

Complexity Analysis → Single Most Important 7

$O(4 \cdot \log_2 N)$
 ↳ Time
 ↳ Space

```
int sum = 0;
for (int i = 0; i < n; i++) {
    sum += b * i;
}
```

$O(n)$

1
 int sum =
 1
 0.1

— 1 — — — — —
 0 ... n-1

$n = 10^9$

$\text{sum} = \frac{n(n-1)}{2}$

$\begin{matrix} 31 \\ -2 \end{matrix} \quad \begin{matrix} 31 \\ +2 - 1 \end{matrix}$

int → 4B → 32b

short → 4bit

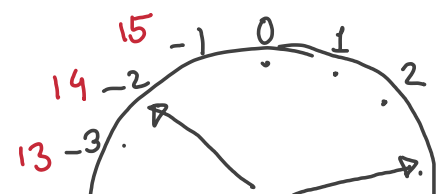
short a = 4 + 2
 a++ = 3

$2^4 = 16$
 -8 -7 -6 -5 -4 -3 -2 -1 | 0 1 2 3 4 5 6 7

$7 + 7 = -2$

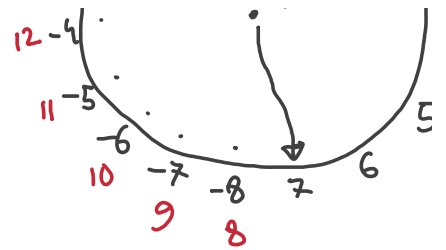
$14 \% 16 = 14$

$242 \% 16 = 3$



2 1 3 4 5 6 7 8 9 10 11 12 13

$$\text{val} - 2^{32} = X$$



$$2^k \leq n \quad 2^{16} = 65536$$

$$\Rightarrow \log_2(2^k) \leq \log_2(n)$$

$$\Rightarrow k \cdot \log_2(2) \leq \log_2(n)$$

$$\therefore k \leq \log_2(n)$$

$$\log_2(n) \geq x_1$$

$$\boxed{\frac{x_1}{2}} = n$$

1	2	3	4	5	6	7	8	9	10	11	12	13

$$= n + \frac{n}{2} + \frac{n}{3} + \frac{n}{4} + \frac{n}{5} + \dots + \frac{n}{n}$$

$$= n \left(1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \dots + \frac{1}{n} \right) \leftarrow \text{H}_n$$

$$= n \cdot \log_2 n \quad n \rightarrow \infty$$

$$\boxed{n} \quad \frac{n}{8}$$

$$\frac{n}{2} \quad \frac{n}{16}$$

$$\frac{n}{4}$$

$$\rightarrow \text{for}(i=n; i>0; i/=2)$$

$$\text{for}(j=1; j<i; j++)$$

$$\begin{aligned}
 & n + \frac{n}{2} + \frac{n}{4} + \frac{n}{8} + \dots \\
 &= n \left(1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \dots \right) \\
 &= n \cdot 2
 \end{aligned}$$

```

for(i=n; i>0; i/=2)
    for(j=1; j<i; j++)

```

