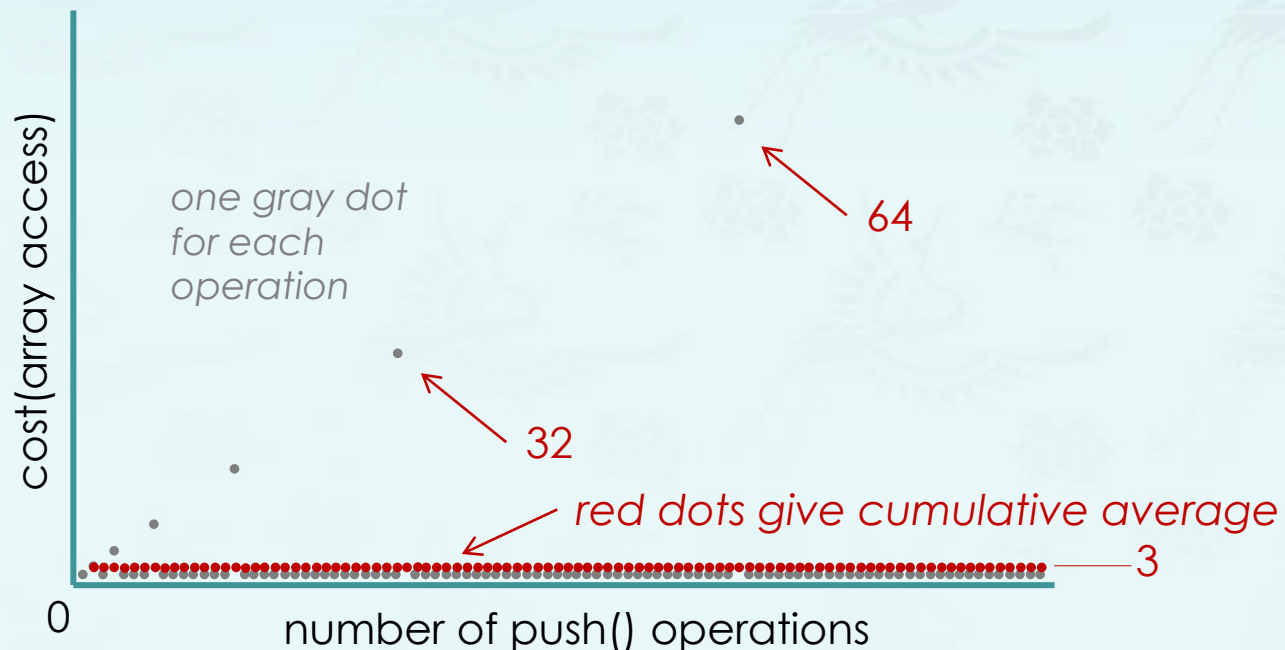# Stack: Quiz

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

$$T(N) = N + (1 + 2 + 4 + 8 + \ldots + N)$$

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

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

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

$$T(N) = N + 1 + 2 + 4 + \cdots + 2^k \quad (2^k = N, \ k \div \text{ real number})$$

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

$$= N + 2^k + 1$$

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

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

= ? $2N + 1$

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

cost(array access)

one gray dot
for each
operation

64

32

red dots give cumulative average

3

0

number of push() operations