

Seive of Exoctosthenes

Prime Numbers & Thodisi Math

Lecture-37

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What is a prime number?

2 factors only -> 14 the number itself

2,3,5,7,11,13 Donly even frime

4 3 1, 2, 4 9 3 1, 3, 4



Checking if a number is Prime or Not

```
9f your number is n
      2 40 11-1
           1,2,3,4,5,6,10,12,15,20,30,60
* if 'i' is a factor of 'n' then 'n/i' is also a factor
                               1, 2, 5, 10
```

Prime -> 2 factors

Composite -> even

rumber of

factors

except perfect

squares



Checking if a number is Prime or Not

Ques: Prime in Diagonal

Very Simple

T.C. = $O(n \sqrt{n})$ or $O(n^{3/2})$





Finding factors of a number

if 'n' is divisible by 'i', it means 'i' is a factor of n

$$60 = 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60$$

Sqrt(n)









Ques: Smallest Value After Replacing With Sum of Leetcode - 254 Prime Factors

$$\Rightarrow n \Rightarrow \text{ sum of prime factors}$$

$$\Rightarrow 60 \Rightarrow 2^{2} \cdot 3^{1} \cdot 5^{1} \Rightarrow 2+2+3+5$$

$$\Rightarrow 12 \Rightarrow 2^{2} \cdot 3 \Rightarrow 2+2+3$$

4 3 2 4 2

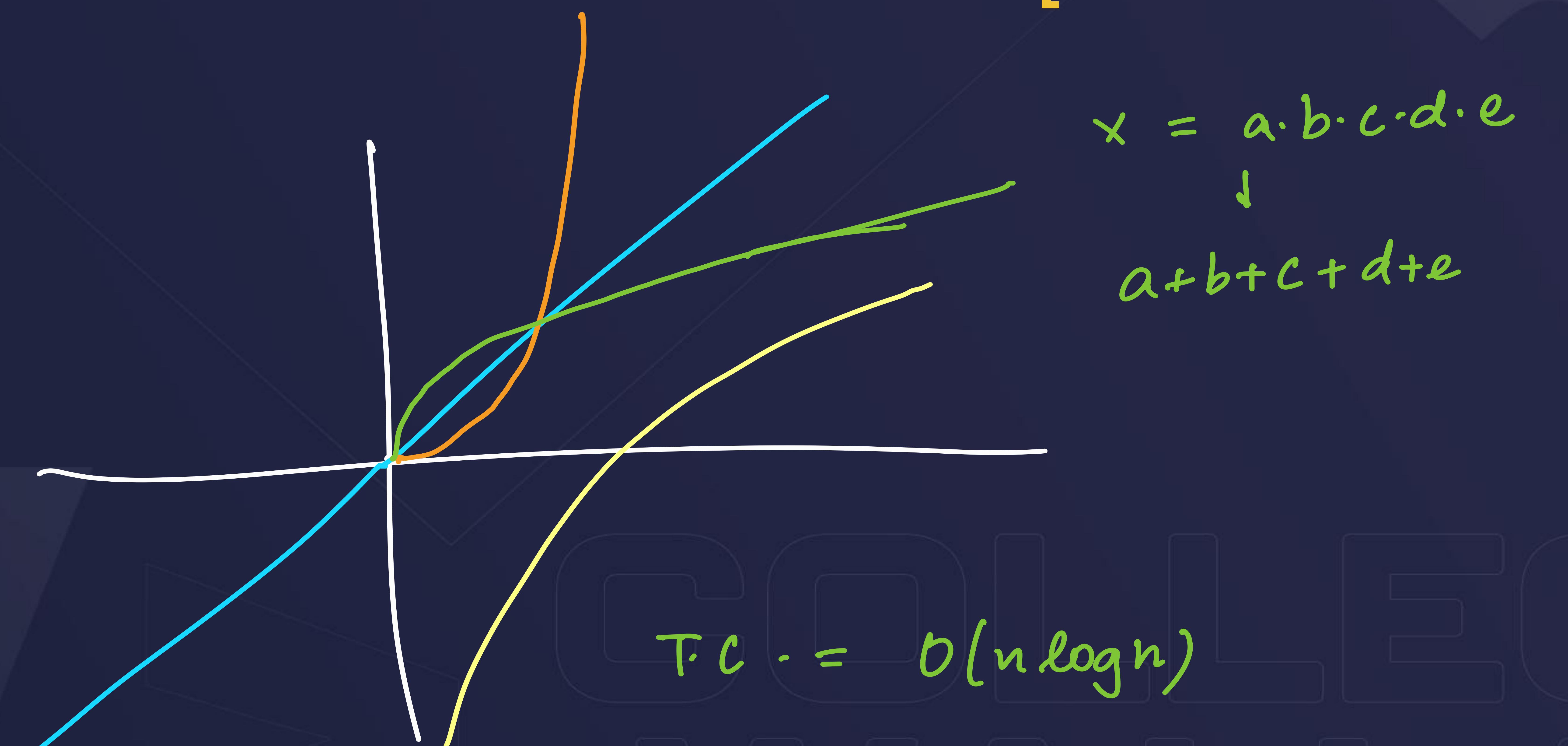
$$n = 46$$

1, 2, 23, 46

 $8 \times 9 = 42$
 $= 2^{3} \cdot 3^{2}$
 $= 1 \text{ to } n = 8$



Ques: Smallest Value After Replacing With Sum of Prime Factors [Leetcode - 204]



Ques: Count Primes

Sieve of Eratusthenesis -> Gnid $S \cdot C \cdot = O(n)$

				5	6		8			
	12							19	2-0	
2-1	2.2	2-3	24	25	26	23			30	
3	32	33	34	25	36	37	38	39	40	
	42	43	4 U	45	46		us.	44	50	
51	52	53	54	55	56	54	58	SA	60	
	62	63	64	65	66	63	68	69	40	
	7-7-	33	3-4	3-5	3-6	4-7-	3-8		2-0	
					86					
41	42	93	94	95	96	93	QB.	99	100	

n=100 [Leetcode - 204]

S.C. =
$$O(n)$$

T.C. =

for(int i=2; i = sqrtln); i++)\(\)

if(\(\arr(i) = 1 \)

\(\frac{n}{2} + \frac{n}{3} + \dots \\ \frac{1}{2} + \frac{1}{3} + \frac{n}{4} + \dots \\ \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \dots \\ \frac{1}{2} + \frac{1}{3} + \frac{1}{3} + \dots \\ \frac{1}{2} + \frac{1}{3} + \frac{1}{3} + \dots \\ \frac{1}{2} + \frac{1}{3} + \dots \\ \frac{1}{3} + \d



Time Complexity of Sieve



Time Complexity of Sieve

$$n \rightarrow 2^{32}$$

$$\sqrt{n} = 2^{16}$$

$$log_2 Jn = log_2 2^{13} = 16 log_2 2 = 16$$

$$O(n \cdot lvg(logn))$$
 $SO(n)$

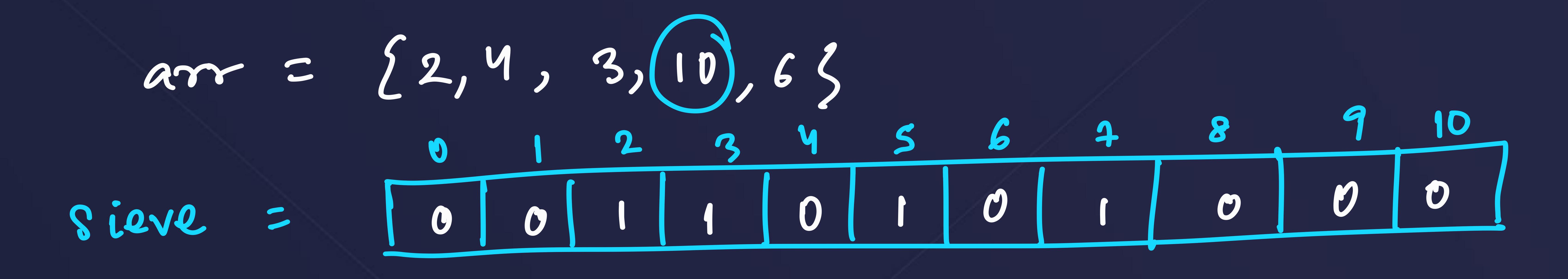


Time Complexity of Sieve

$$\Rightarrow \frac{1}{2} + \frac{1}{3} + \frac{1}{5} + \frac{1}{7} + \frac{1}{11} + \frac{1}{13} + \frac{1}{19} + \frac{1}{19} + \cdots + \frac{1}{n} \approx \log(\log n)$$



Ques: Distinct prime factors of Product of Array [Leetcode - 2521]



primes =
$$\{2, 3, 5, 7\}$$

taken = $\{0, 0, 0, 0, 0\}$

n=8	n= 12
CPCPC	CPCP



Leetcode - 650



Leetcode - 650]

· Current no. Uska highest factor dhoondo

$$20 \leftarrow 10 \rightarrow 20/10 = 20/28$$
 count = 2
 $10 \leftarrow 5 \rightarrow 10/5 \rightarrow 2 \rightarrow count = 4$
 $5 \leftarrow 1 \rightarrow 5/1 \rightarrow 5 \rightarrow count = 9$

CPPPPCPCP

CPPPPCPCP



[Leetcode - 650]

$$n = 90 = 45$$
 $90/45 = 2$
 $45/15 = 3$
 $15 = 5$
 $15/5 = 3$
 $5 = 1$
 $5/1 = 5$



while (n>1)2 -> O(log2n) ib (isPrime(n))4 -> Qsn) Count 4= 15 int hf - O(Sn)

Leetcode - 650]

$$1, 5, 13, 65$$
 $T.c. = O(sn.logn)$

Ques: Ugly Number



 $a \times b = \mathcal{H}CF(a,b) \times LCM(a,b)$

Thank you!

OOPS -> Lecture

Harsh Sir -> SDE at a MNC