

Amortization Analysis (20 pts)

Suppose we have m heavy stone tablets each with a “0” on one side and “1” on the other side. We want to use these tablets as an incrementing counter representing m bits. Initially all m stone tablets start at 0. And each step, we will simply increment the counter.

For example, below is an example when $m = 8$.

Initial	0 0 0 0 0 0 0 0
Step 1	0 0 0 0 0 0 0 1
Step 2	0 0 0 0 0 0 1 0
Step 3	0 0 0 0 0 0 1 1
Step 4	0 0 0 0 0 1 0 0
...	

From initial to step 1, the 8th stone was flipped from 0 to 1

From step 1 to step 2, the 8th stone was flipped from 1 to 0 and the 7th stone was flipped from 0 to 1.

From step 2 to step 3, the 8th stone was flipped from 0 to 1.

From step 3 to step 4, the 6th stone was flipped from 0 to 1, and the 7th and 8th stone was flipped from 1 to 0.

And so on...

Assume the flipping stone from 0 to 1 and 1 to 0 costs the same, and m is sufficiently large for a sequence of n increments.

Q1. In a sequence of n increments, what is the worst-case cost for an increment in terms of n ?

Q2. In a sequence of n increments, what is the amortized cost per increment? Use accounting method.

In your description, specify what should be the charge for 0->1 flip and 1->0 flip and provide the reasoning.

Q3. Potential method?