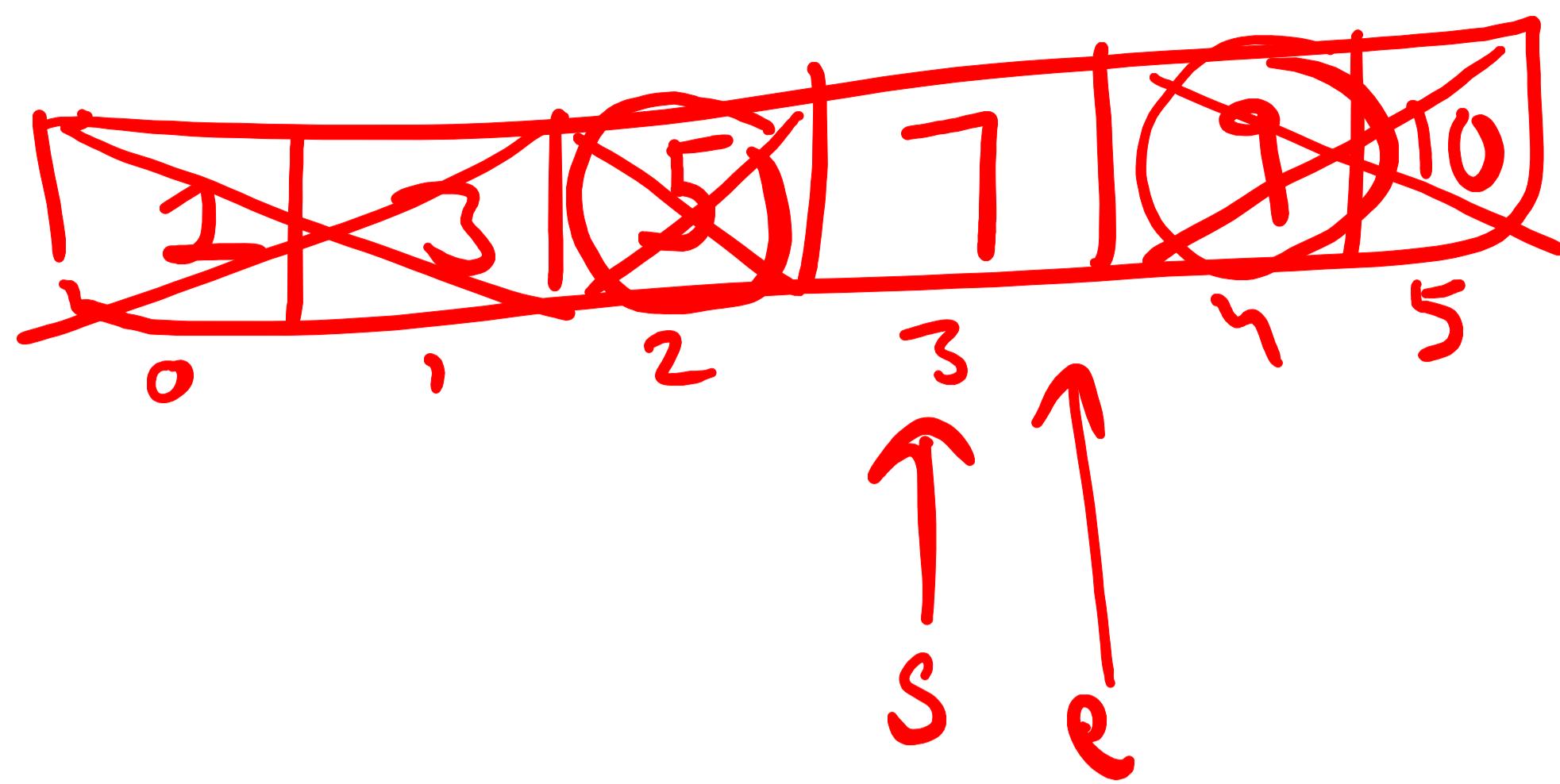


## Binary Search



Key

7

$$m = \frac{(s+e)}{2}$$

$$= \frac{5+3}{2}$$

$$= 4$$

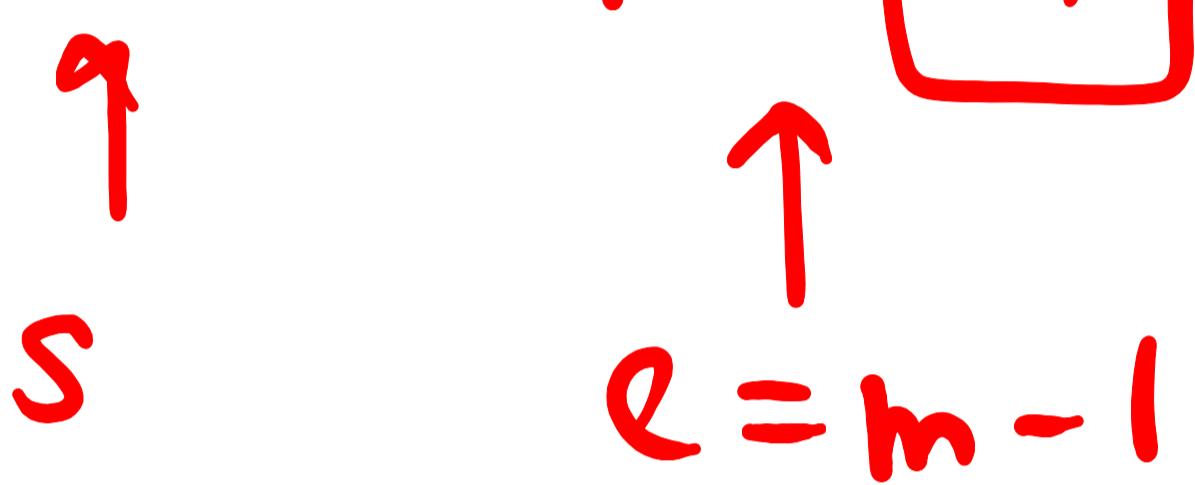
①  $a[m] == \text{key}$

②  $a[m] > \text{key}$

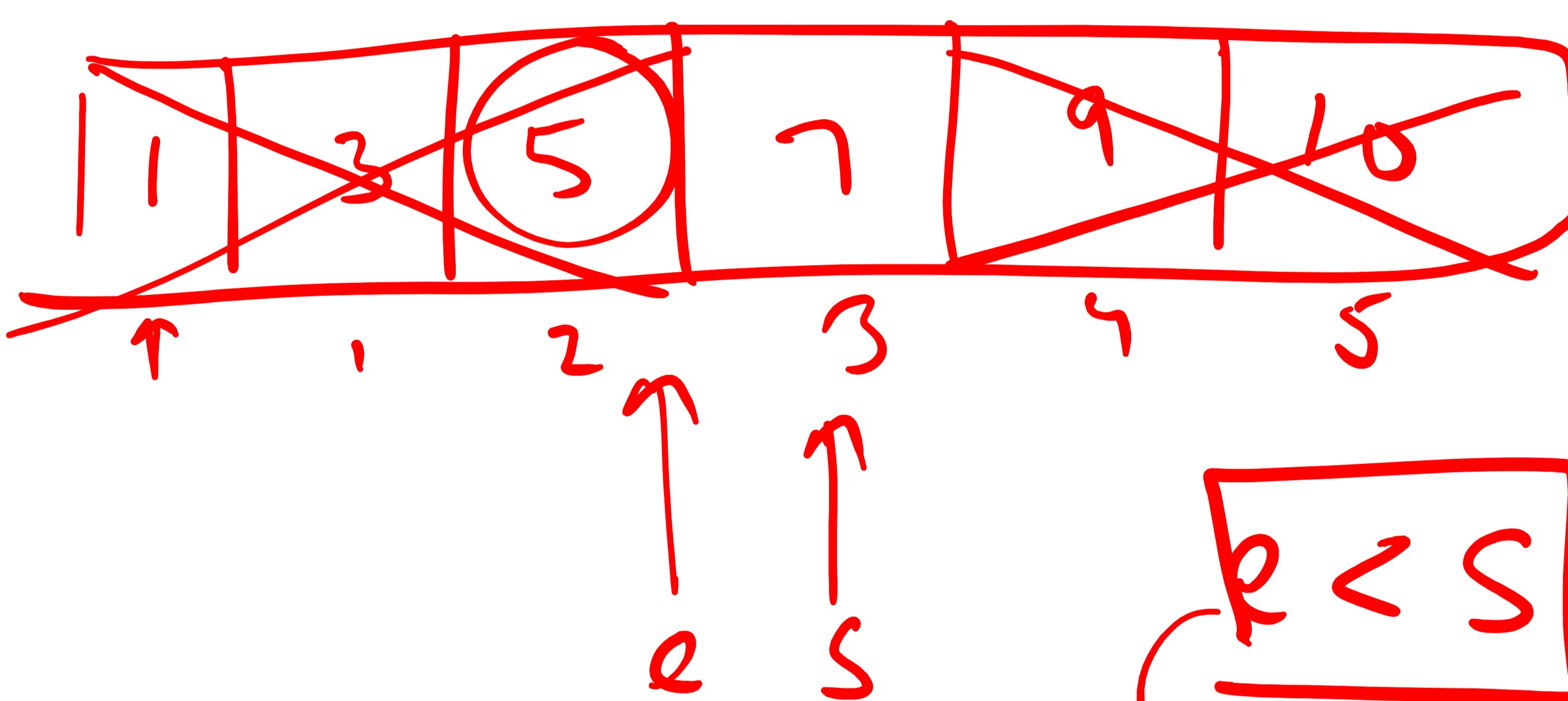
$$e = m - 1$$

③  $a[m] < \text{key}$

$$s = m + 1$$



6



$$s = 0$$

$$e = n - 1$$

$$e < s$$

Break

Not found

while ( $s \leq e$ ) {

$$m = \frac{(s+e)}{2}$$

if

$\equiv$

the if >

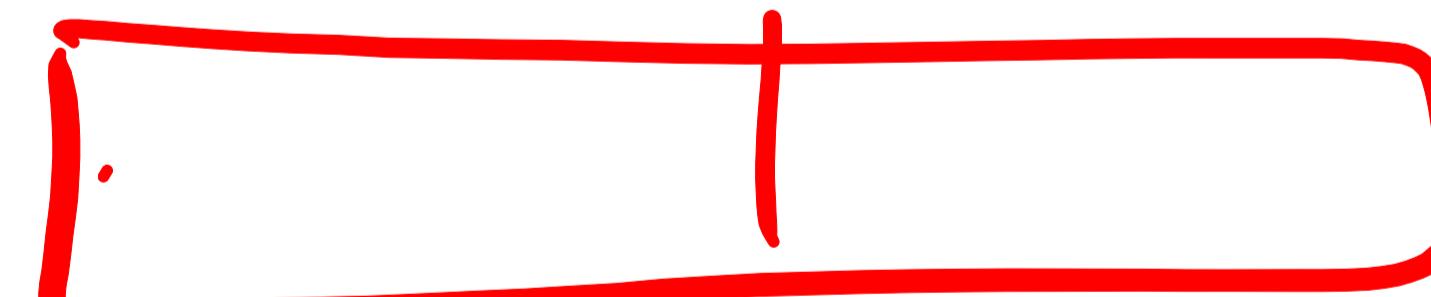
else <

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

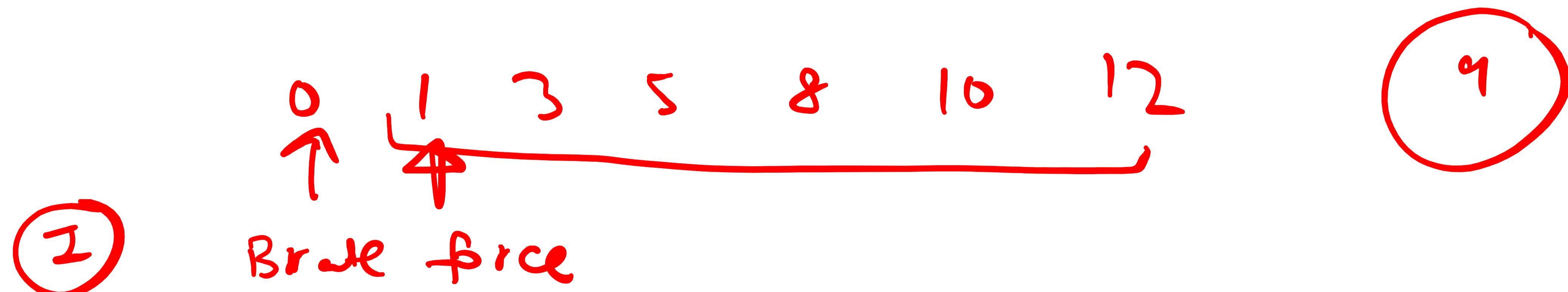
$$\Rightarrow n = 2^k$$

$$\Rightarrow \log_2 N = k$$

}



Pair that sum  $x$ .



(II)

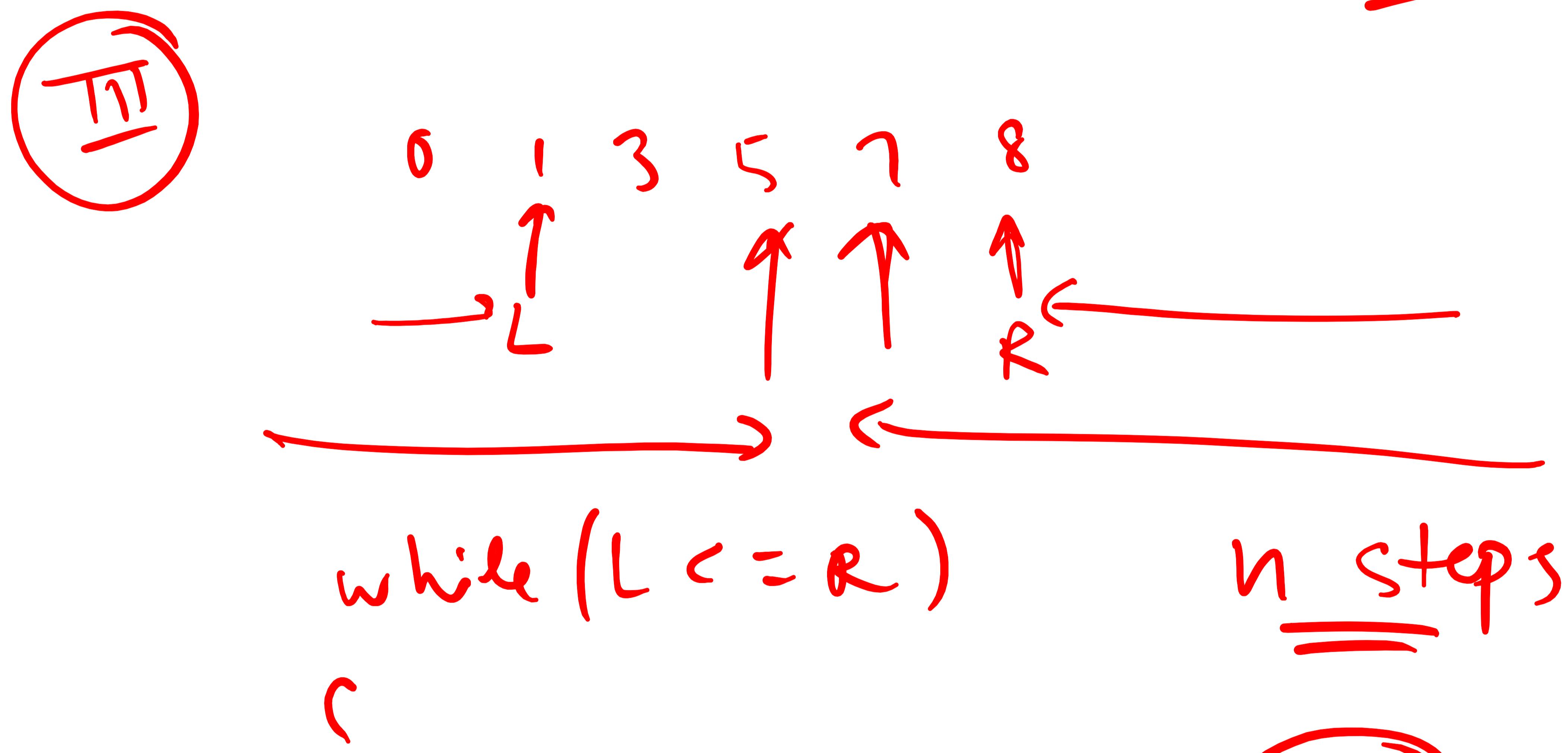
```
for(i=0...n-1)
    Key = 9 - a[i];
    BS(Key)
```

$\approx n^2 = 10^6$

$\approx n \log N$

$= 10^3 \cdot 10$

$= \underline{\underline{10^4}}$



n

Triplets

(I)

$n^3$

(II)

$n^2 \log n$

(III)

$n \cdot n = n^2$

$T - a[i]$

$x, y$

`for (i = 0 . . . n - 1)`

$$\text{Remaining} = \frac{15 - a(i)}{\underbrace{n}_{\text{Pars}}}$$

s

1 2 3 4 5 6 7



~~cout < &x;~~

~~int a[10];~~

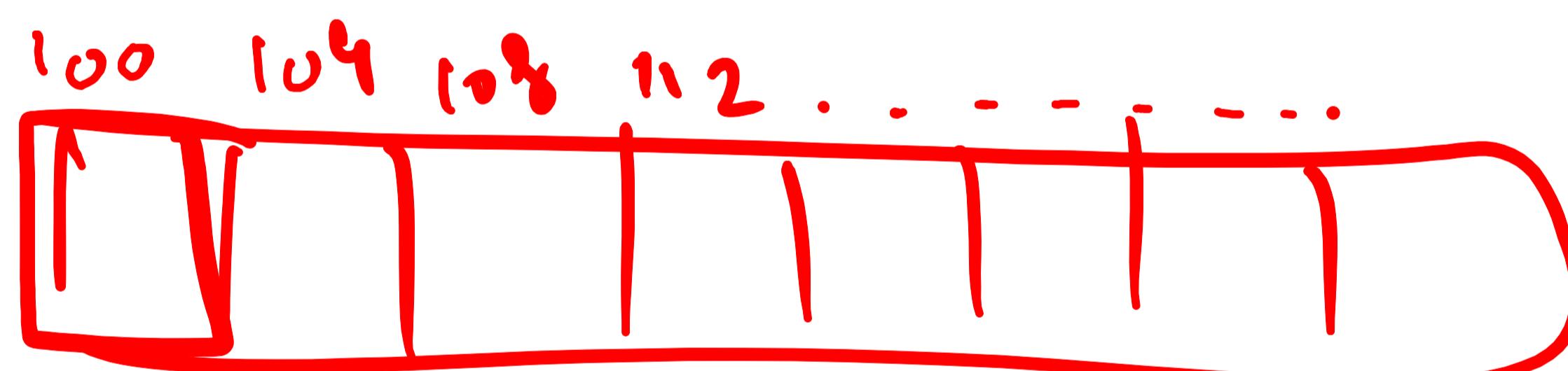
64 bit address

64 bits

Pointer

int \*ptr ;

ptr = &x;

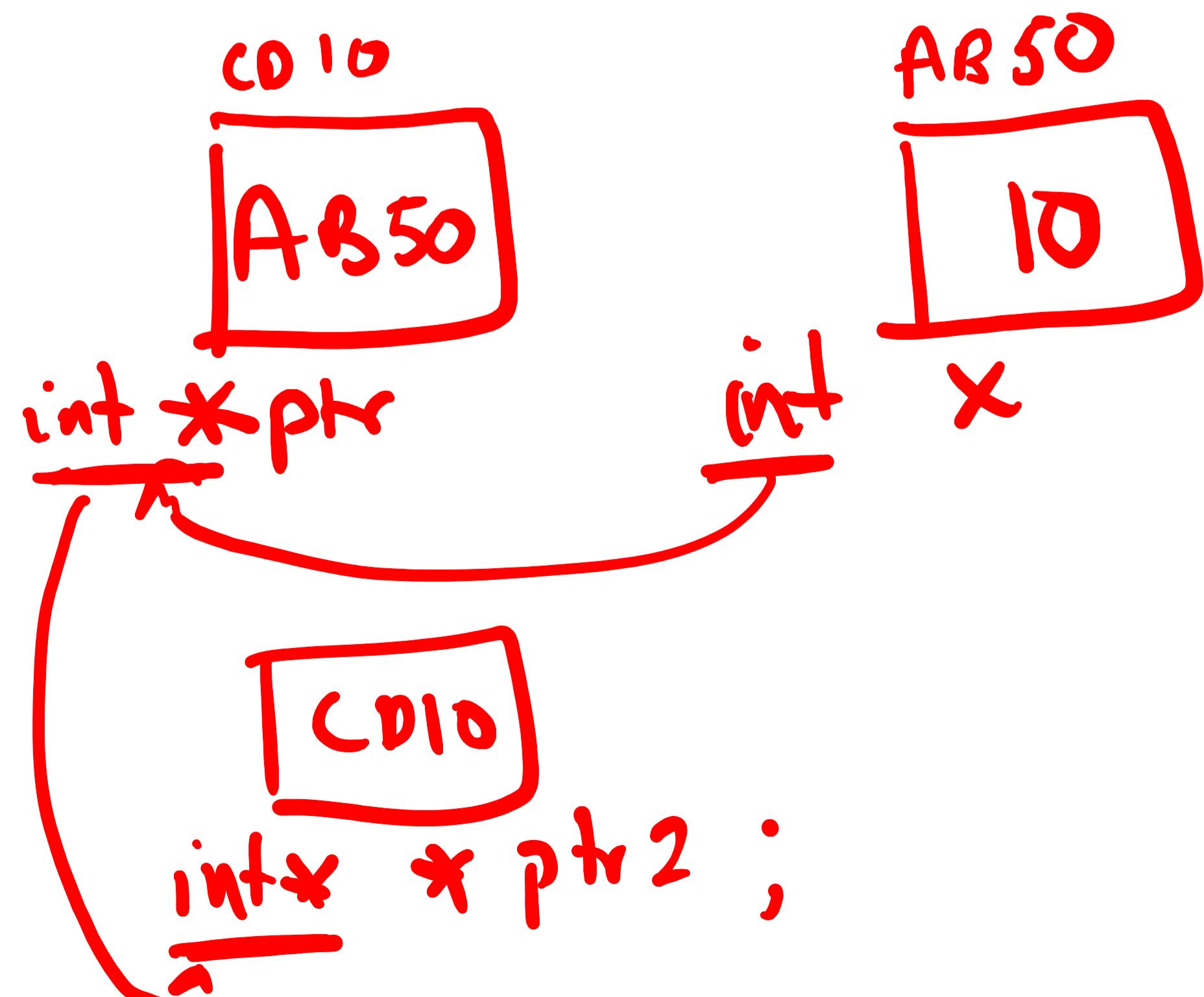


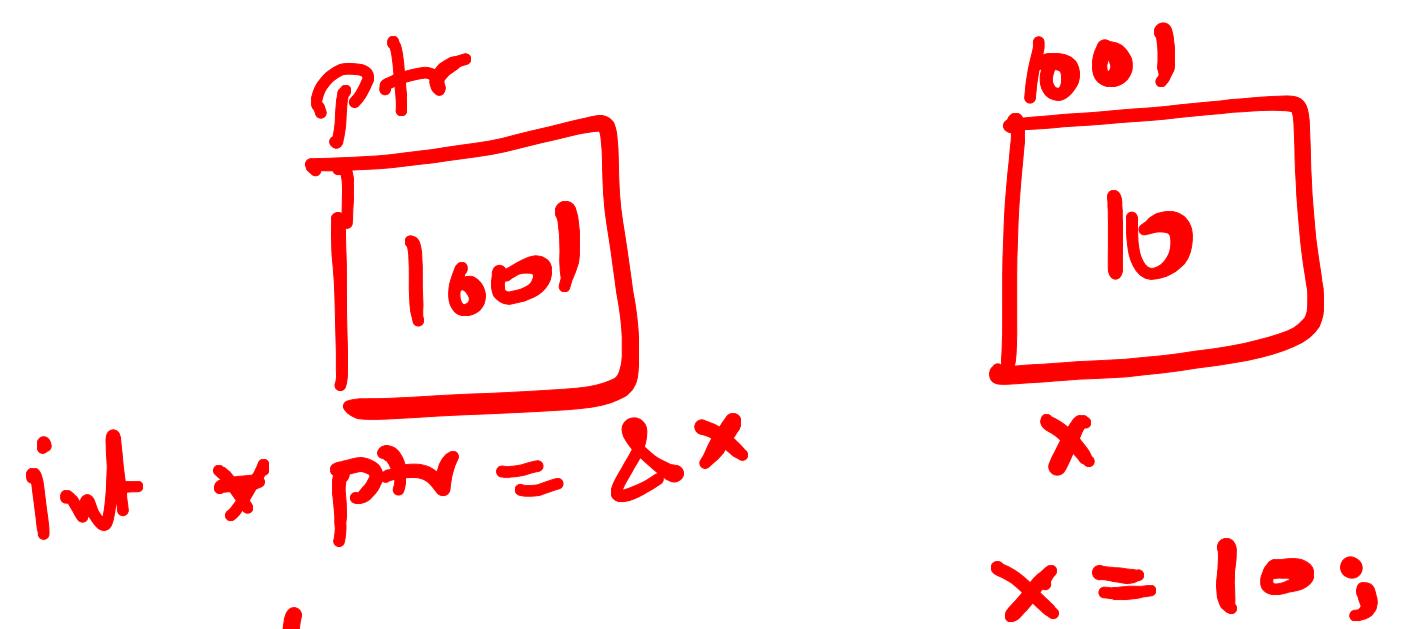
~~cout < a; = 100~~

~~cout < &a; = 100~~

~~cout < &a[0]; = 100~~

int x = 10 ;



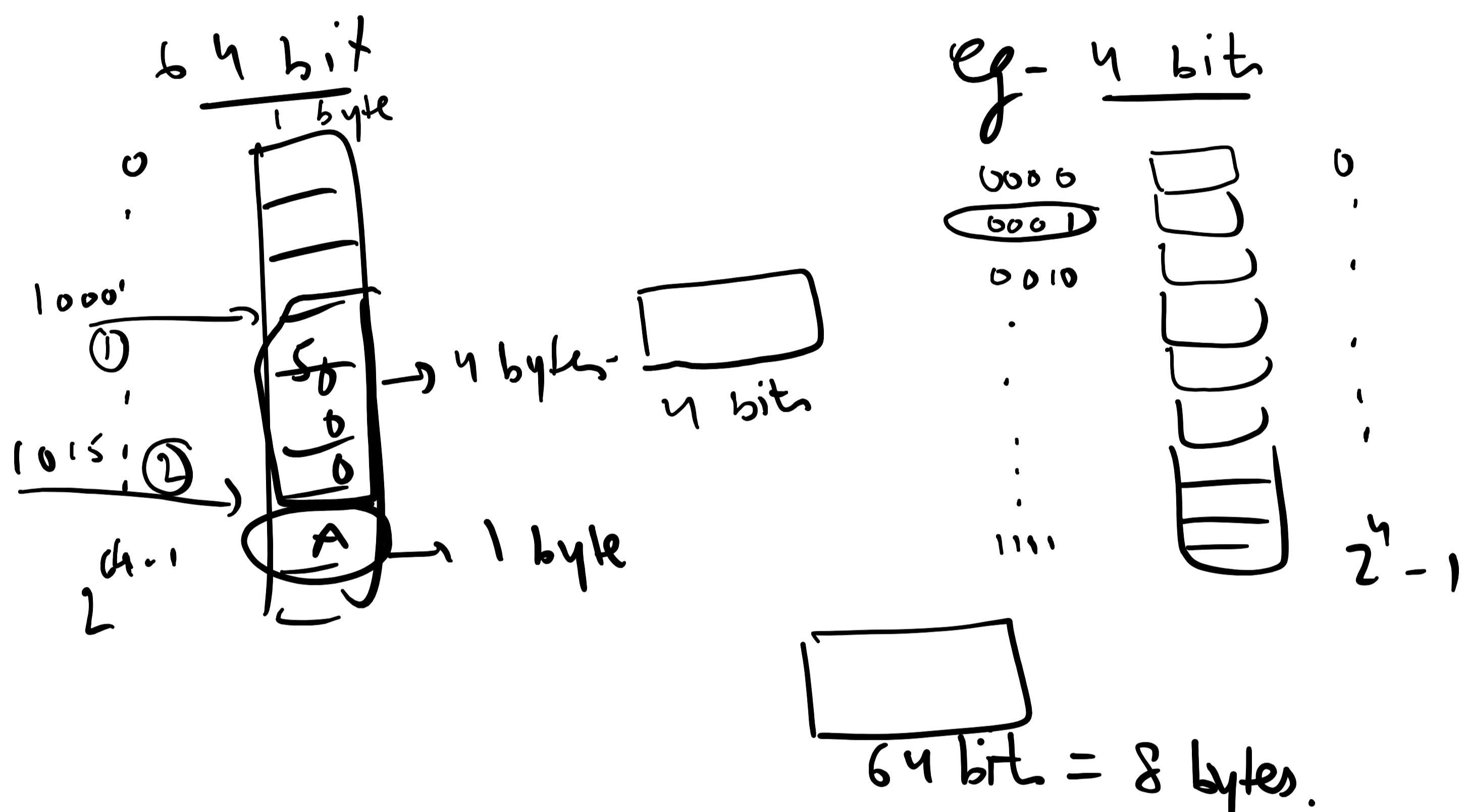
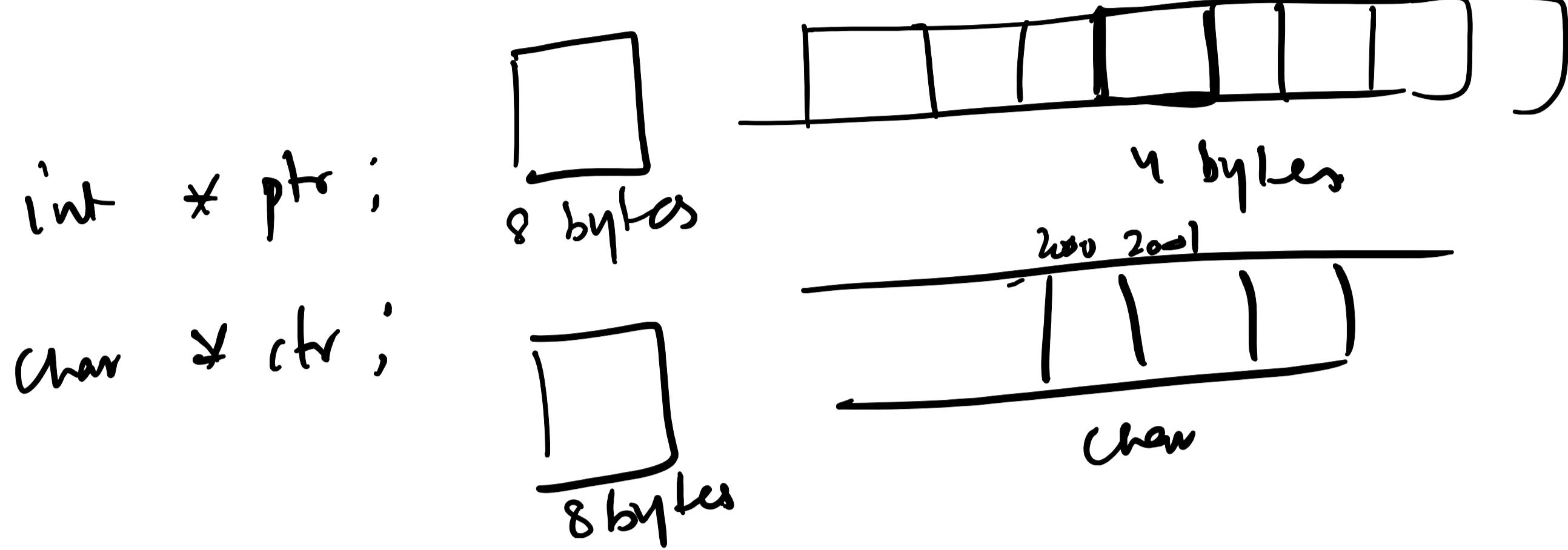


`cout << x;`      `10`  
`cout << &x;`      `1001`

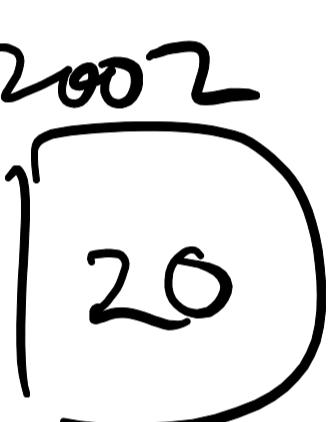
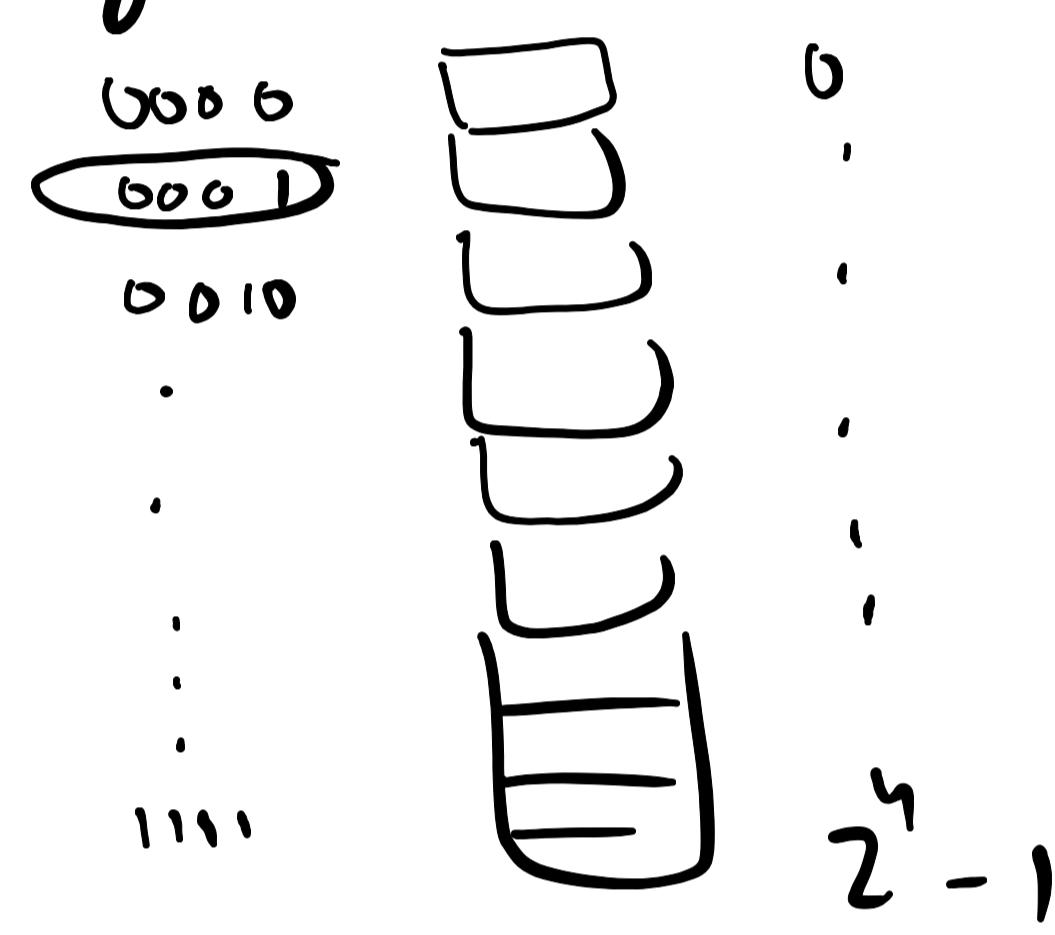
~~`cout << *(&x);`      `10`~~

`cout << ptr;`      `1001`  
`cout << *ptr;`      `10`

& Bucket = Address  
\* Address = Value at that address



eg - 4 bits



$y = 2_0;$

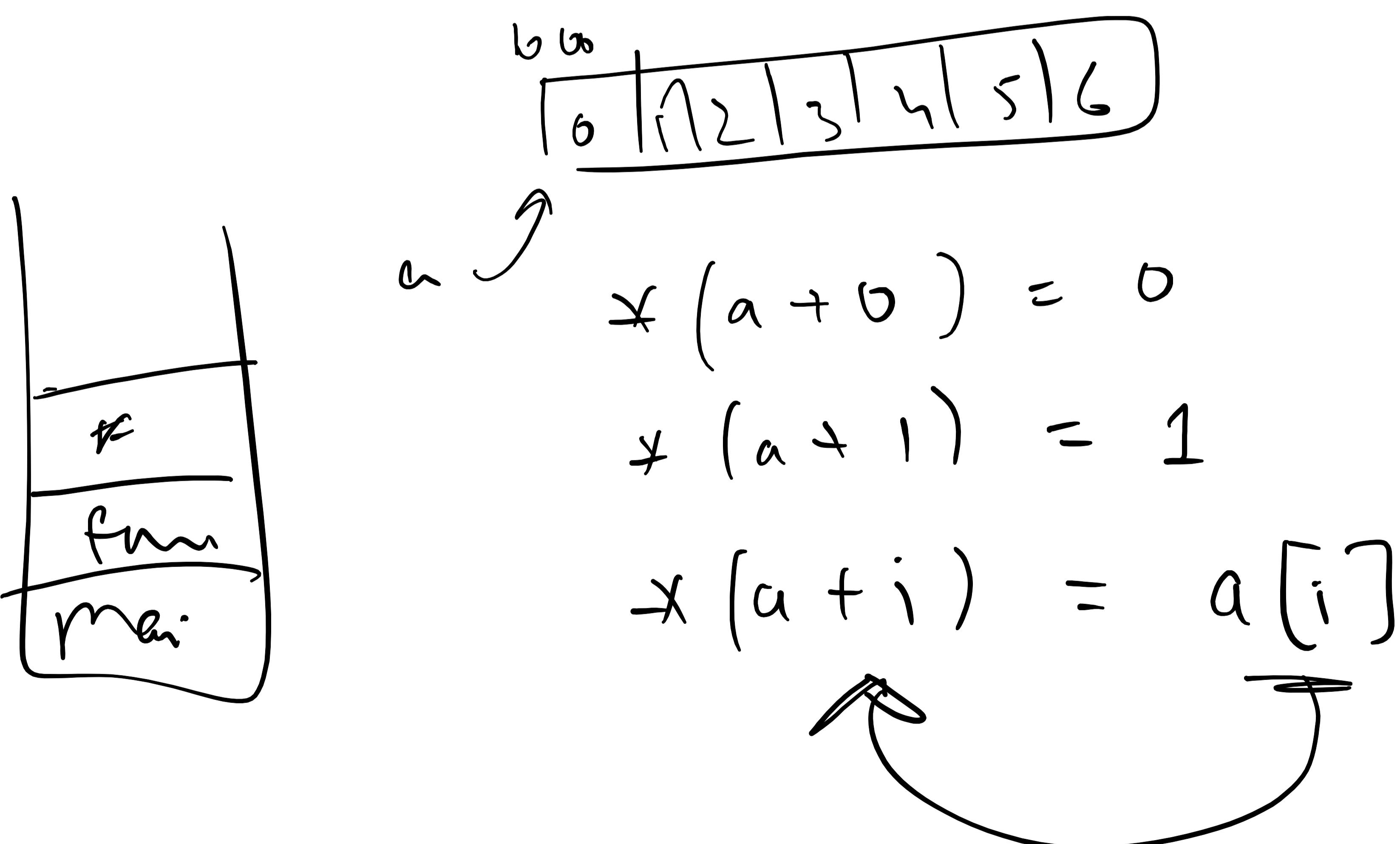
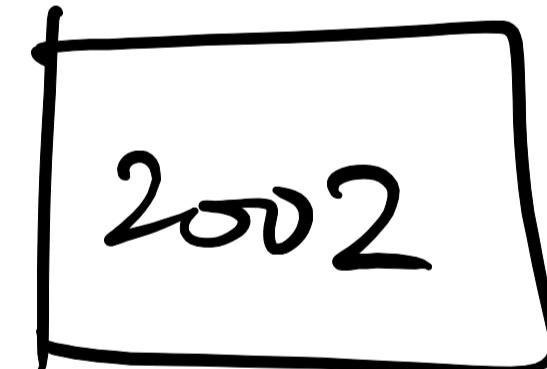
`int * ptr1`      `1000`  
`char * ptr2`      `1015`

`ptr1 = &x`

`ptr1 = &y;`

`cout << *ptr1;`      `// 5600`

`cout << *ptr2;`      `// A`



$$\star (\alpha + 0) = 0$$

$$\star (\alpha + 1) = 1$$

$$\star (\alpha + i) = a[i]$$

# PRIME VISITS

$$T \leq 10^3$$

$a \dots b \leq 10^6$

$b = 10^6$

```
while (T) {
    cin >> a >> b;
    for (i=a; i<=b; i++)
```

if (i is Prime)

count++;

$T = T - 1$

for (loop)

$$T \cdot (a-b) \cdot \sqrt{N}$$

$$10^3 \cdot 10^6 \cdot \sqrt{N}$$

$$= 10^3 \cdot 10^6 \cdot \sqrt{10^4}$$

$$\approx 10^{11-12} \text{ computations}$$

$$10^3 \cdot 10^6 \cdot \sqrt{10^4}$$

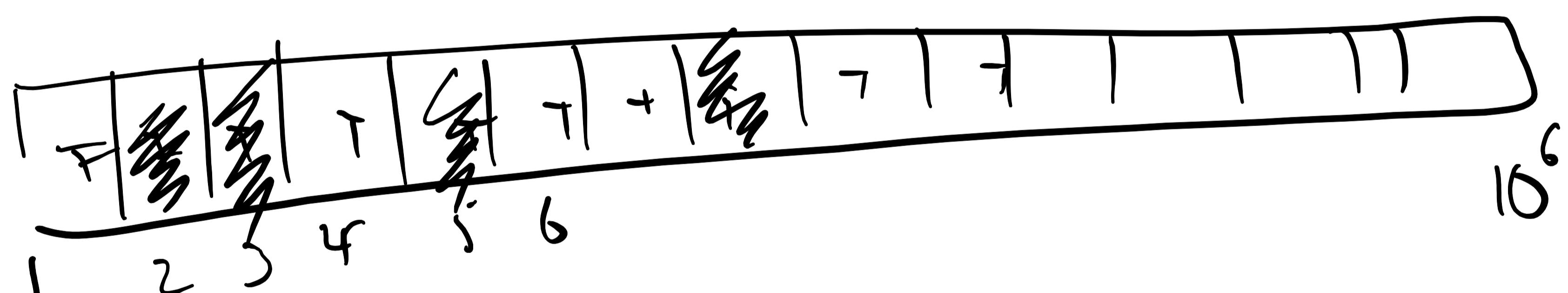
$$= 10^{11-12}$$

$$1S = 10^8 \text{ computations}$$

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

2 3 5 7 11 13 17 19 23 29 31 37 41 43 47 53 59

50 51 52 53 54 55 56 57 58 59 60



$$= 10^6 \cdot \sqrt{N}$$

$$= 10^6 \cdot \sqrt{10^4}$$

$$\approx 10^8$$

$$+ 4 \times 10^6 \text{ bytes}$$

$$T \cdot (b-a)$$

$$10^3 \cdot (10^5)$$

$$\approx 10^8$$

$$2 \times 10^8 \checkmark$$

256 MB

while ( $T--$ ) {

cin >> a >> b;

for (a = b)

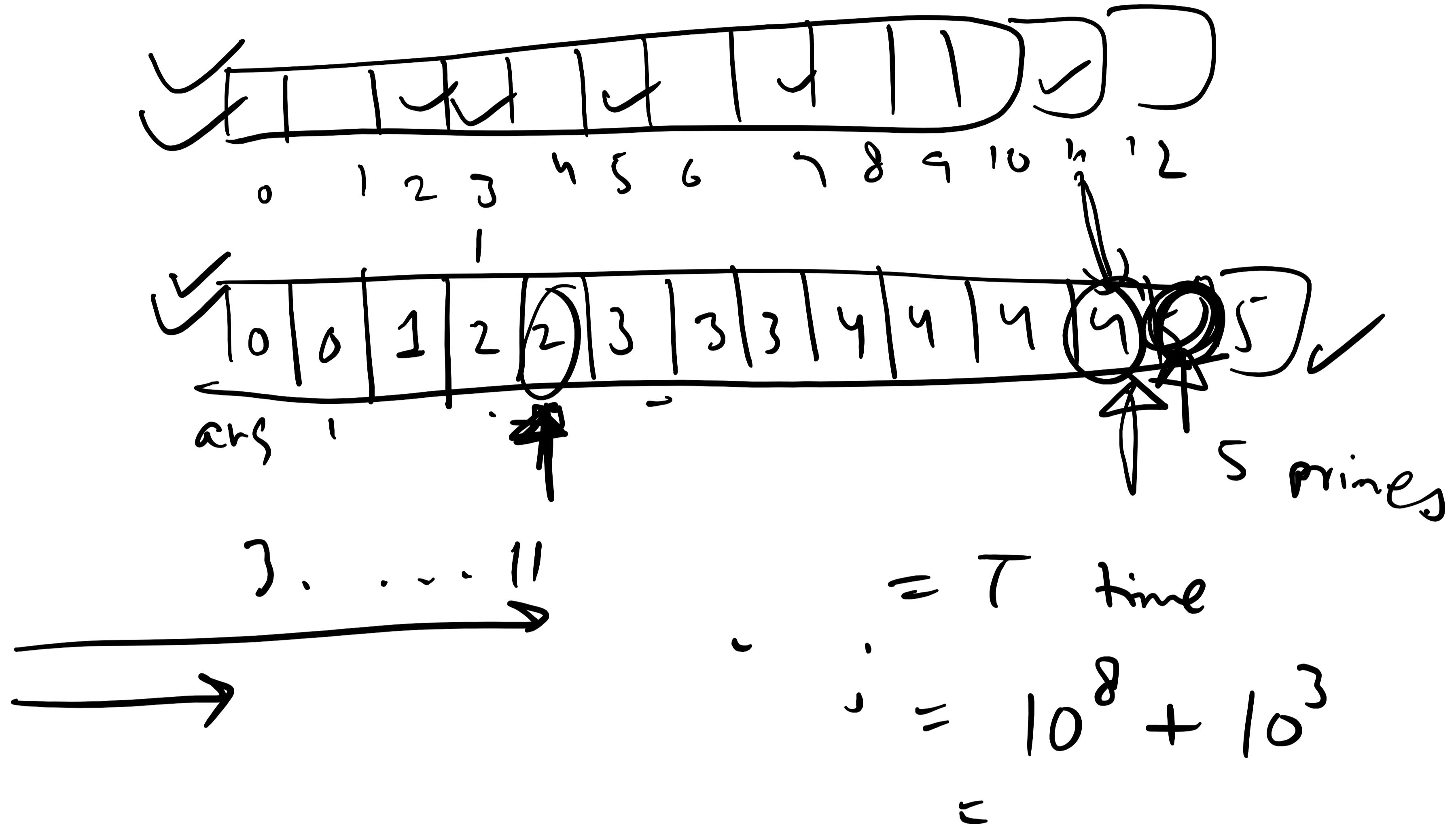
if (a[i] == true)

count++;

}

$$\begin{aligned}
 & T(b-a) \cdot \sqrt{N} \\
 & = 10^3 \cdot 10^5 \cdot 10^2 \\
 & = 10^{10} \\
 & 10^{\frac{1}{2} \sqrt{N}} + T(b-a) \\
 & = 2 \times 10^8
 \end{aligned}$$

1000 times  
faster



int  $a$   
deg 18

char  $a[10^5]$ ;  
char  $b[10^5]$ ;

101110101

1001111

$\text{cin} \rightarrow a \rightarrow b$  :

a b c  
101110101 '0' '0'

for ( $i=0; a[i] != '0'; i++$ )  
     $\checkmark$   
         $\nearrow$







