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DAA Hands on - 11

1) Given a dynamic table (see section 17.4) that doubles in size when it needs more space. Find the amortized runtime for inserting n elements.

a) Use the aggregate method in the aggregate method use consider the total cost across all the insertions & calculate the average (amortized) cost per insertion

When inserting the i^{th} element, if a (resize) operation is not needed the existing happens costs (i) as it involves copying the existing elements to new table of size 2K (K is no. of resizes performed).

Total cost $= O(n)$ ~~x~~ $\Rightarrow O(n \log n)$

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

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

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

b) Accounting method :- In the accounting method, we assign each insertion a higher "amortized" cost the store "credits" that pay for future resizing costs.

Pseudo code :-

```
for i = 1 to n
    If table is full
        new table = create new table
        with size then copy elements
        from old table to new table

    table = new_table
    insert element i into table
initial charge = 0
for i = 1 to n
    charges t = 2
    If table doubled in -
        - size from 2m
    credits t = m
```

total charges = $2 * n = O(n)$

total credits = $m + 2m$ — $n/2 * m$

$= O(n)$

amortized cost per insertion

$=$ total / n

$= O(n/n)$

$= O(1)$

Runtime per insertion $O(1)$

Total time $O(n)$.