Sieve Of Eratosthenes

2 to n → print all prime

n = 39

size = n+1 → boolean

2, 3, ~~4~~, 5, ~~6~~

temp = ~~2~~ ~~3~~ ~~4~~ ~~5~~ 6

0		10	✗	20	✗	30	✗
1		11	✓	21	✗	31	✓
2	✓	12	✗	22	✗	32	✗
3	✓	13	✓	23	✓	33	✗
4	✗	14	✗	24	✗	34	✗
5	✓	15	✗	25	✗	35	✗
6	✗	16	✗	26	✗	36	✗
7	✓	17	✓	27	✗	37	✓
8	✗	18	✗	28	✗	38	✗
9	✗	19	✓	29	✓	39	✗

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

temp = 2 $\quad \frac{n}{2}$

temp = 3 $\quad \frac{n}{3}$

temp = 4 $\quad$ X

⋮

temp = $\sqrt{n}$ $\quad \frac{n}{\sqrt{n}}$

$$T = \frac{n}{2} + \frac{n}{3} + \frac{n}{5} \cdots\cdots \frac{n}{\sqrt{n}}$$

$$T = n \left[\underbrace{\frac{1}{2} + \frac{1}{3} + \frac{1}{5} + \cdots + \frac{1}{\sqrt{n}}}_{\log(\log(n))} \right]$$

$$T = n * \underbrace{\log_2(\log_2(n))}$$

$$T \approx O(n)$$

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

↓

2, 3, 5

a = 21   b = 37

n = 37 - 21 + 1 (total no.)
= 17

0	(21)	✗	9	(30)	✗
1	(22)	✗	10	(31)	✓
2	(23)	✓	11	(32)	✗
3	(24)	✗	12	(33)	✗
4	(25)	✗	13	(34)	✗
5	(26)	✗	14	(35)	✗
6	(27)	✗	15	(36)	✗
7	(28)	✗	16	(37)	✓
8	(29)	✓			

$a = 19$ $\quad b = 31$ $\quad n = 31 - 19 + 1 = 13$

0	(19)	✓
1	(20)	X
2	(21)	X
3	(22)	X
4	(23)	✓
5	(24)	X
6	(25)	X
7	(26)	X
8	(27)	X
9	(28)	X
10	(29)	✓
11	(30)	X
12	(31)	✓

↓

temp = 2, 3, 5

smt

$\left\lceil \frac{19}{2} \right\rceil * 2 \Rightarrow 20$

$\boxed{idx = smt - a}$

$\left\lceil \frac{19}{3} \right\rceil * 3 \Rightarrow 21$

$\left\lceil \frac{19}{5} \right\rceil * 5 \Rightarrow 20$

119. Pascal's Triangle II

$$^{n}C_{r+1} = \frac{^{n}C_{r} * (n-r)}{r+1}$$

	0	1	2	3	4
0	1				
1	1	1			
2	1	2	1		
3	1	3	3	1	
4	1	4	6	4	1

i, j

row = 3

$^{i}C_{j}$ val at i, j

$^{3}C_{0} = 1$

$^{3}C_{1} = 1 * \frac{3}{1} = 3$ $\quad n = 3,\ r = 0$

$^{3}C_{2} = 3 * \frac{2}{2} = 3$ $\quad n = 3,\ r = 1$

$^{3}C_{3} = 3 * \frac{1}{3} = 1$ $\quad n = 3,\ r = 2$

relation b/w ${}^nC_r$ & ${}^nC_{r+1}$.

$${}^nC_r = \frac{n!}{(n-r)!\,r!} \qquad {}^nC_{r+1} = \frac{n!}{(n-r-1)!\,(r+1)!}$$

$$\frac{{}^nC_r}{{}^nC_{r+1}} = \frac{\cancel{n!}}{(n-r)!\,r!} \times \frac{(n-r-1)!\,(r+1)!}{\cancel{n!}}$$

$$\frac{{}^nC_r}{{}^nC_{r+1}} = \frac{\cancel{(n-r-1)!}\,(r+1)\,\cancel{r!}}{(n-r)\,\cancel{(n-r-1)!}\,\cancel{r!}} \qquad \frac{{}^nC_r}{{}^nC_{r+1}} = \frac{r+1}{n-r}$$

$$\boxed{{}^nC_{r+1} = \frac{{}^nC_r \times (n-r)}{(r+1)}}$$