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Assignment
Chapter-17

(1)

Sol :- To find the amortized runtime for inserting n elements that doubles in size when it needs more space

a) using the aggregate method :-

An aggregated technique is calculated by dividing the total cost by n to get the amortized cost per insertion.

Let's assume that the table 1, or any constant size. The initial insertion cost is 1. The second insertion cost is 2. The third insertion cost is 1. The fourth insertion cost is 4. If we continue this pattern, we can get the cost 5th insertion is 1 and the cost for 6th insertion is 8. The cost will increase each time we change the size of the table. ~~The cost will increase each time~~
The total cost for n insertion can be calculated as.

$$1+2+1+4+1+8+\ldots+1+2^{(\log(n)-1)}$$

The term $2(\log(n)-1)$ represents the cost of resizing the table to its final size.

Let's divide this total by n in order to get the amortized cost per insertion

$$O(\log n) - 1 = \frac{(1+2+4+1+8)}{n}$$

This formula can be calculated using efficient arithemetic operations as well as logarithmic calculations.

b) using the Accounting method :-

In the Accounting method, we provide a credit for debit to each insertion operation in the accounting approach. The amortized cost includes both the actual operation cost and any additional credit or debit.
Assume that each insertion operation has a cost of 2; we double the size of the table and give a credit of 2 for every element in the table. The table initially has a capacity of 1. Every insertion procedure cost 2, so the total cost of n insertions is 2n. To resize the table, we need to multiply the table by log 2(n). Each resizing process costs m, which doubles each time the table is enlarged twice by log 2(n). consequently, each element of the table is credited with a credit 2m, resulting in a total credit of $2+4+8+8+2+2^k$. The total credit granted for each insertion is $2n-2 = 2n-2$. The amortized cost for each insertion is O(1) using the accounting approach.