Homework - 17

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1) inserting n elements using

a) aggregate method

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

so if the original size is 1, after insertion it doubles the size to 2 after 2 more insertions it doubles to size 4 etc

in general after k doublings the size is 2^k.

pseudo code:

```
initialize table with capacity=1
for i=1 to n:
    if table is full:
        newtable = create newtable
                   with size 2*current size
    copy elements then from old
```

table to new table
table = newtable
insert element i into table
let,
$k = \log(n+1) - 1$
Total cost $= O(n) * k$
$= O(n \log n)$
~~cost per month~~ =
cost per insertion $= O(\log n)$
run time per insertion is
$O(\log n)$
Total time is $O(n) * \log(n+1)$

b) accounting method

Charge 2 units for each insertion.

When the table doubles in size from m to 2m, credit m units

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

Total ~~cost~~ credit is $m + 2m + 4m + \cdots$
$n/_2 * m = O(n)$

Pseudo 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 = newtable.
    insert elements i into table
  initialize 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 = $O(n)$

  cost per insertion = total/n
                     = $O(n)/n$
                     = $O(1)$
runtime per insertion = $O(1)$
        Total time = $O(n)$
```