

### 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.
- ② Use the aggregate method we consider the total cost across all the insertions and calculate the average (amortized) cost per insertion.

When inserting the  $i$ th element if a resize operation is not needed the existing happens cost  $O(1)$  as it involves copying the existing elements to the new table of size  $2k$  ( $k$  is number of resizes performed)

Accounting method :- In this 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

newtable = 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  $+$  = 2

if table doubled in size from  $m$  to  $2m$

credits  $t = m$

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

total credit =  $m + 2m + \dots + n/2 * m = O(n)$

Amortized cost per insertion

$$= \text{total} / n$$

$$= O(n/n)$$

$$= O(1)$$

Runtime per insertion  $O(1)$

total time  $O(n)$