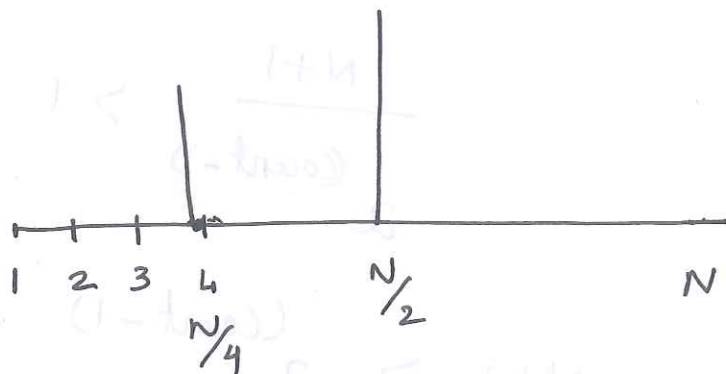→ Computational Complexity - <u>Running time</u> - Binary

→ <u>Binary Search</u>

input = key, a[N]

mid = $\dfrac{Hi + Lo}{2}$



value of mid ⟹ $\dfrac{N}{2}, \dfrac{N}{4}, \dfrac{N}{8} \dots$

end of mid calculation = $\dfrac{N}{2^x}$   where   $\dfrac{N}{2^x} > 1$

No of compares like)

if ( key < a[mid] ) ⟹   If N=1 =

N = 3 = 1 comparison
N = 7 = 2 comparisons
N = 15 = 3 comparison

| N | 3 | 7 | 15 | 31 |
|---|---|---|---|---|
| mid | $\dfrac{N+1}{2}$  2 | $\dfrac{N+1}{2}, \dfrac{N+1}{4}$  {4, 2} | $\dfrac{N+1}{2}, \dfrac{N+1}{4}, \dfrac{N+1}{8}$  {2, 4, 8} | $\dfrac{N+1}{2}, \dfrac{N+1}{4}, \dfrac{N+1}{8}, \dfrac{N+1}{16}$ |
| count of mids. | 1 | 2 | 3 | 4. |

so mid is calculated

$$\frac{N+1}{2^{(count-1)}} > 1$$

$$N+1 > 2^{(count-1)}$$

$$\log(N+1) > count - 1$$

$$count < 1 + \log(N+1)$$

$$\approx \boxed{count < 1 + \log N}$$