Hands-On - 11

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Q1.

a) Aggregate Method

The aggregate method calculates the total cost of series of operations & divides by no. of operations to find average.

- Suppose we have a dynamic array that starts with a capacity of 1
- Each time we insert an element and array is full, the array size doubles.

To analyze cost,

- Single insertions: Inserting an element cost $O(1)$ unless resizing is required.
- Resizing: Each time resizing happens, all elements need to be copied to new array so the cost is $O(k)$.

∴ The total cost of inserting n elements is

$$T(n) = \sum_{i=0}^{\log n} O(2^i) = O(n)$$

Thus the amortized cost per insertion is $O(1)$

b) Accounting method

Here we assign credit to each operation, which covers not only immediate cost but also my future costs associated with operation.

For each operation, we charge cost of 3 units,

- 1 units for actual insertion
- 2 units to 'save-up' for furture resizing operations.

When a resize operation occurs, the saved units cover the copying cost,
- Doubling from k to 2k requires copying k elements, which will be covered by previously saved credits

Since each insertion is charged a constant cost of 3 units, the amortized cost per insertion remains $O(1)$,