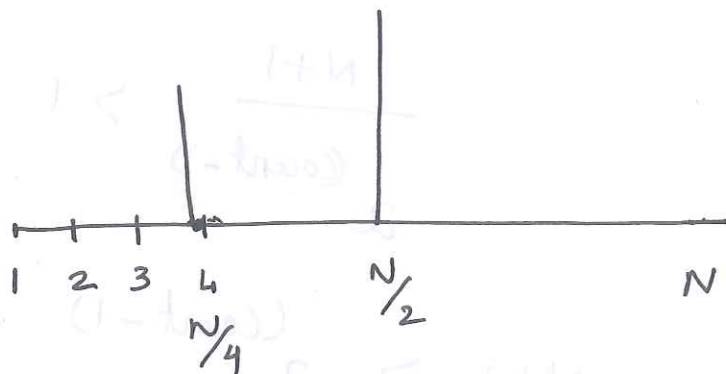


→ Computational Complexity - Running time - Binary

→ Binary Search

input = key, $a[N]$

$$\text{mid} = \frac{H_i + L_o}{2}$$



Value of mid $\Rightarrow \frac{N}{2}, \frac{N}{4}, \frac{N}{8}, \dots$

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

No of compares like)

if (key < $a[\text{mid}]$) \Rightarrow

if $N = 1$

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

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

so mid is calculated

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

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

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

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

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

N	mid				count of mid
	1	2	3	4	
1	1				1
2	1	2			2
3	1	2	3		3
4	1	2	3	4	4
5	1	2	3	4	5
6	1	2	3	4	6
7	1	2	3	4	7
8	1	2	3	4	8
9	1	2	3	4	9
10	1	2	3	4	10
11	1	2	3	4	11
12	1	2	3	4	12
13	1	2	3	4	13
14	1	2	3	4	14
15	1	2	3	4	15
16	1	2	3	4	16
17	1	2	3	4	17
18	1	2	3	4	18
19	1	2	3	4	19
20	1	2	3	4	20
21	1	2	3	4	21
22	1	2	3	4	22
23	1	2	3	4	23
24	1	2	3	4	24
25	1	2	3	4	25
26	1	2	3	4	26
27	1	2	3	4	27
28	1	2	3	4	28
29	1	2	3	4	29
30	1	2	3	4	30
31	1	2	3	4	31