* Big-Oh Notation : Def^{n} :

Suppose, that an algo has complexity of

$O(N^3)$

① What does it mean in simple words?

Ans :) So, in simple language it means that, this is the upper bound.

2) Meaning, CN^3 : Size of the ~~arrog~~ array will grow as the input grow in an N^3 fashion (eg: Binary & Linear search). But, what does this Big-Oh saying. It's saying that the complexity "the graph & the relationship" it can't exceed N^3.

3) For Eg : your algo that you've written may be solved in a constant time, it may be solved in $O(N)$ time, or $O(\log N)$ or $O(N^2)$ times etc. But it will never be solved or exceed the time complexity, relationship, the graph, the function value, it will never exceed more than N^3.
It will never be like $O(N^4)$ or $O(N^3 \log N)$ etc.

* Maths :

$$f(n) = O(g(n)) \quad \text{-- (1)}$$

$$\lim_{n \to \infty} = \frac{f(n)}{g(n)} < \infty \quad \text{-- (2)}$$

(2) It is actually some finite value.

As we said the "Always look for worst case complexity" & "Always look at complexity for large / ∞ data".

So, Here we're applying that.

$$\lim_{n \to \infty} = \frac{f(n)}{g(n)} < \infty$$

Eg:

$$O(N^3) = O(6N^3 + 3N + 5)$$

g(n) f(n)

$$= \lim_{n \to \infty} \frac{6N^3 + 3N + 5}{N^3}$$ — {when the value of n reaches / closed to ∞} (limits)

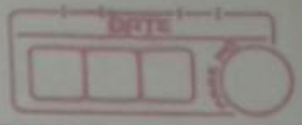
$$= \lim_{n \to \infty} 6 + \frac{3}{N^2} + \frac{5}{N^3}$$

$$6 + \frac{3}{\infty} + \frac{5}{\infty}$$ — {anything ÷ by ∞ = 0}

$$= 6 + 0 + 0$$

$$= 6 < \infty$$

Hence, proved! It is a finite value because this is showing an upper bound.



Note: Our algorithm will never exceed the complexity of this. It can be better than this like it can also be solved in less complexity, but at any case it will never exceed.