Asymptotic Notation - Part I

Complete Course on Algorithm for GATE - CS & IT

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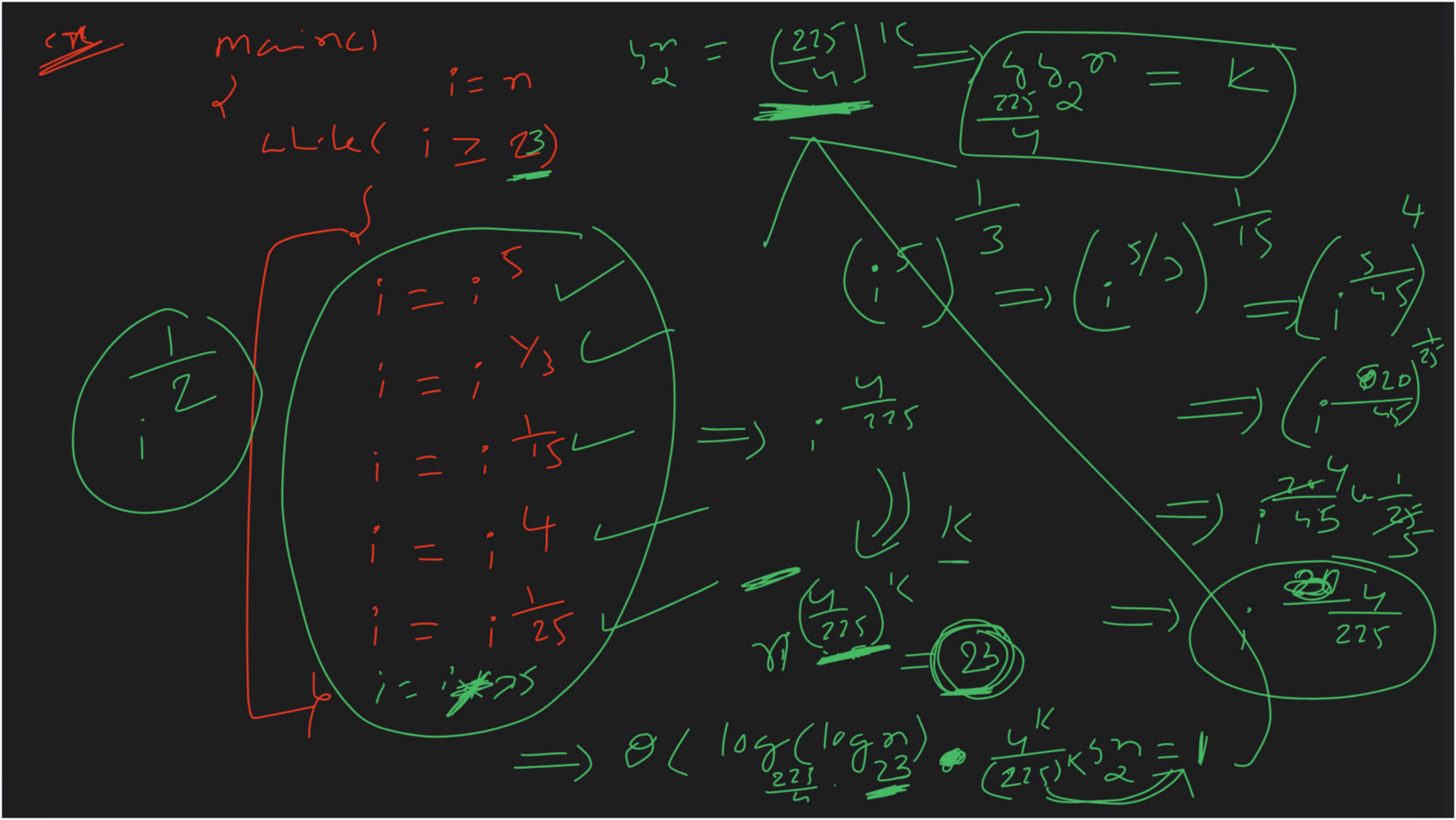

main()
i = n
while(i ≥ 23)
i = i^5
i = i^{1/3}
i = i^{1/15}
i = i^4
i = i^{1/25}
i = i*225
i^{1/2}
⇒ i^{4/225}
k
n (4/225)^k = 23
⇒ 0(log_{225/4}(log_{23} n) · 4^k/(225)^k) n/2 = 1
i^{225/4} 2^n = k
1/3
1/15
⇒ (i^{5/3})
⇒ (i^{5/15})^4
⇒ (i^{20/45})^{1/2}
⇒ i^{4/45 · 1/2}
⇒ i^{4/225}

```
main()
{
    for(K=1; K<=n; K++)
    {
        p=0, q=0
  ①     for(i=1; i<=n; i=2*i)      } log_2 n
            p++
  ②     for(j=1; j<=p; j=2*j)      } log_2 p  ==>  log_2(log_2 n)
            q++
    }
    return(q);
}                                   log_2(log_2 n)
```

K=1
p = log n
q = log log n

|1=2

① no-K

① TC: $\Theta(\log n)$

② q-value: $\Theta(\log_2(\log_2 n))$

wilt-K
wiltout retu

$\Theta(n \log n)$

$\Theta(\log(\log n))$

② with-K
with return

$\Theta(\log n)$

$\Theta(\log(\log n))$

```
Main()
{
    q = 0
    for(i=1; i<=n; i++)
    {
        p = 0
        for(j=1; j<=n; j++)  ⟹ n
            p++;

        for(k=1; k<=p; k=2*k)  ⟹ log p ⟹ log n
            q++
    }
}
```

TC: $\Theta(n^2)$

q-value: $\Theta(n \log n)$

ex

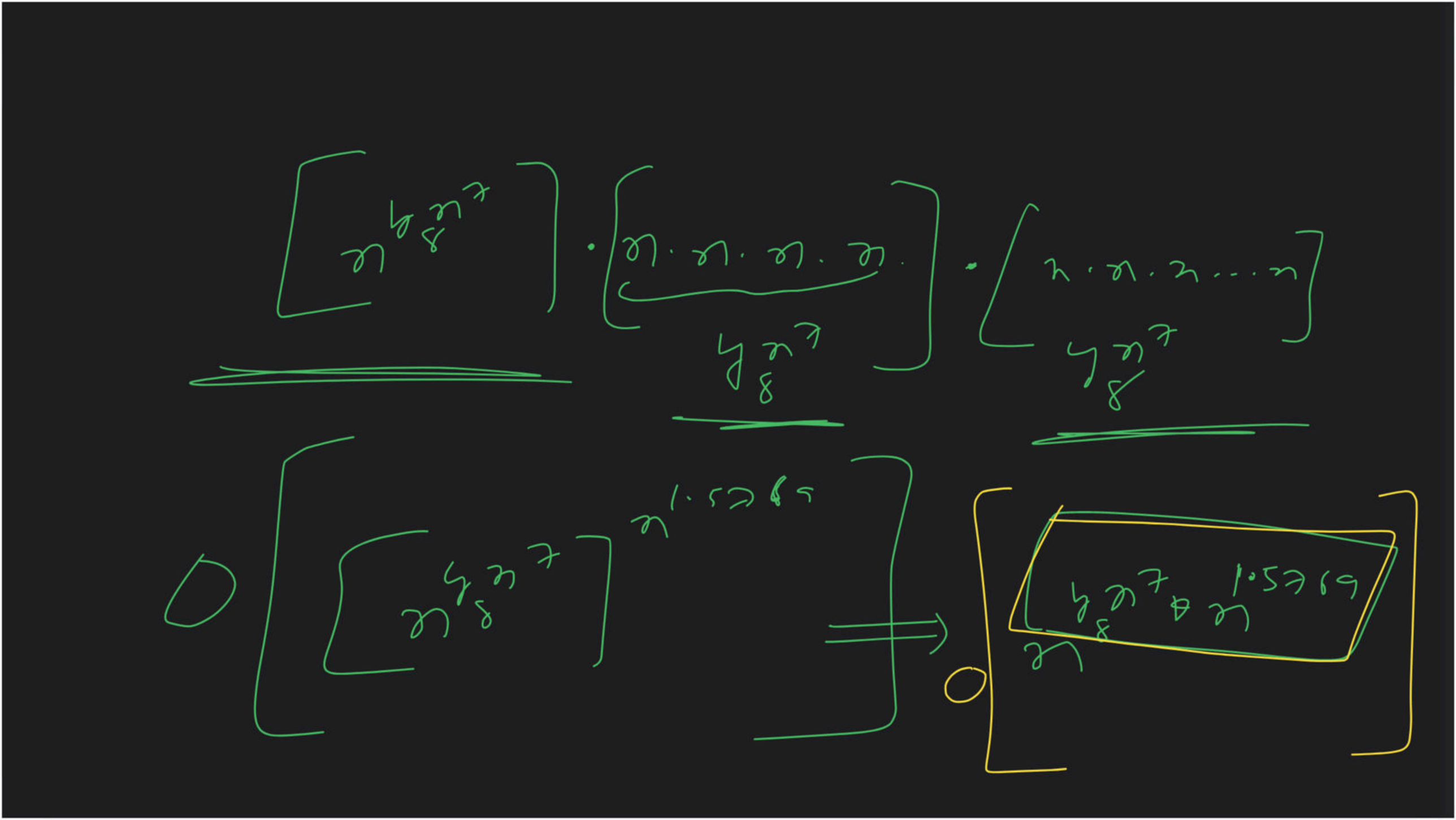
```
main()
{
    x = 0
    for(i=1; i<=n^41; i=i+1)
    {
        j = 1000
        while(j <= n^7)
        {
            j = 2*j;
            j = 4*j;
            j = j+-;
            x = x*n;
        }
    }
}
```

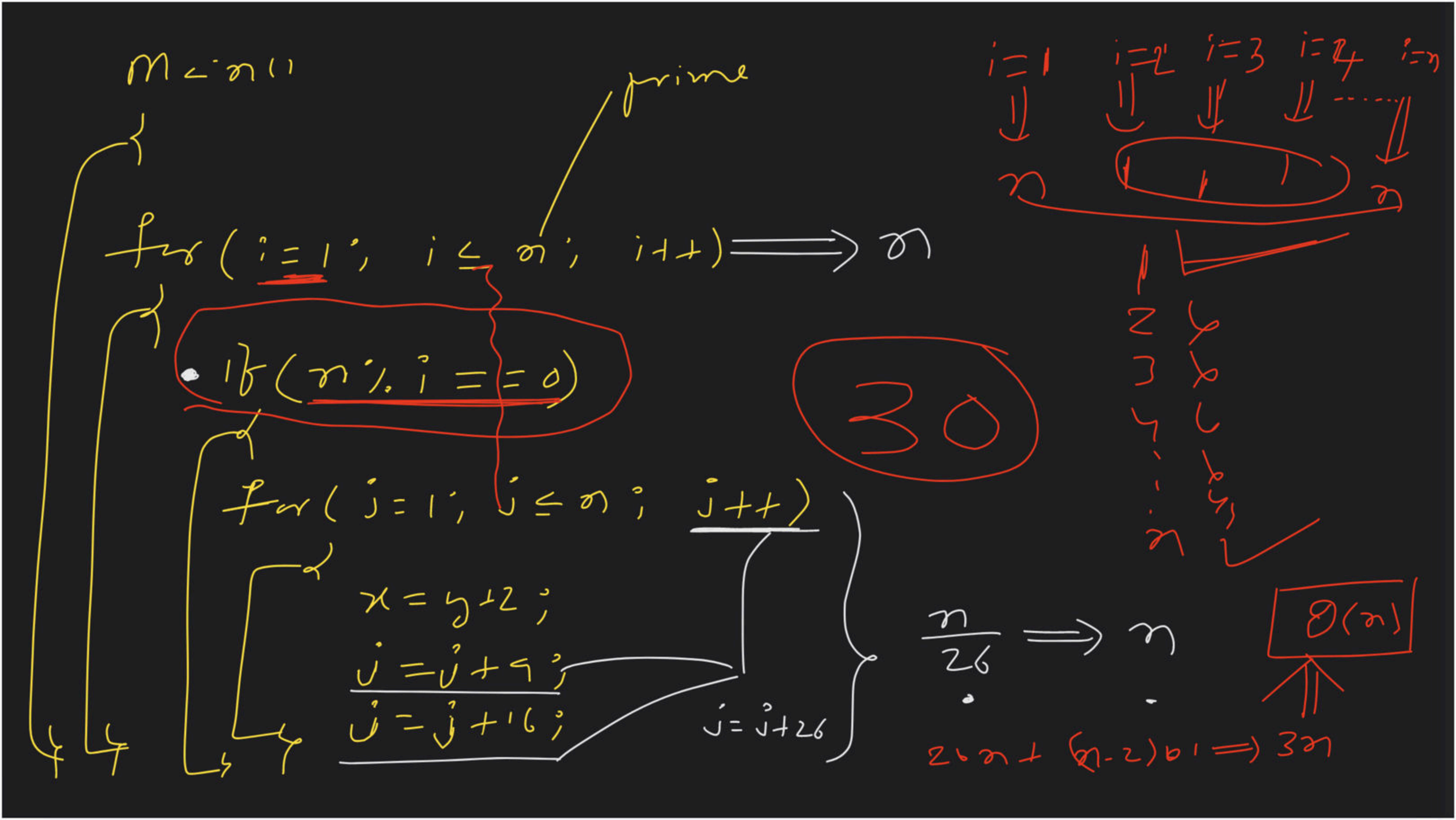
$i = 1, 2, 3, \ldots \Longrightarrow n^{41}$

$\Longrightarrow n^{41/26} \Longrightarrow n^{1.5769}$

$+ = \Theta(n^{1.5769} * \log n)$

$j = 2*j;\ j = 4*j;\ j = j+-; \Longrightarrow i = 8*j \Longrightarrow \log_8 n^7$




main()
prime
for(i=1; i<=n; i++) ⟹ n
if(n%i==0)
for(j=1; j<=n; j++)
x=y+2;
j=j+5;
j=j+16;
j=j+26
30
i=1 i=2 i=3 i=4 i=n
n
n
2 comparisons
n/26 ⟹ n
2.n + (n-2).1 ⟹ 3n
θ(n)

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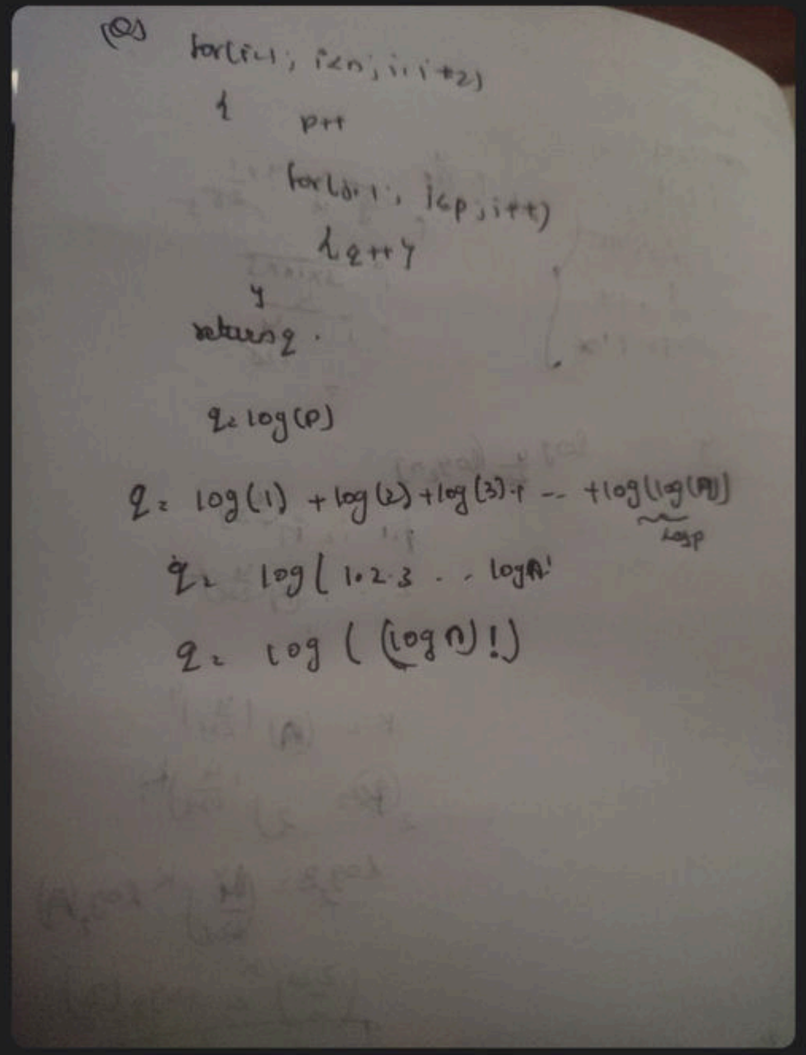
▲ 1 • Asked by Sai Teja

is it correct..?



n

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

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

$n^{\frac{1}{2^3}}$

$\vdots$ k-th term

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

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

$\log n = 2^k$

$\log\log n = k$

$i = n$

while ($i \geq 2$)

{

$i = i^{\frac{1}{2}}$

}