Sequence Alignment

S_1 = Ocurence

S_2 = OCCurance

O C u r e n C e x x x x x

O C C u r a n C e

7 mismatch

O C □ u r e n C e

O C C u r a n C e

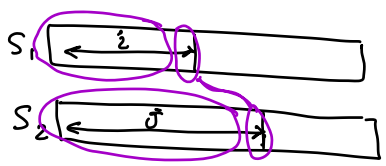
$\Delta(S_1, S_2)$ = 1 gap (δ) + 1 mismatch(e, a) (α_{ea})

Given Two Strings S_1 and S_2, what is the edit distance (Min distance) between the two Strings

$|S_1| = n$, $|S_2| = m$

OPT(n, m) : optimal solution

OPT(i, j) :



$$OPT(i,j) = \begin{cases} j\,\delta & i = 0 \\ i\,\delta & j = 0 \\ \min \begin{cases} \alpha[S_1[i], S_2[j]] + OPT(i-1, j-1) \\ \delta + OPT(i-1, j) \\ \delta + OPT(i, j-1) \end{cases} \end{cases}$$

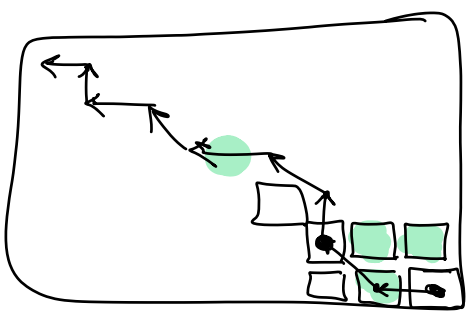
Eq(*)

```
O(n) → for i = 1 to n    M[i,0] = iδ
O(m) → for j = 1 to m    M[0,j] = jδ
        for i = 1 to n
            for j = 1 to m
O(nm)                    M[i,j] = Eq(*)
O(n)
O(m)
        return M[n,m]
```

Space: $O(nm)$

time: $O(nm)$

* Easy to Compute Edit distance in $O(nm)$ time & $O(\min(n,m))$ Space.



* Find the optimal actions in $O(nm)$ time & $O(n+m)$ Space.