Stack: Quiz

- The time complexity T(N) of inserting first N items by using resize(capacity * 2) may be expressed in an open form:

$$\mathbf{T(N) = N + (1 + 2 + 4 + 8 + \ ... + N)}$$

- Rewrite T(N) shown above in a closed form.

On my honor, I pledge that I have neither received nor provided improper assistance in the completion of this assignment.

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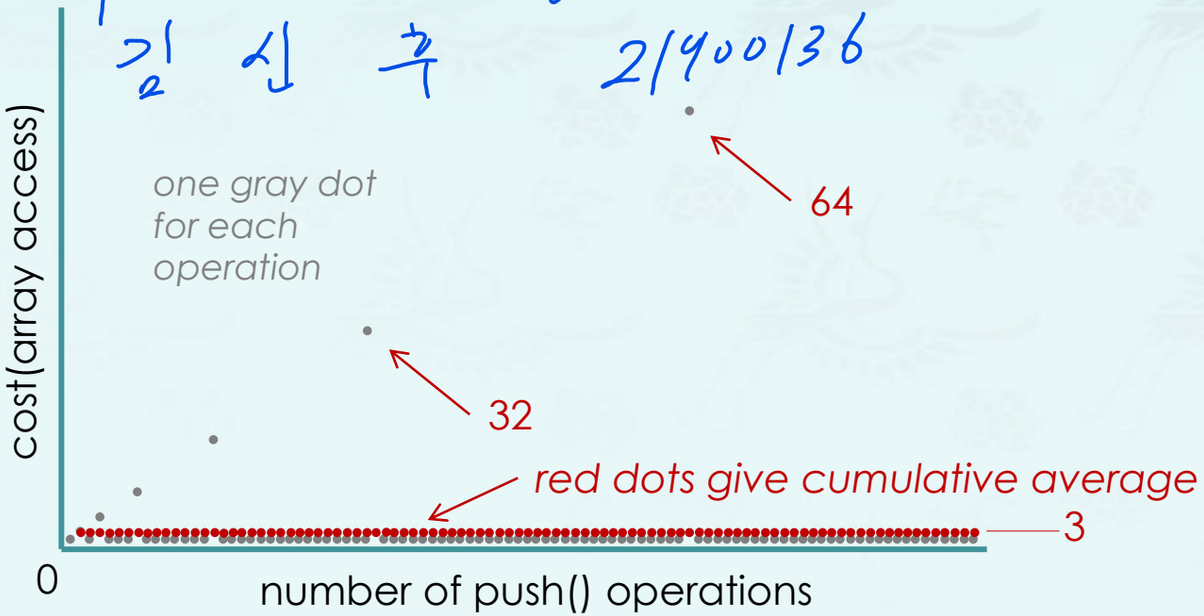

$$1 + a + a^2 + \ a^3 + \cdots + a^n = \frac{a^{n+1} - 1}{a - 1}$$

$$1 + 2 + 4 + \cdots + 2^n = \frac{2^{n+1} - 1}{2 - 1} = 2^{n+1} - 1$$

$T(N) = N + 1 + 2 + 4 + \cdots + 2^k$ ($2^k = N$, k is real number)

$= N + 2^{k+1} - 1$ ($\because \sum_{i=0}^{k} 2^i = 2^{k+1} - 1$)

$= N + 2^k + 1$

$= 2N + 1$ ($\because 2^k = N$)

Therefore, $\mathrm{T(N)} = N + (1 + 2 + 4 + \cdots + N)$

$= ?\ 2N+1$

The time complexity of the algorithm is O(n).