Time Complexity - Part III

Complete Course on Algorithm for GATE - CS & IT

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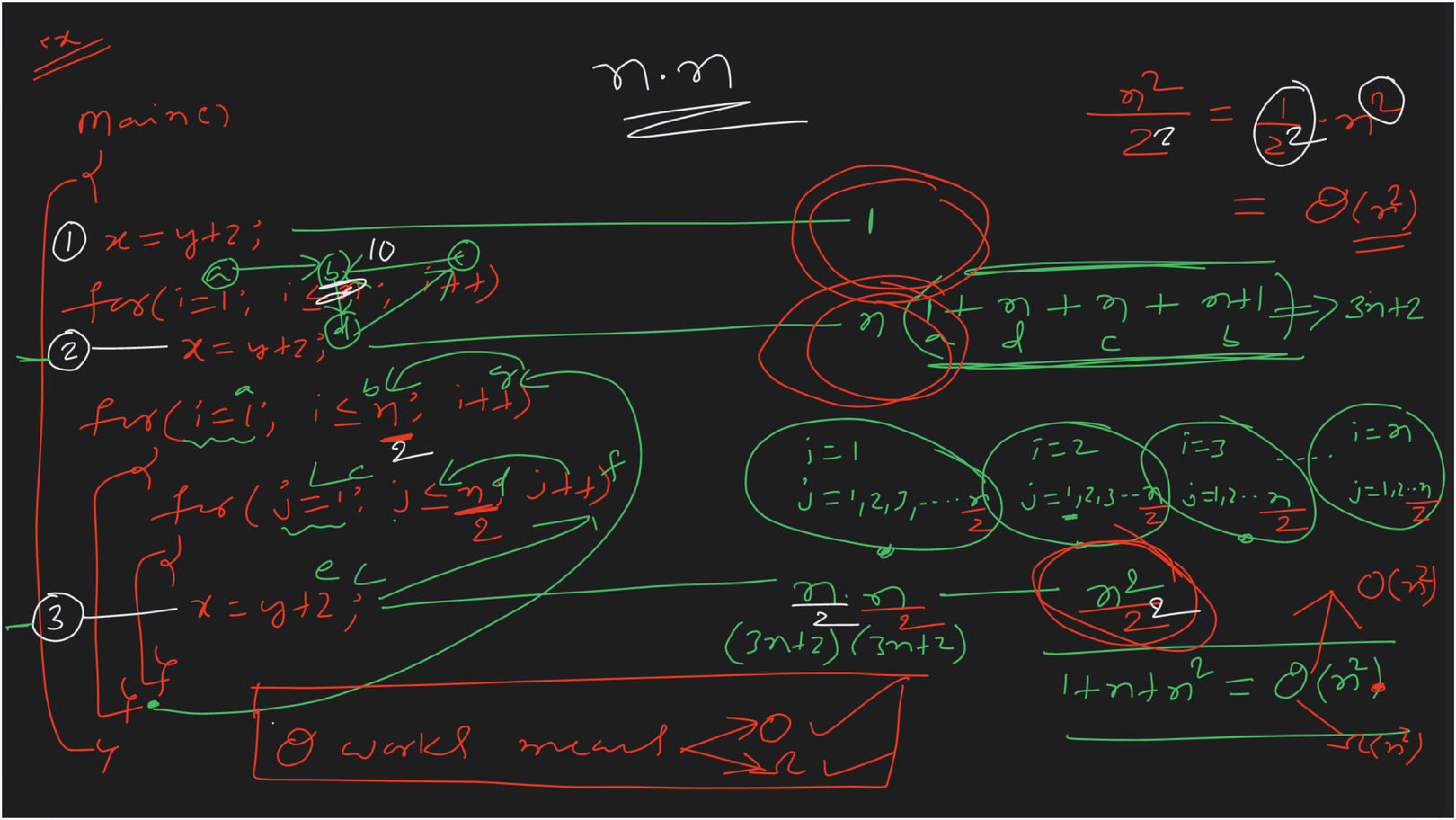


ex
main()
{
① x = y+2;
for(i=1; i≤n; i++)
② x = y+2;
for(i=1; i≤n/2; i++)
{
for(j=1; j≤n/2; j++)
{
③ x = y+2;
}
}
}
n·n
1
n
1 + n + n + n+1 ⇒ 3n+2
i=1 j=1,2,3,...n/2
i=2 j=1,2,3...n/2
i=3 j=1,2...n/2
i=n j=1,2..n/2
n/2 · n/2
(3n+2)(3n+2)
n²/2²
n²/2² = 1/2² · n²
= Θ(n²)
1+n+n² = Θ(n²)
O(n²)
Ω(n²)
Θ work 8 mean O Ω

ex

```
main()
{
for(i=1; i<=n; i++)
    x=y+z;

for(i=n; i>=1; i--)
    x=y+z;

for(i=1; i<=n^2; i++)
    x=y+z;

for(i=1; i^2<=n; i++)
    x=y+z;
}
```

$3 \le n$ ..... $n \le n$ $(n+1) \le n$

$2 \le n$

$1 \le n$

$1,2,3,4,\ldots$ n

n

$1,2,3,4,5,\ldots$ $\sqrt{n}$

$(\sqrt{n})^2 \le n$ $O(\sqrt{n})$

$1^2 \le n$ $2^2 \le n$ $3^2 \le n$ ..... $n^2 \le n$ n^2

CSE

$(1) \le n$

$6^2 \le n$

$5^2 \le n$

$i+1 \Rightarrow 11$

$i=10$

$i=i+1 \Rightarrow 11$

$i++$

ex

```
main()
{
    for(i=1; i <= n^27; i++)
        x = y+z
    for(i=n^7; i >= 1; i--)
        x = y+z;
    for(i=5; i^14 <= n^6; i++)
    {
        x = y+z;
    }
}
```

$\Theta(n^7)$

$1^5 \le n^{27}$, $2^5 \le n^{27}$, $3^5 \le n^{27}$ .... k-times $(k)^5 \le n^{27}$

$\Downarrow$

$$\left(n^{27/5}\right)^5 \Rightarrow n^{\frac{27}{5} \cdot 5} \Rightarrow n^{27}$$

$i \le n^{27}$; i++ $\Longrightarrow n^{27/5}$

1, 2, 3, 4, ...

for(i = n^7 (100); i >= 1; i--) $\Longrightarrow n^7$

100, 99, 98 1

$n^7, n^7-1, n^7-2, \ldots 5, 4, 3, 2, 1$

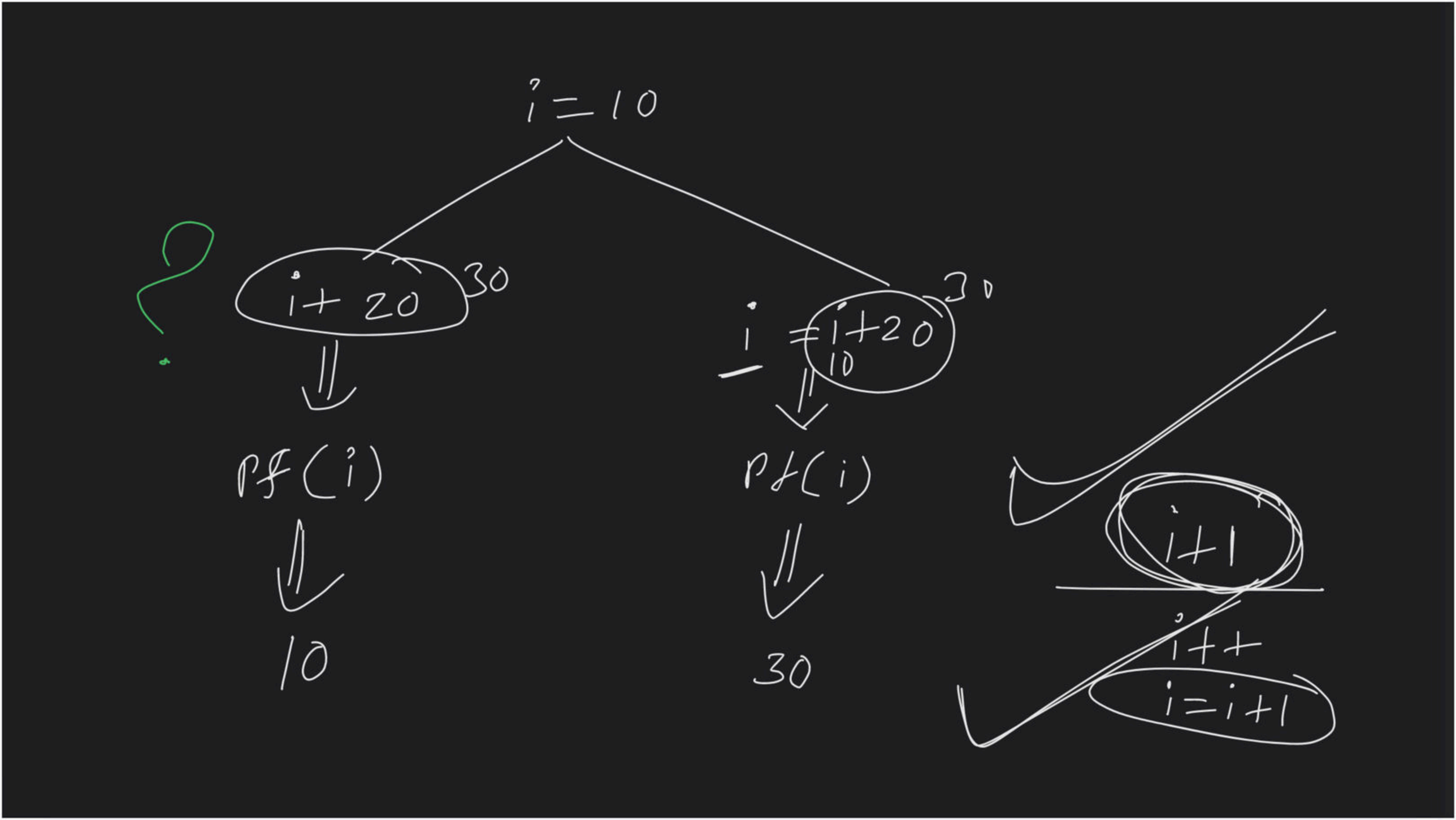
5, 6, 7, 8, ...

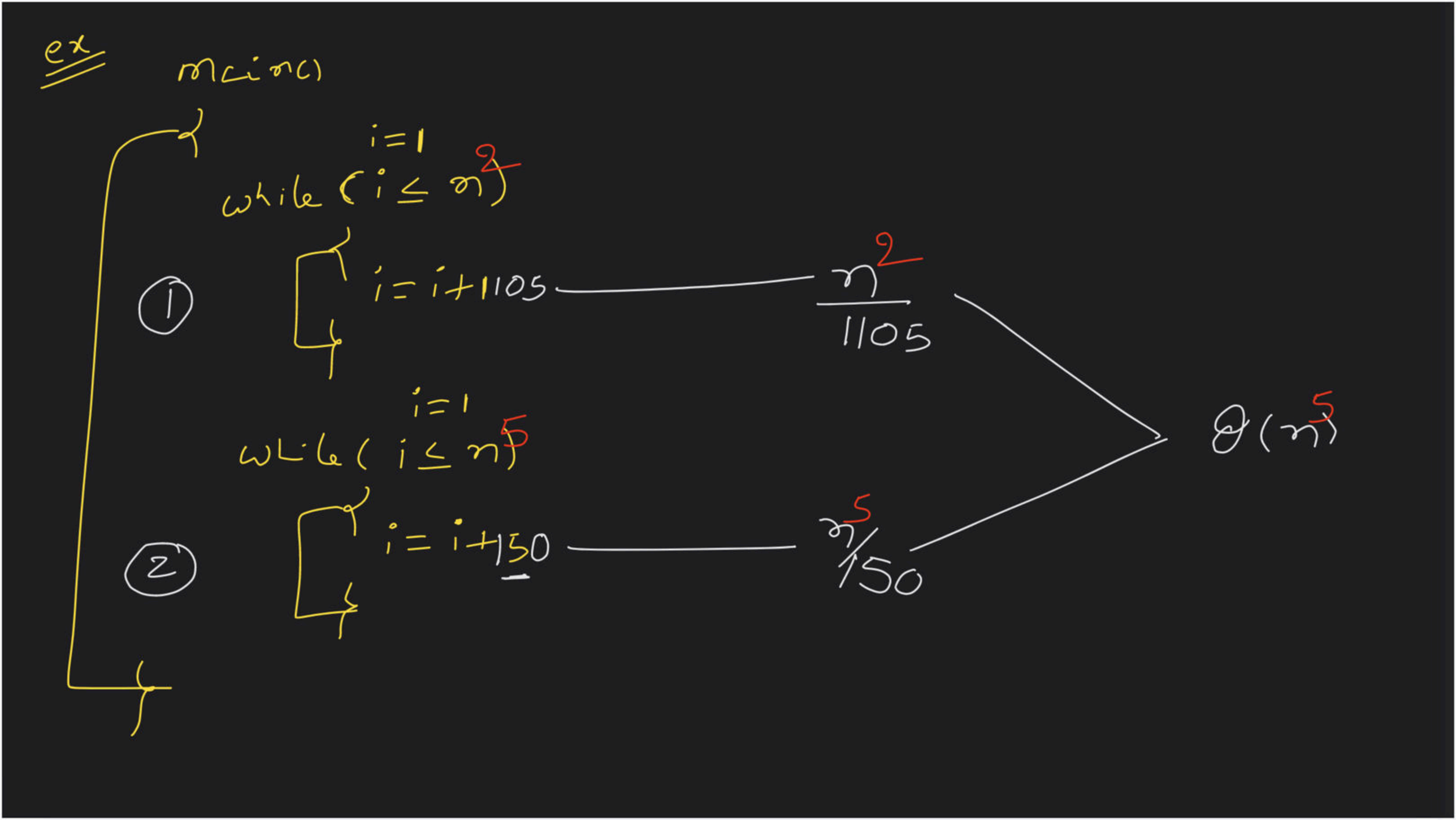
$5^{14} \le n^6$

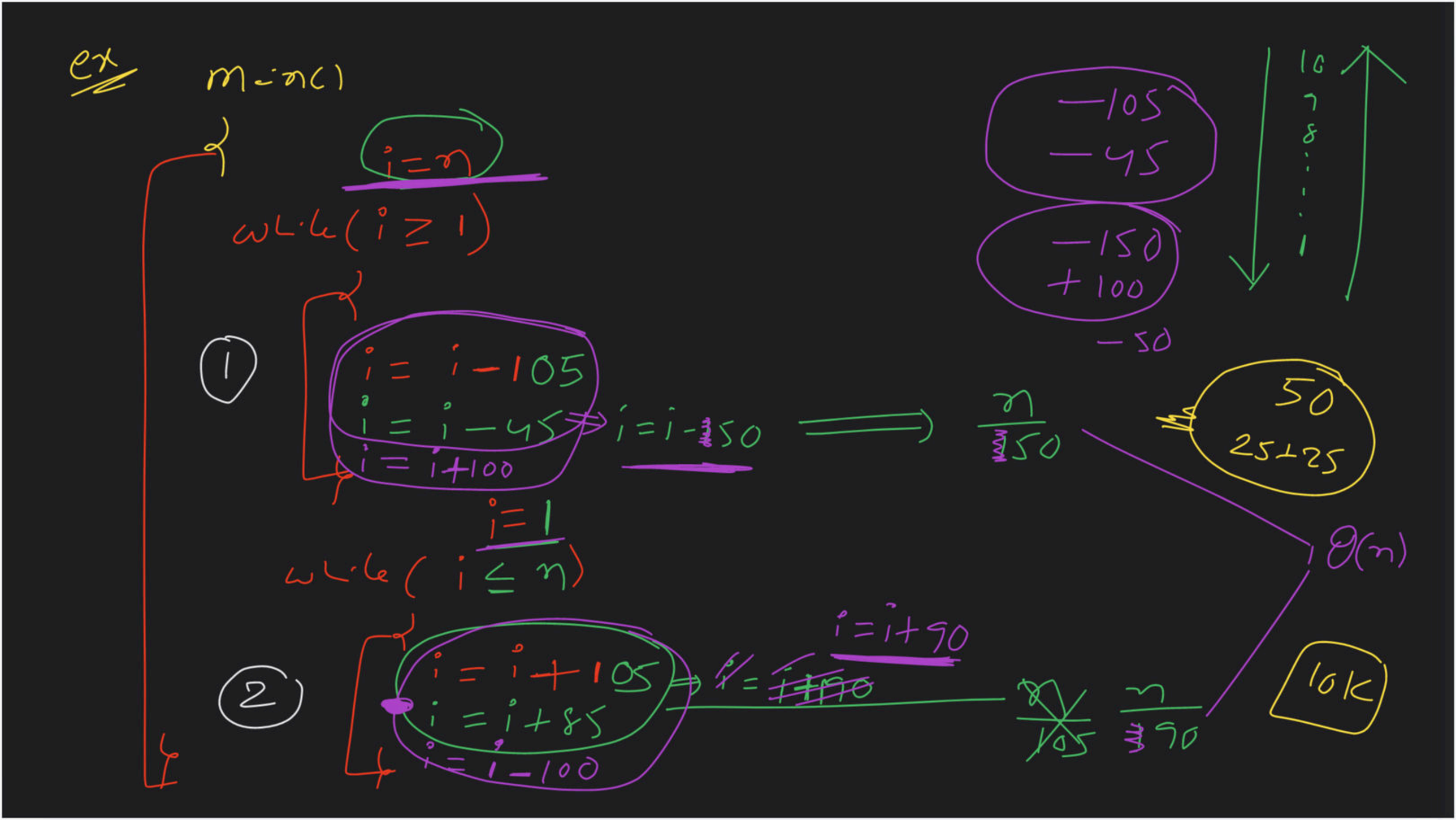
$6^{14} \le n^6$, $7^{14} \le n^6$, ... k $(k)^{14} \le n^6$

$n^{6/14}$

$(a^m)^n \Rightarrow a^{mn}$


i=10
i+20
30
i=i+20
10
30
pf(i)
10
pf(i)
30
i+1
i++
i=i+1


ex
main()
i=1
while (i ≤ n^2)
i = i+1105
n^2 / 1105
i=1
while (i ≤ n^5)
i = i+150
n^5 / 150
θ(n^5)


ex
main()
i=n
while(i≥1)
①
i = i-105
i = i-45
i = i+100
i=i-150
n/150
-105
-45
-150
+100
-50
10
7
8
.....
1
50
25+25
O(n)
i=1
while(i≤n)
②
i = i+105
i = i+85
i = i-100
i=i+90
n/90
10K