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Ch.17 HW

1) Given a dynamic table that doubles in size when it needs more space. find the amortized runtime for inserting n elements.

a) use the aggregate method.

Ans: The average cost per insertion is calculated using the aggregate technique, which takes into account the overall cost over all insertions. Since the i th element entails copying existing items to a new table of size 2^k. it occurs at of $O(1)$ only if no resizing is done.

$$\text{Total cost} = O(n)k$$
$$= O(n \log n)$$

$$\text{Cost per insertion} = O(\log n)$$

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

b) use the accounting method

* Each insertion is given a larger amortized cost on accounting so that credits for future resizing expenses can be stored.
* Total credit is $m + 2m + 4m + \dots n/2 * m = O(n)$

Pseudocode:-

```
for i=1 to n:
    if table is full:
        newtable = create newtable with size of current size
        copy element from old table to new table
        table = new table
    insert element i into table
initial charges = 0          → initialize credits = 0.
for i=1 to n:
    Charges + = 2
    If table doubled in size from m to 2m:
        credits + = 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).
```