Design Analysis and Algorithm

Handson-12, Homework-17

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Aggregate method

a) The aggregate method is a technique used in amortized analysis to determine the average cost per operation over a sequence of operations.

In the aggregate method we consider the total cost across all the insertions and calculate the average cost per insertion

⇒ When inserting the p^{th} element, if a resize operation is not needed then the existing happen cost O(1) as it involves copying the existing elements to a new table of size 2^k

k is the number of resizes performed.

Total cost = $O(n) k$

$= O(n \log n)$

Cost per insertion = $O(\log n)$

Runtime per insertion = $O(\log n)$

Total time is $O(n) * \log(n+1)$

b) Accounting Method

The accounting method is used to analyze the amortized cost of a sequence of operations by charging some operations more than their actual cost and saving the excess as credits.

Pseudocode:

```
from i=1 to n
    if table is full
        new table = Create new table with size 2 * current size
    then copy elements from old table to new table
        table = new table
    insert element i into table
        initate charge = 0
        for i = 1 to n
            charges += 2
    if table double in size from m to 2m
        Credits += m
```

Total charge = $2^* n = O(n)$

Total credit $= m + 2m + \cdots + m/2 * m = O(n)$

Amortized cost per insertion = Total/n

$= O(n/n)$

$= O(1)$

Run times per insertion $= O(1)$

Total time $= O(n)$