$n = 18 \quad (16+2)$

$n = 10010$
      4 3 2 1 0

$\& B = 01000$

$\underbrace{00000}$
         1

000001
000010
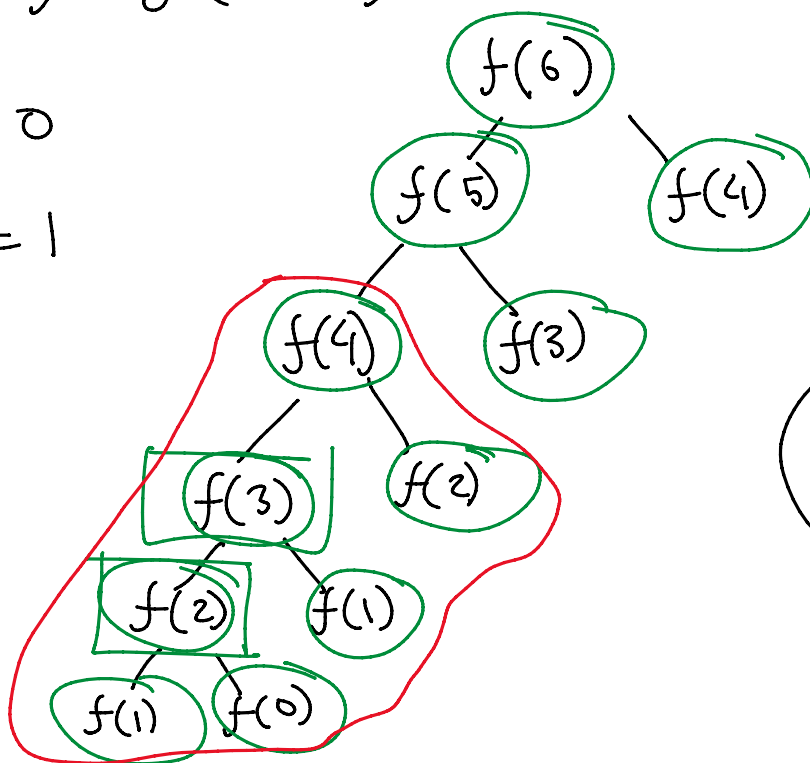000100
001000

$n \& (1 << k) > 0 \quad \longrightarrow 1$

$\underline{\underline{=}} \quad \underline{\underline{\underline{\phantom{(1<<k)}}}} \qquad \longrightarrow 0$

$0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55,$

$f(N) = f(N-1) + f(N-2)$

$f(0) = 0$

$f(1) = 1$

$O(2^N)$

$O(N)$

$O(\log N)$

XOR
AND
OR
SHIFT

$v = 18$

$L \rightarrow$ $\leftarrow R$

Binary Search

~~Trojan~~

TRUE   T

$5, -3, 0, 1, 5, 10, 11, 17, 100$

R↓ L↓
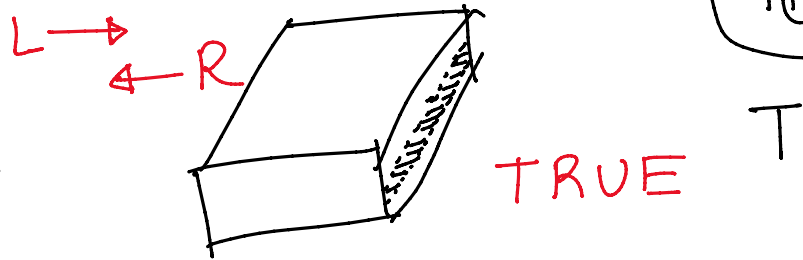
$\frac{0+3}{2} = 1$ $\frac{1+1}{2} = 1$

N সংখ্যক element নিয়ে থাকবো

sorted থাকবো
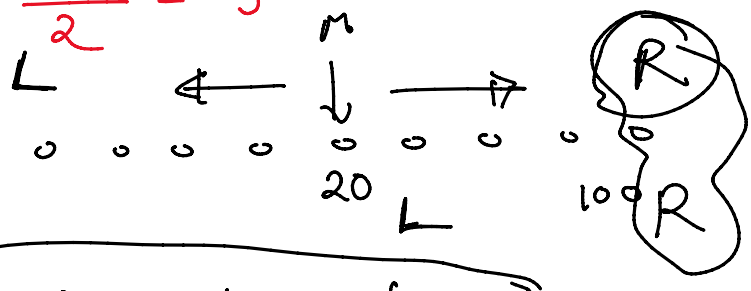
Target element কে খুঁজে বের করতে হবে।

$L = 0$ M $R = 6$

$a_0 \quad a_1 \quad a_2 \quad a_3 \quad a_4 \quad a_5 \quad a_6$

$$M = \frac{L+R}{2} = \frac{0+6}{2} = 3$$

$L \leftarrow$ $M↓$ $\rightarrow R$

20   100
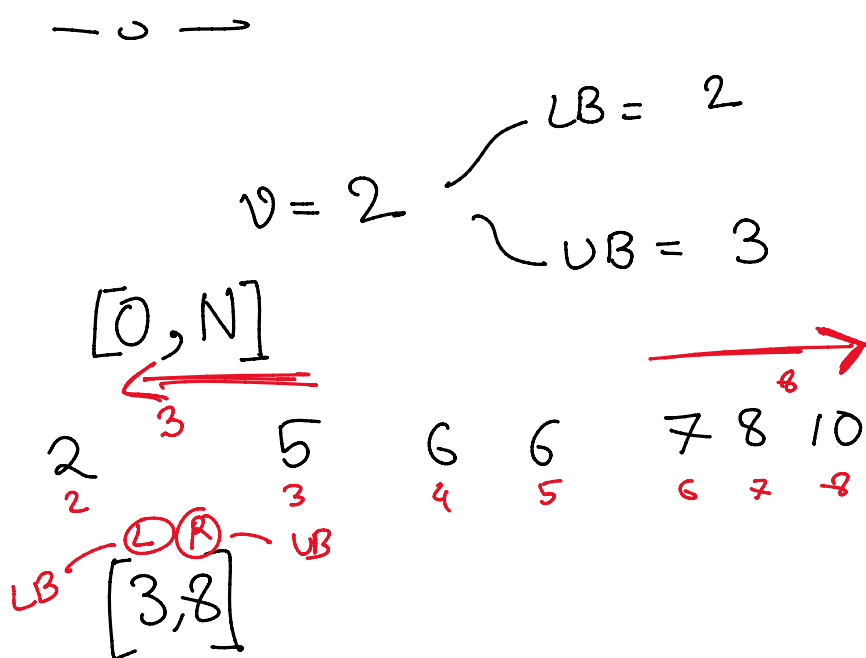
while $(L \leq R)$

{   M = (L+R)/2;

{
   M = (L+R)/2;

   ⟹ if (arr[M] == target) return true;
   else if (arr[M] > target) R = M-1
   else   L = M+1;

}
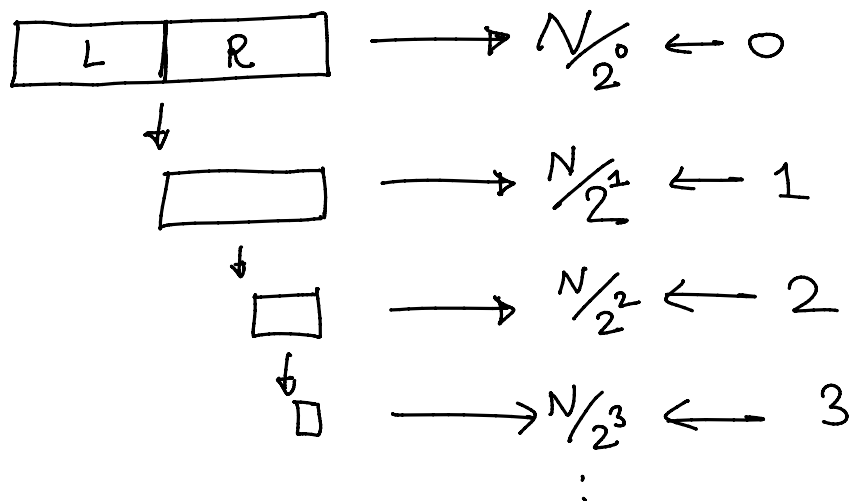
return false;

— ○ →

Concept:

1. Lower Bound
2. Upper Bound

$$v = 2 \begin{cases} LB = 2 \\ UB = 3 \end{cases}$$

$[\overline{0}, N]$

$$\begin{array}{cccccccccc} \underline{1} & \underline{1} & \underline{2} & & 5 & 6 & 6 & 7 & 8 & 10 \\ 0 & 1 & 2 & & 3 & 4 & 5 & 6 & 7 & 8 \end{array}$$

LB — (L)(R) — UB
$[3,8]$

— • —

$L = 0, \quad R = N-1$

L	R

$\longrightarrow N/2^0 \leftarrow 0$

$\downarrow$

$\longrightarrow N/2^1 \leftarrow 1$

$\downarrow$

$\longrightarrow N/2^2 \leftarrow 2$

$\downarrow$

$\longrightarrow N/2^3 \leftarrow 3$

:

$$\frac{N}{2^k} = 1$$

$$\Rightarrow N = 2^k$$

$$\Rightarrow k = \log_2(N)$$

$\dfrac{N}{2^k}$ $\longleftarrow$ k $\qquad$ $N = 10^6$

$\hookrightarrow \log_2(N) \approx 20$

$O(\log N \, Q \, T)$

$N = 20$

$Q = 5 \times \boxed{10^4}$

$T = 5$

$5 \times 100 \times 10^9$

$\boxed{5 \times 10^6}$

10^8

2.5×10^2

$2.5 \times 100 = 250s$

$25 \times 10^9 = \boxed{2.5 \times 10^{10}}$

10^8