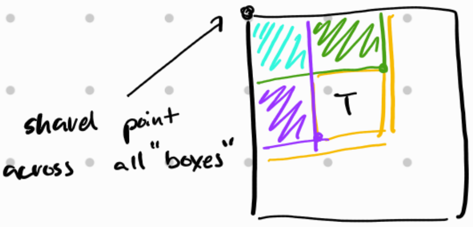
## Initial Notes

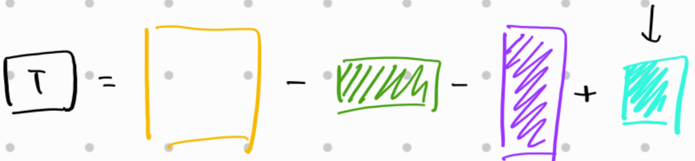
- Constraint of $O(1)$ for sumRegion, naive computation takes atleast $O(N)$
- Must be able to compute something ahead of time, given the constructor

## Idea:

We can quickly derive the sum in $O(1)$ time by solving for regions ahead of time



The math works out to be:

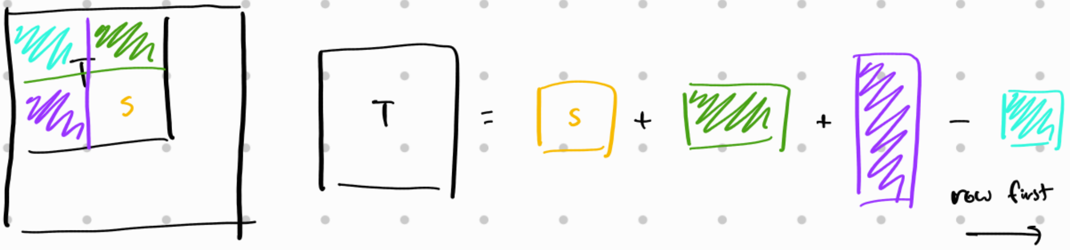


this part is subtracted twice, so we add it once

The math is constant time (lookups are constant too)

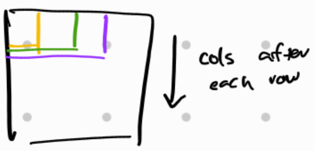
So how can we derive these boxes?

- Naive derivation is bad — $O(N^4)$ complexity
- Use DP to build the solution, as we can build off previous solutions



This works as we build solutions in (row↔col) order

row first



can be other way around