[Assignment]

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[CH-17] [HW]

* Question - 1 :- Inserting n element using

[a] Aggregte method

* The table doubles in size when it runs out of space.

* So, if the orginal size is 1, after insertion it doubles to size 2, after 2 more insertion it doubles to size 4 etc.

* In general, after k doubling the size is 2^k.

Pseudocode :-

```
initialize table with capacity = 1

for i=1 to n:
    if table is full:
        new table = Create new table with
                    Size 2 * current size
```

Copy element from old table
to new table.

table = newtable
insert element i into table

Let $k = \log(n+1) - 1$
Total cost $= O(n) * k$
$= n(n\log n)$

Amortized cos per insertion $= O(\log n)$

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

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

* [b] Accounting method

* Change 2 units for each insertion

* When the table doubles in size from m to 2m, credits m units.

* The credit exactly pay for the copy cost of $O(m)$

* Total credit is $m + 2m + 4m + \dots + n/2 * m = O(n)$

Psuedo code :-

```
initialize table with capacity = 1

for i = 1 to n :
  if table is full :
      newtable = create newtable with
                 size 2* current size

      copy element from old table
      to new table
       table = new table

  insert element i intotable .

 initialize changes 0
 initialize credits = 0

 for i = 1 to n :
      charges + = 2

    if table doubled in size from m to 2m

          credits + = n
```

Total charges $= 2Kn = O(n)$

Total credits $= m + 2m + .. + n/2 * m = O(n)$

Amortized cost per insertion $= \text{Total} / n$

$= O(n) / n$

$= O(1)$

Runtime per insertion $= O(1)$

Total time $= O(n)$