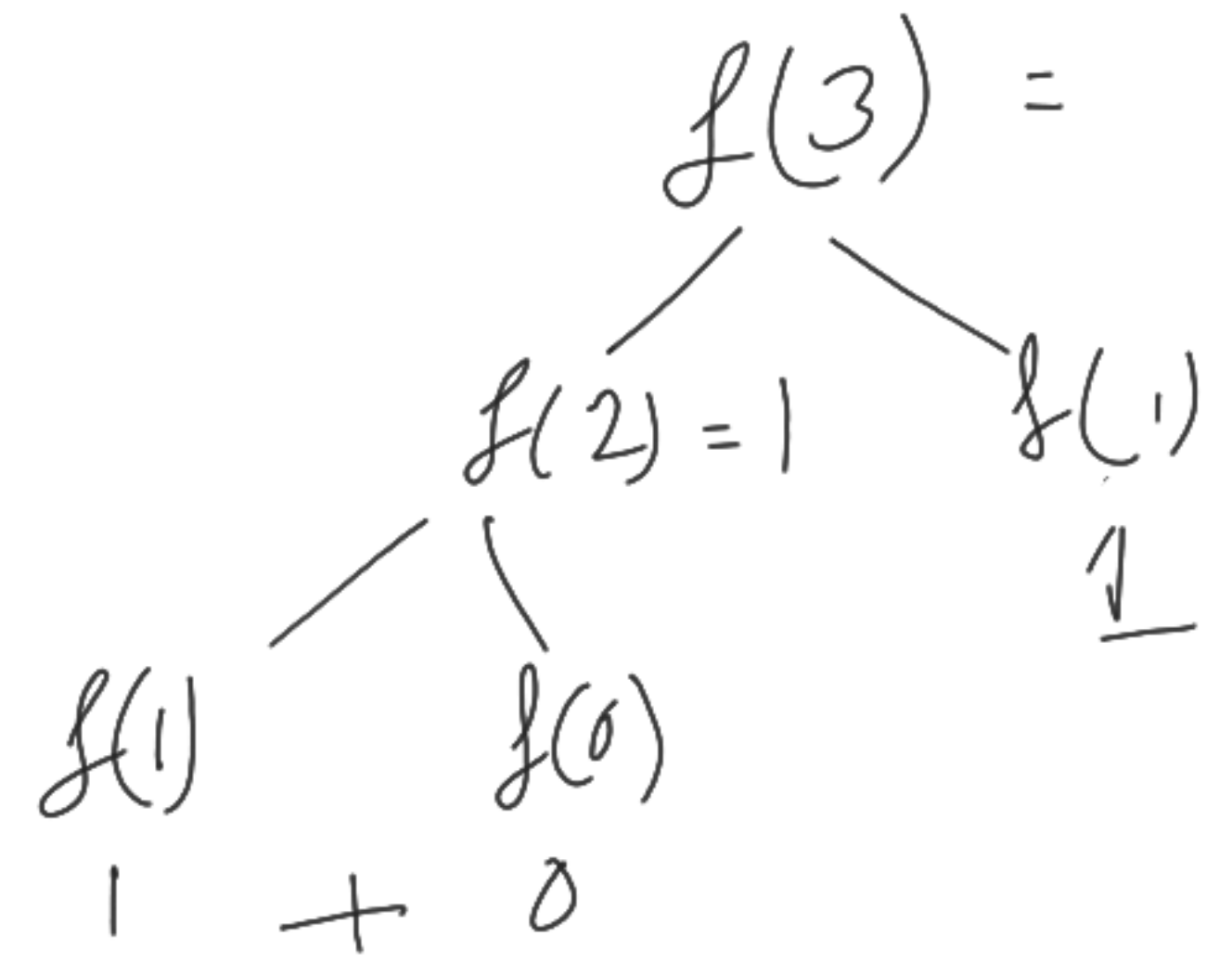```java
int search(List<int> nums, int target) {
    int l = 0;
    int r = nums.length - 1;

    while(l <= r) {
        int m = (l+r) ~/ 2;

        if(target == nums[m]) {
            return m;
        } else if(target < nums[m]) {
            r = m-1;
        } else {
            l = m +1;
        }
    }
    return -1;
}
```

$V$  $\underline{0 \quad 1}$  1  2  ③  5  8  13

$y$  0  1  2  3  4  5  6  7

1  2  3  4  $\cdots$  n

$\underline{2}$  2  2  2  $\cdots$

$2^2$  ②$^n$

$f(3) =$

$f(2) = 1$  $f(1)$

$\underline{1}$

$f(1)$  $f(0)$

1  +  0

$$[\ 2\ \textcircled{1}\ 3\ 4\ ] \Rightarrow [\ 4\ 3\ 2\ 1\ ]$$

$$[\ 2\ 3\ 1\ 4\ ]$$

$$\checkmark\ [\ \underline{2\ 3}\ 4\ |\ 1\ ]$$

$$[\ 3\ 2\ 4\ |\ 1\ ]$$

$$[\ 3\ 4\ |\ 2\ 1\ ]$$

$$[\ 4\ 3\ 2\ 1\ ]$$