Sieve Of Eratosthenes

1. Given an Integer 'n'.
2. Print all primes from 2 to 'n'.
3. Portal is not forced you, but try to submit the problem in less than n.root(n) complexity.

36

1 x 36

2 x 18

3 x 12

4 x 9

~~6 x 6~~

9 x 4

12 x 3

18 x 2

36 x 1

24

1 x 24

2 x 12

3 x 8

4 x 6

6 x 4

8 x 3

12 x 2

24 x 1

T : $n\sqrt{n}$

S : O(1)

```
for( int num = 2 ; num <= n ; num++) {
    for( int div = 2 ; div * div <= num ; div++) {
        if( num % div == 0) -> not prime
    }
}
```

Sieve of Eratosthenes

n = 34

① · create an arr of n+1 size, mark initially : T

0 - ~~T~~ F

1 - ~~T~~ F

✓ 2 - T

✓ 3 - T

4 - ~~T~~ F

✓ 5 - T

6 - ~~T~~ F

7 - T

8 - ~~T~~ F

9 - ~~T~~ F

10 - ~~T~~ F

11 - T

12 - ~~T~~ F

13 - T

14 - ~~T~~ F

15 - ~~T~~ F

16 - ~~T~~ F

17 - T

18 - ~~T~~ F

19 - T

20 - ~~T~~ F

21 - ~~T~~ F

22 - ~~T~~ F

23 - T

24 - ~~T~~ F

25 - ~~T~~ F

26 - ~~T~~ F

27 - ~~T~~ F

28 - ~~T~~ F

29 - T

30 - ~~T~~ F

31 - T

32 - ~~T~~ F

33 - ~~T~~ F

34 - ~~T~~ F

K = ~~2~~

~~3~~

~~4~~

~~5~~

~~6~~

7

k → 2 to $\sqrt{n}$

primes

(2, 3, ~~4~~, 5)

```java
for(int k = 2; k * k <= n;k++) {
    if(arr[k] == true) {
        for(int i = 2*k; i <= n; i += k) {
            arr[i] = false;
        }
    }
}
```

```java
for(int i = 2; i <= n;i++) {
    if(arr[i] == true) {
        System.out.print(i + " ");
    }
}
```

$2 \longrightarrow \frac{n}{2}$

$3 \longrightarrow \frac{n}{3}$

$\vdots$

$\sqrt{n} \longrightarrow \frac{n}{\sqrt{n}}$

$$T(n) = \frac{n}{2} + \frac{n}{3} \cdots + \cdots \frac{n}{\sqrt{n}}$$

$$= n\left[\frac{1}{2} + \frac{1}{3} + \cdots \frac{1}{\sqrt{n}}\right]$$

$$= n * \log(\log(n))$$

↳ approx constant

T: n

S: $O(n)$

Segmented Sieve

Easy

Prev Next

1. Generate all primes between 'a' and 'b'(both are included).
2. Print every number in new line.
3. Allowed time Complexity : O(nlog(log n)), where n = b - a.
4. Allowed Space Complexity : O(n), where n = b -a;

Note : Please focus on constraints.

1. 1 <= a <= b <= 10^9
2. b - a <= 10^5

a to b

$a = 9 \times 10^5$ $b = 10^6$

$n = 10^6 - 9 \times 10^5 = 10^5 (10-9) = 10^5$

array : upto 10^5

a = 22 b = 51 gap = 51 - 22 + 1 = 30

0 (22) → ~~T~~ F

1 (23) → T

2 (24) → ~~T~~ F

3 (25) → ~~T~~ F

4 (26) → ~~T~~ F

5 (27) → ~~T~~ F

6 (28) → ~~T~~ F

7 (29) → T

8 (30) → ~~T~~ F

9 (31) → T

10 (32) → ~~T~~ F

11 (33) → ~~T~~ F

12 (34) → ~~T~~ F

13 (35) → ~~T~~ F

14 (36) → ~~T~~ F

15 (37) → T

16 (38) → ~~T~~ F

17 (39) → ~~T~~ F

18 (40) → ~~T~~ F

19 (41) → T

20 (42) → ~~T~~ F

21 (43) → T

22 (44) → ~~T~~ F

23 (45) → ~~T~~ F

24 (46) → ~~T~~ F

25 (47) → T

26 (48) → ~~T~~ F

27 (49) → ~~T~~ F

28 (50) → ~~T~~ F

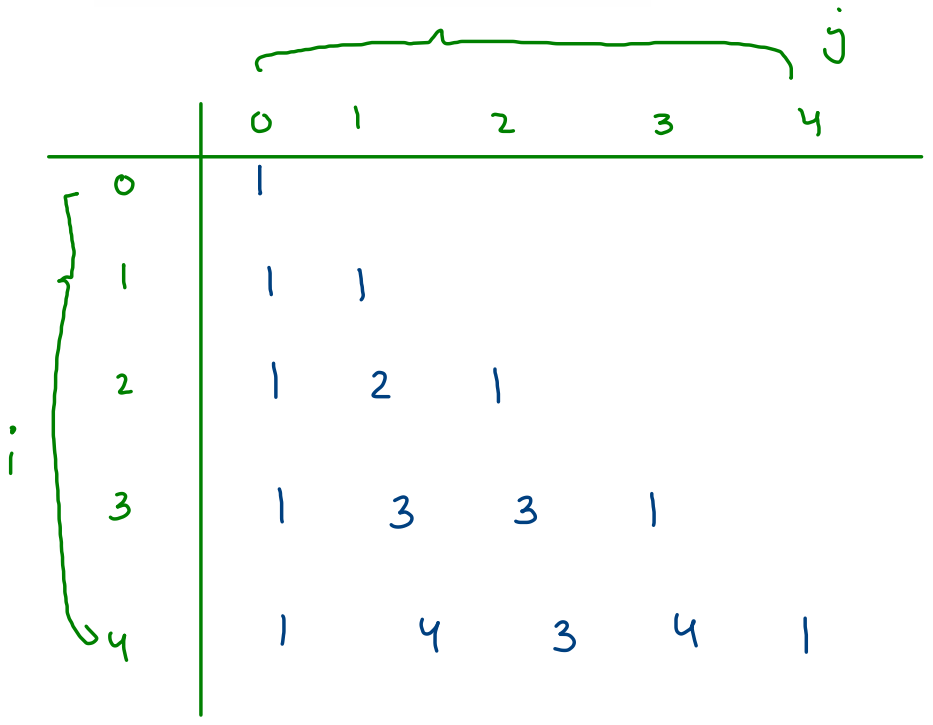
29 (51) → ~~T~~ F

2 to $\sqrt{6}$: 2, 3, 5, 7

primes

K = ~~2 3 5~~ 7

119. Pascal's Triangle II



$i C j$

$i_{C_0} \rightarrow i_{C_1} \rightarrow i_{C_2} \ldots\ldots$

n_{C_r} $n_{C_{r+1}}$

relation