FIND ALL PRIME NOS TILL $N = 19$

Prime[]

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
		T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T

FIND ALL PRIME NOS TILL $N = 19$

Prime[]

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
		T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T

$(N+1)$

Prime $\Rightarrow 2$

FIND ALL PRIME NOS TILL (N = 19)

Prime[ ]

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
		T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T

(N+1)

Prime ⇒ 2,

FIND ALL PRIME NOS TILL (N = 19)

Prime[ ]

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
		T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T

(N+1)

Prime ⇒ 2, 3

FIND ALL PRIME NOS TILL $N = 19$

Prime[]

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

$(N+1)$

$\leq \dfrac{N}{2}$

19

$\dfrac{19}{2} = 9.5$
$= 9$

Prime $\Rightarrow$ 2, 3, 5, 7, 11

FIND ALL PRIME NOS TILL $N = 19$

Prime[]

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

$(N+1)$

$\leq \dfrac{N}{2}$

19

$\dfrac{19}{2} = 9.5$
$= 9$

Prime $\Rightarrow$ 2, 3, 5, 7, 11, 13, 17, 19

```
for ( int i = 2 ; i ≤ N/2 ;  i++)
{
    if ( prime [i] == true)
    {
        // make all multiples false
        for (int j = 2 * i ; j ≤ N ; j = j + i)
            prime [j] = false ;
    }
}
```

2 optimizations :-

① $X \cdot Y \implies N$

$\leq \sqrt{N}$ $\geq \sqrt{N}$

② Elements needs to be marked from i^2.

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

⑭   ⑮   ⑯   17   ⑱   19   ⑳   ㉑   ㉒   23   ㉔   25   ㉖

```
for ( int i = 2 ;  i ≤ N/2 ;  i++)
{
    if ( prime [i] == true)
    {
        // make all multiples false
        for ( int j = 2 * i ; j ≤ N ; j = j+i)
            prime [j] = false ;
    }
}
```

sqrt(N)

N
≤ √N

2 optimizations :-

①
$$X \cdot Y \implies N$$

≤ √N   ≥ √N

② Elements needs to be marked from i^2.

2 3 ④ 5 ⑥ 7 ⑧ ⑨ ⑩ 11 ⑫ 13
⑭ ⑮ ⑯ 17 ⑱ 19 ㉑ ㉒ 23 ㉔ 25 ㉖

```
for ( int  i = 2 ;  i ≤ N/2 ;  i++)            sqrt(N)
{
    if ( prime [i] == true)
    {
        // make all multiples false
        for (int j = 2*i; j ≤ N; j=j+i)
            prime [j] = false;
    }
}
```

$\leq \sqrt{N}$

prime No
i →
2*i → N
3 i
4 i

```
for ( int  i = 2 ;  i ≤ N/2 ;  i++)            sqrt(N)
{
    if ( prime [i] == true)
    {
        // make all multiples false
        for (int j = 2*i; j ≤ N; j=j+i)
            prime [j] = false;
    }
}
```
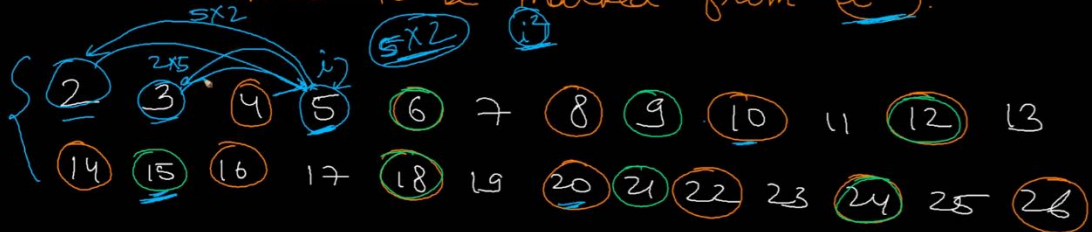
$\leq \sqrt{N}$

i*i i^2 prime No
i →
2*i → N
3 i
4 i

2 optimization :-

① $X \cdot Y \implies \boxed{N}$

$\le \sqrt{N}$ $\ge \sqrt{N}$

② Elements needs to be marked from $\boxed{i^2}$.

$\{$ ② ③ ④ ⑤ ⑥ 7 ⑧ ⑨ ⑩ 11 ⑫ 13

⑭ ⑮ ⑯ 17 ⑱ 19 ⑳ ㉑ ㉒ 23 ㉔ 25 ㉖

optimized Code

```
for( int i = 2; i ≤ sqrt(N); i++)
{
    if ( prime [i] == true)
    {
        for( int j = i*i ; j<N ; j =j+i)
            prime [j] = false;
    }
}
```

TIME COMPLEXITY

$P \Rightarrow$ Highest Prime No. $< N$

$$\left\{ \frac{N}{2} + \frac{N}{3} + \frac{N}{5} + \frac{N}{7} + \cdots + \frac{N}{P} \right.$$

$$= N \left(\frac{1}{2} + \frac{1}{3} + \frac{1}{5} + \frac{1}{7} + \cdots \frac{1}{P} \right)$$

$$= N \log \log N$$

HP of Sum of Primes