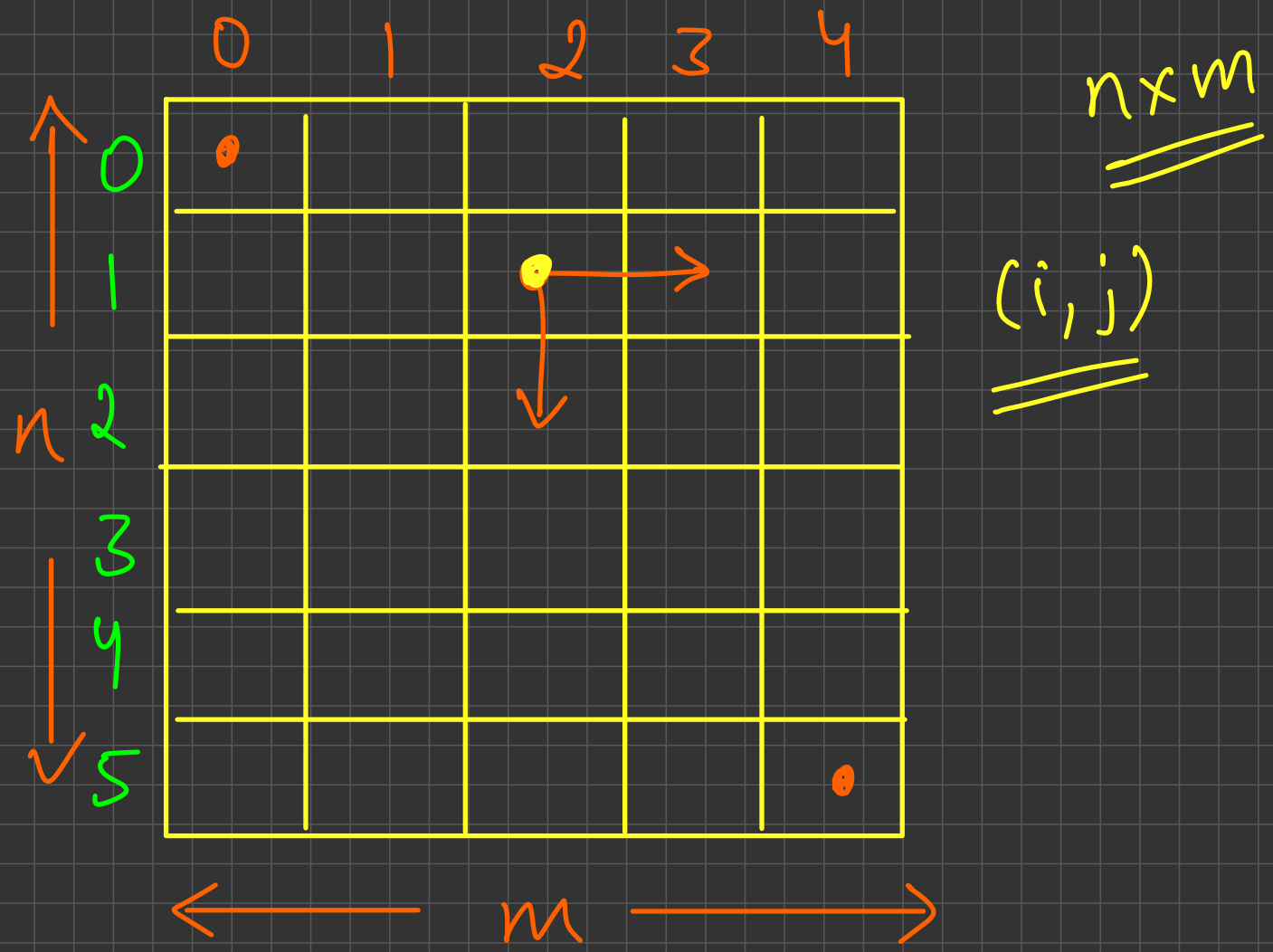
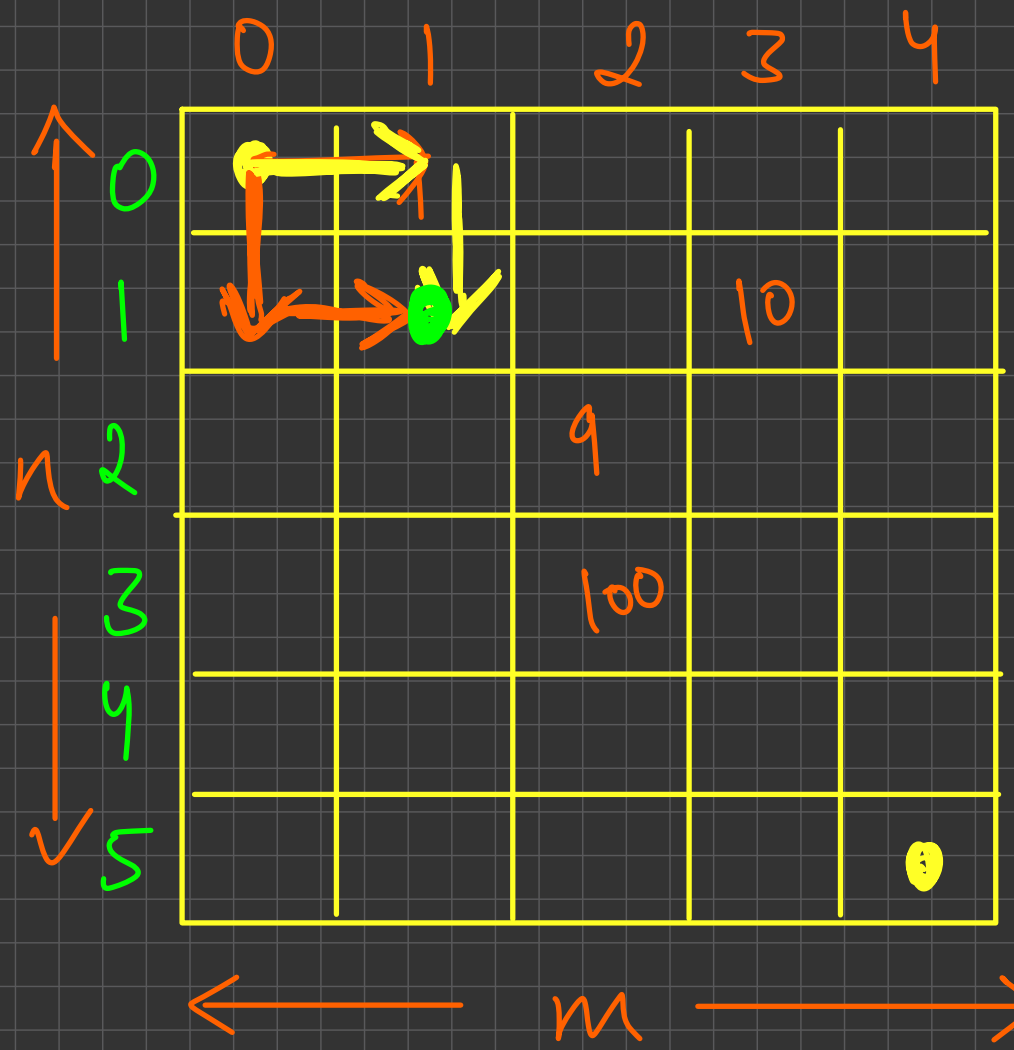
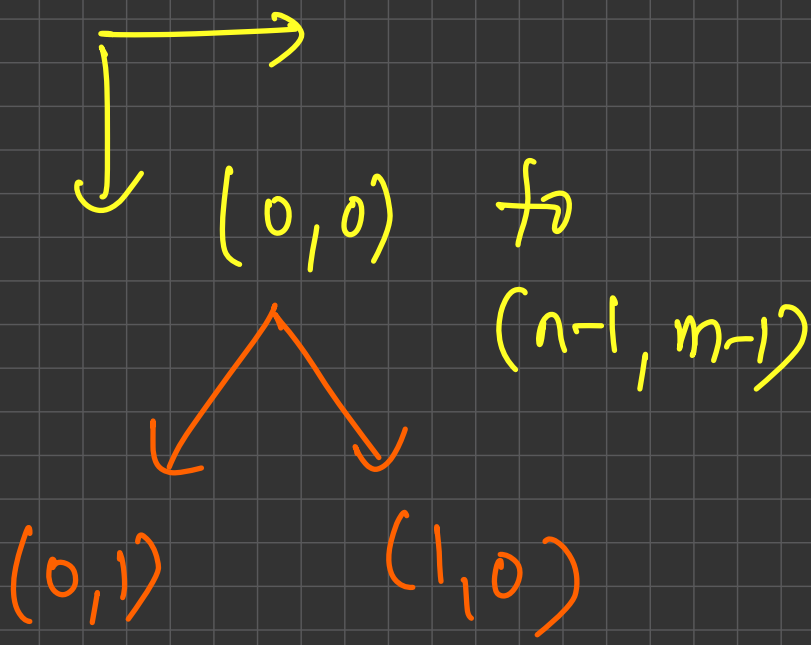
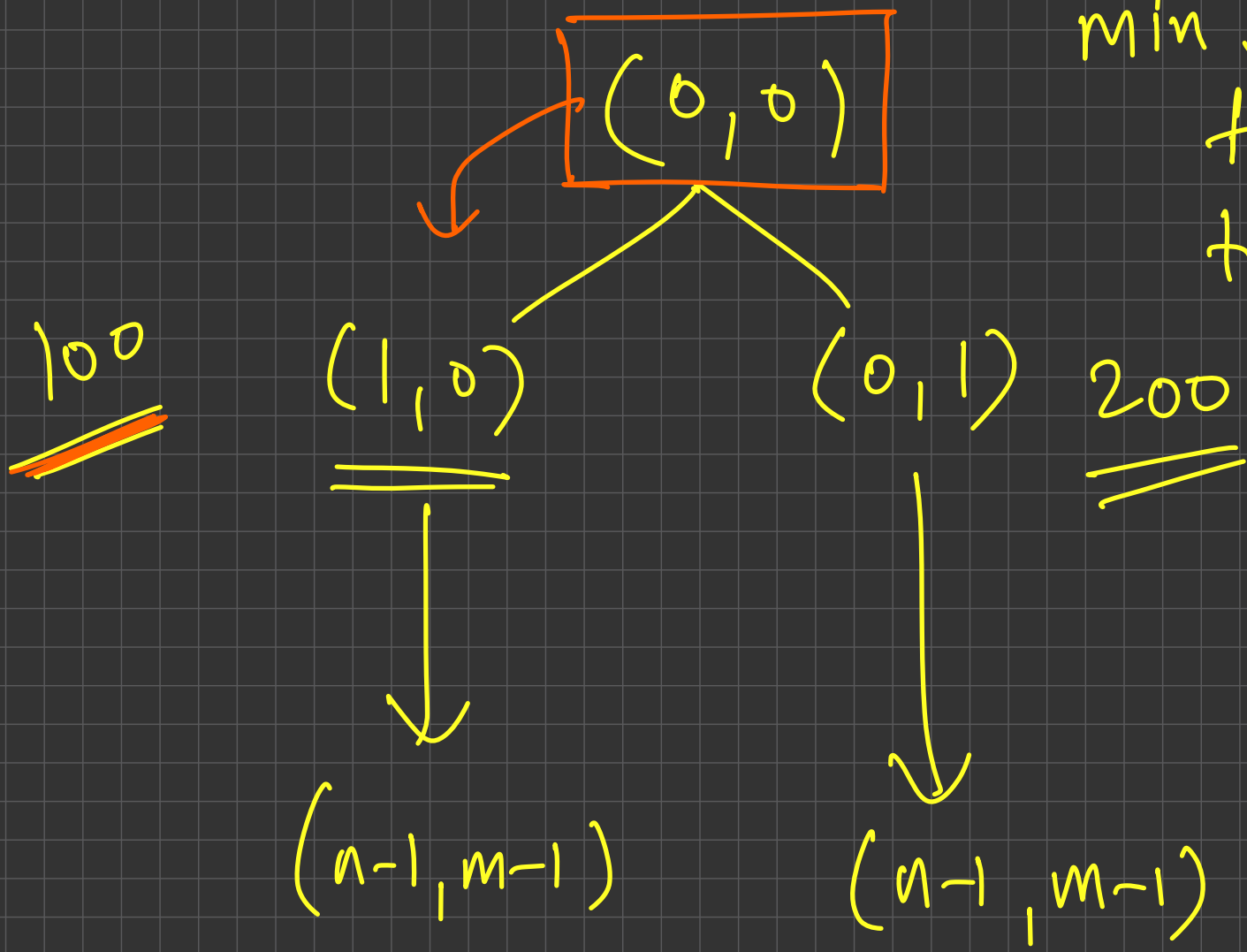
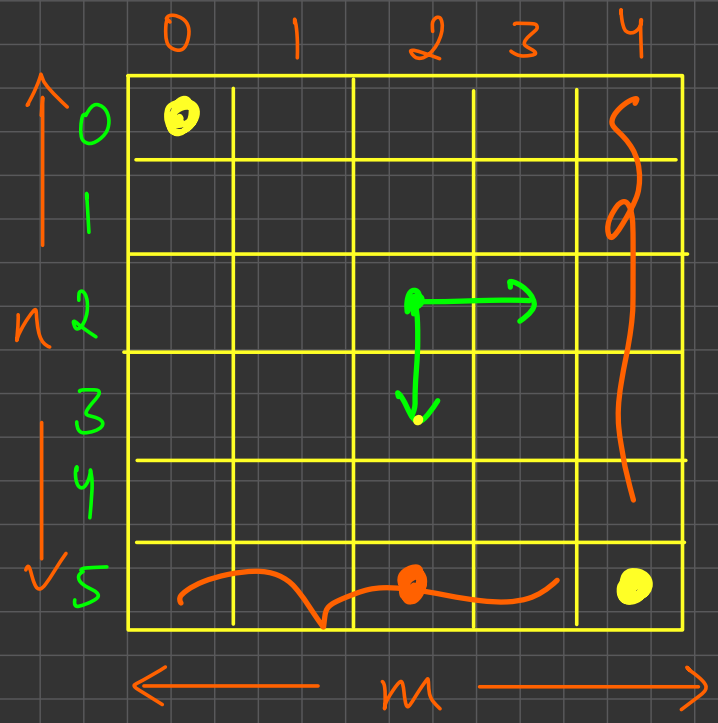

0 1 2 3 4
0
1
2
3
4
5
n
m
nxm
(i,j)


0 1 2 3 4
0
1
2
3
4
5
n
m
10
9
100


(0,0) to
(n-1, m-1)
(0,1)
(1,0)


(0,0)
min sum path
from (0,0)
to (n-1, m-1)
100
(1,0)
(0,1)
200
(n-1, m-1)
(n-1, m-1)



state

$dp[i][j]$ = min sum path from

transition (i,j) to $(n-1, m-1)$

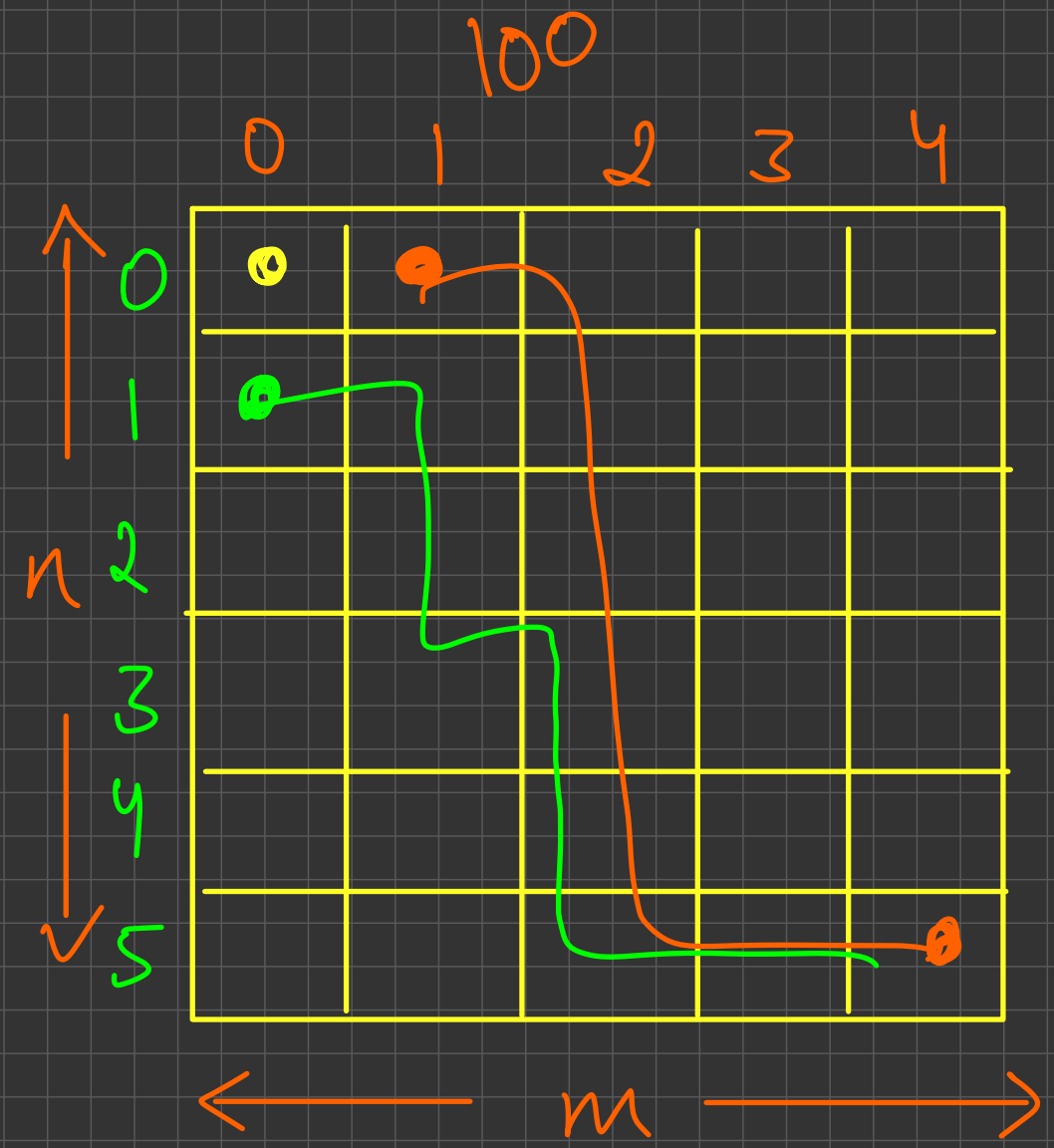
$$dp[i][j] = \min \begin{cases} dp[i+1][j] \\ dp[i][j+1] \end{cases} + grid[i][j]$$

Base Case

$dp[n-1][m-1] = grid[n-1][m-1]$

Final subproblem

$dp[0][0]$ = min sum path from $(0,0)$ to $(n-1, m-1)$



no. of ways to go from (0,0) to (n-1, m-1)

dp[i][j] = no. of ways to go from (i,j) to (n-1, m-1)

state

$$dp[i][j] = dp[i+1][j] + dp[i][j+1]$$

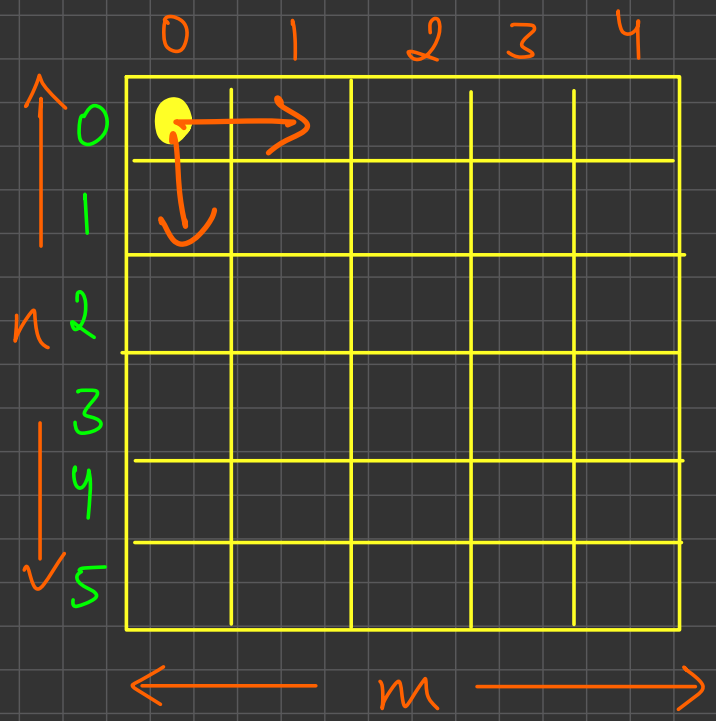
transition

$$dp[n-1][m-1] = 1$$

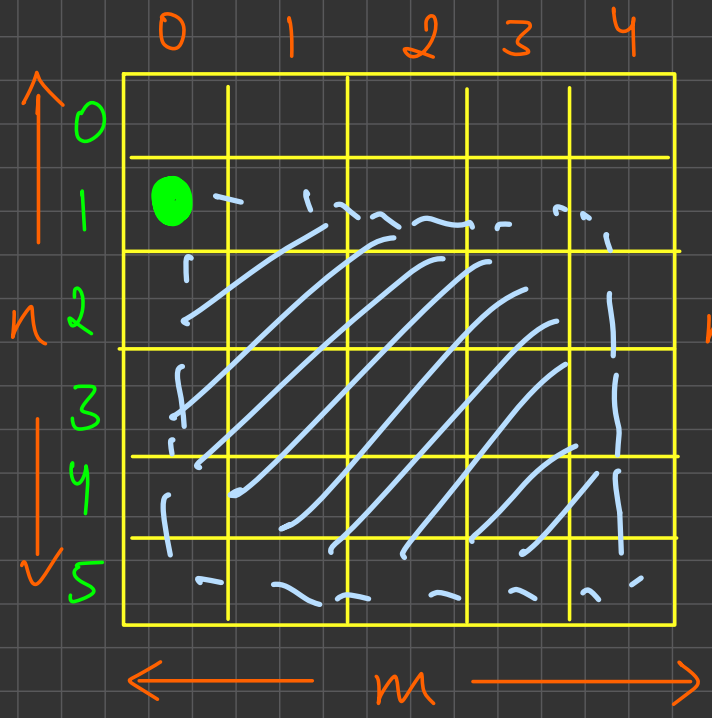
Base case

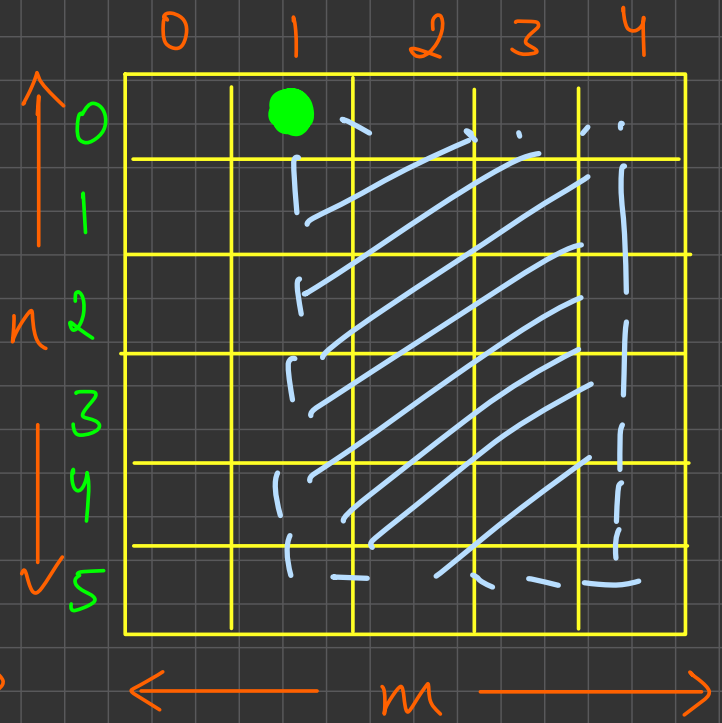
final subproblem:

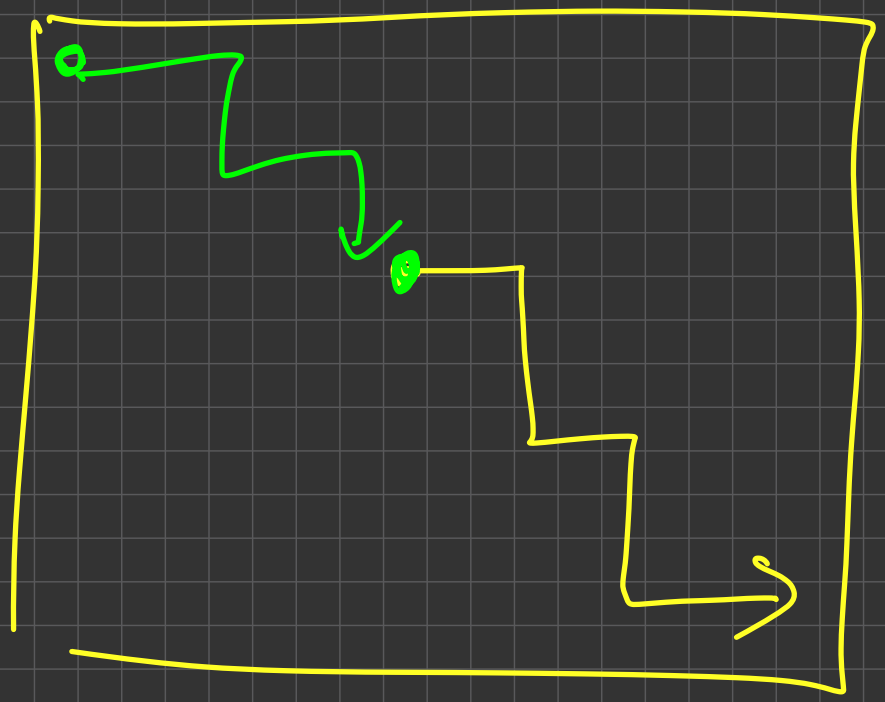
$$dp[0][0]$$



Subproblem?

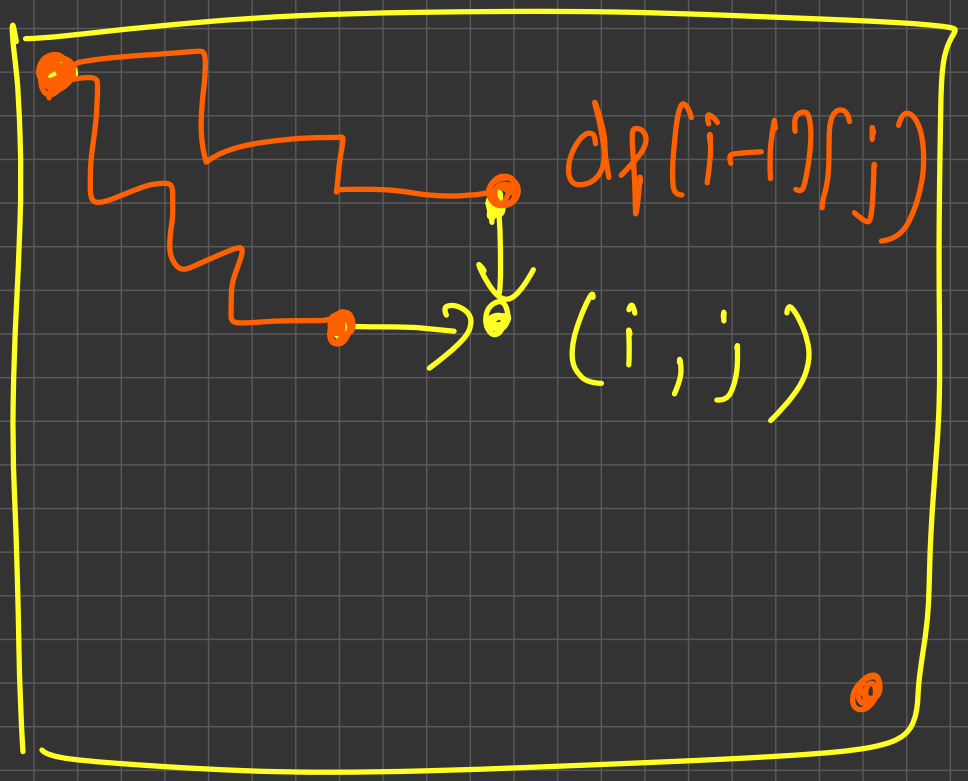






find out min path from (0, 0) to (n-1, m-1)

dp[i][j] = min sum path from (0,0) to (i, j)



$$dp[i][j] = \min \begin{cases} dp[i-1][j] \\ dp[i][j-1] \end{cases} + grid[i][j]$$

Base Case : $dp[0][0] = grid[0][0]$

final subproblem: dp[n-1][m-1]

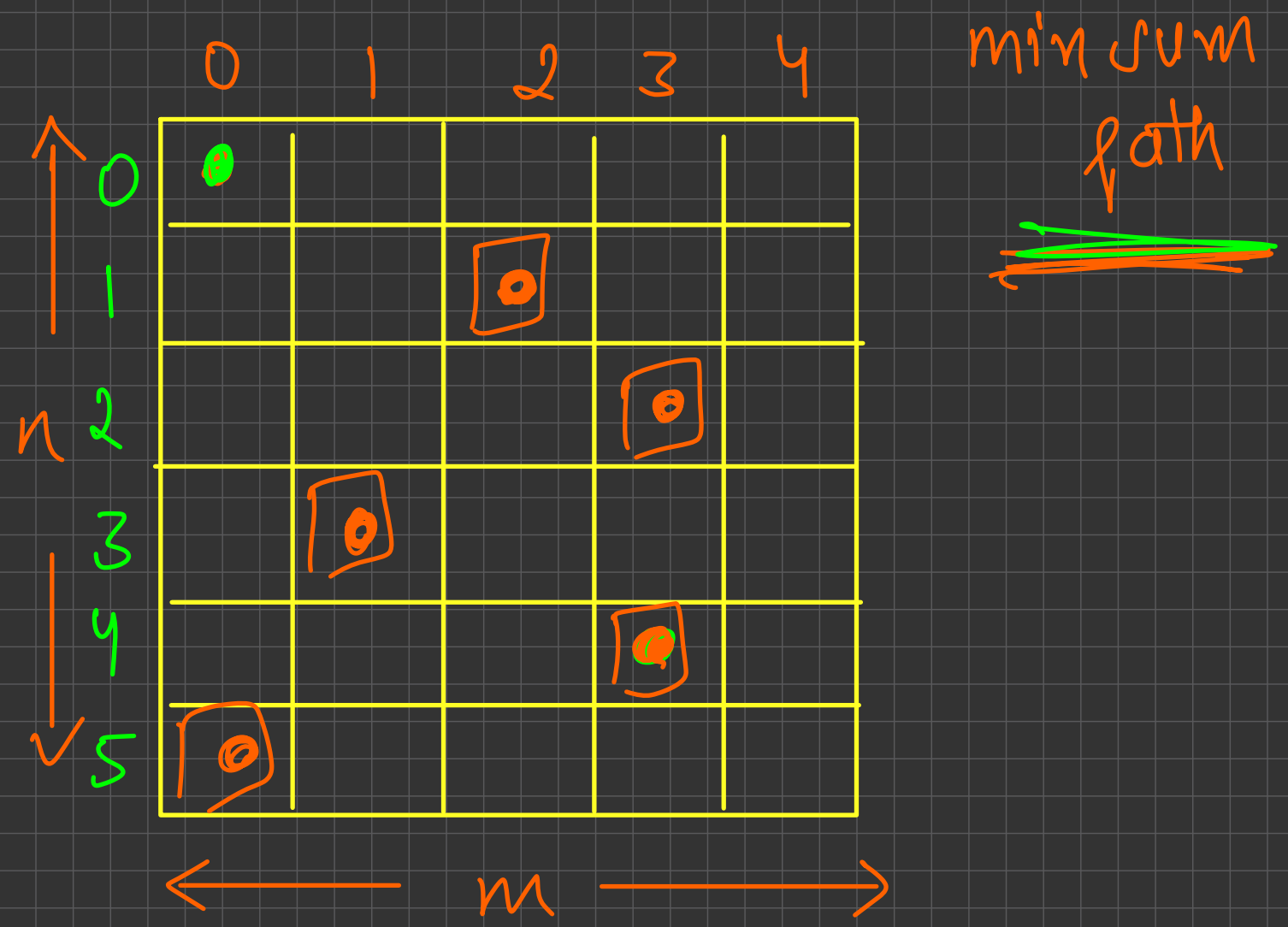
① { max. min / no. of ways }

② avoiding obstacles — no. of ways

③ including 1 checkpoint

④ without dp (not covered in this lecture)

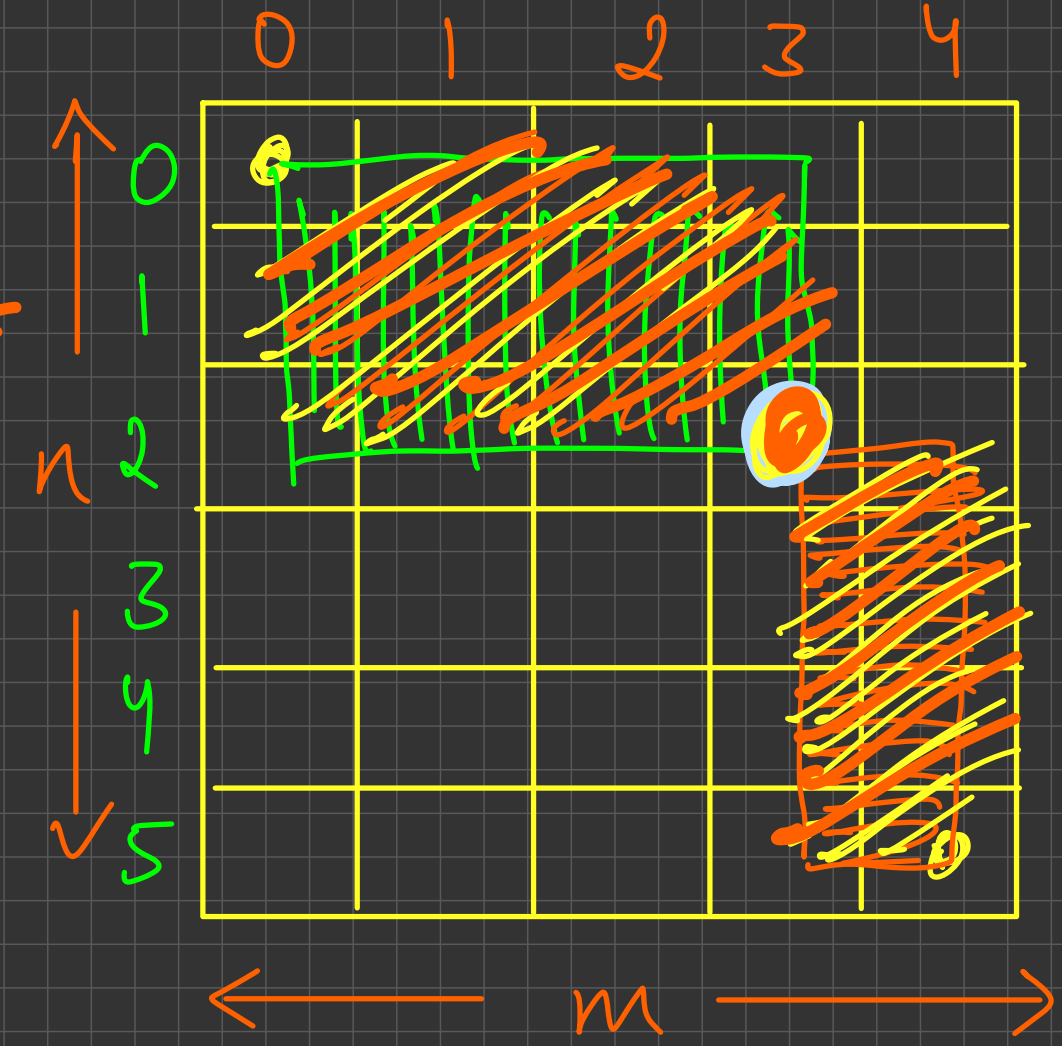
⑤ multiple checkpoints



min sum path

dp[i][j] = min sum path to go from (i,j) to (n-1, m-1)

dp[i][j] = inf if (i, j) is an obstacle



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min / =

max / =

no. of ways

(0,0) to (i,j) x

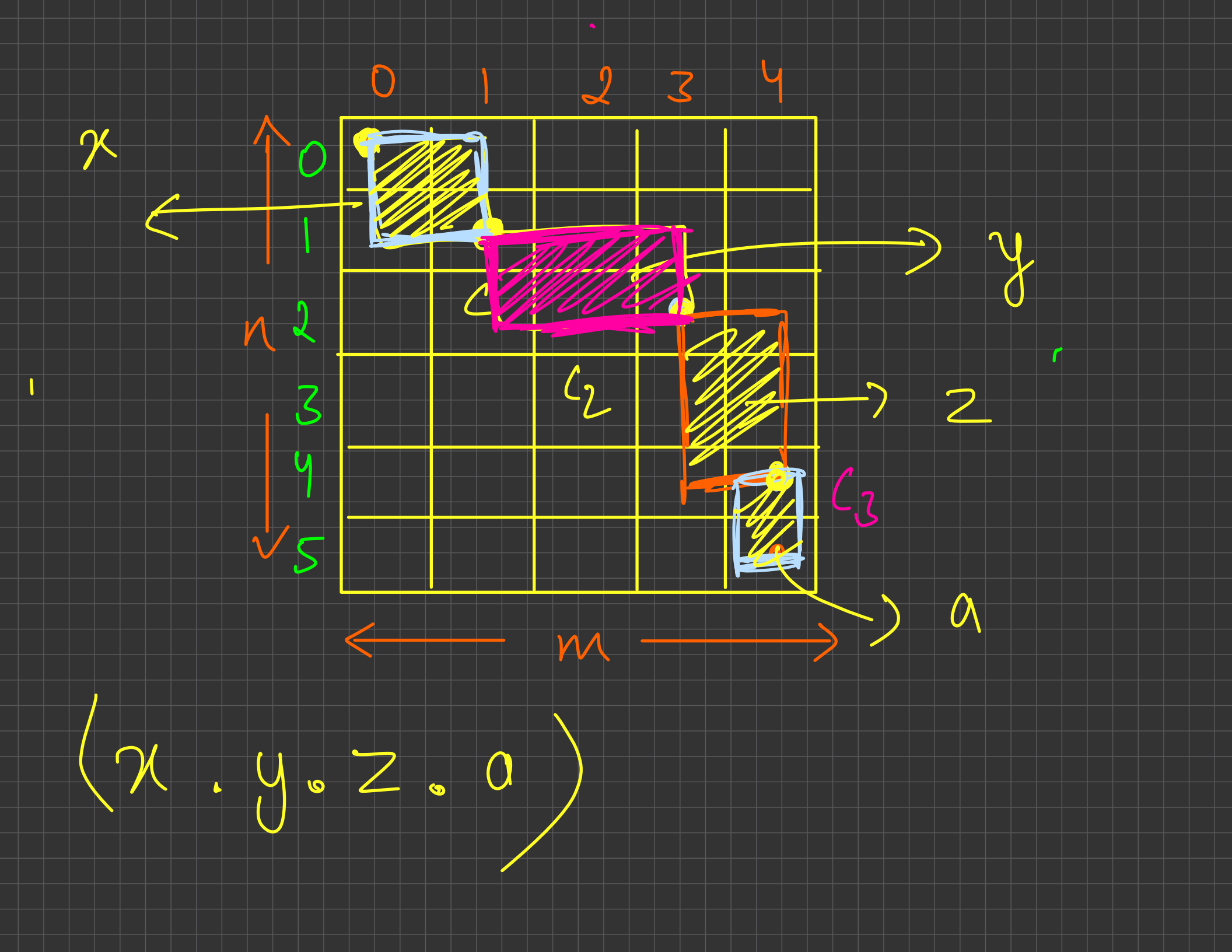
(i,j) to (n-1, m-1) y

ans for (i,j) = x+y - grid[i][j]

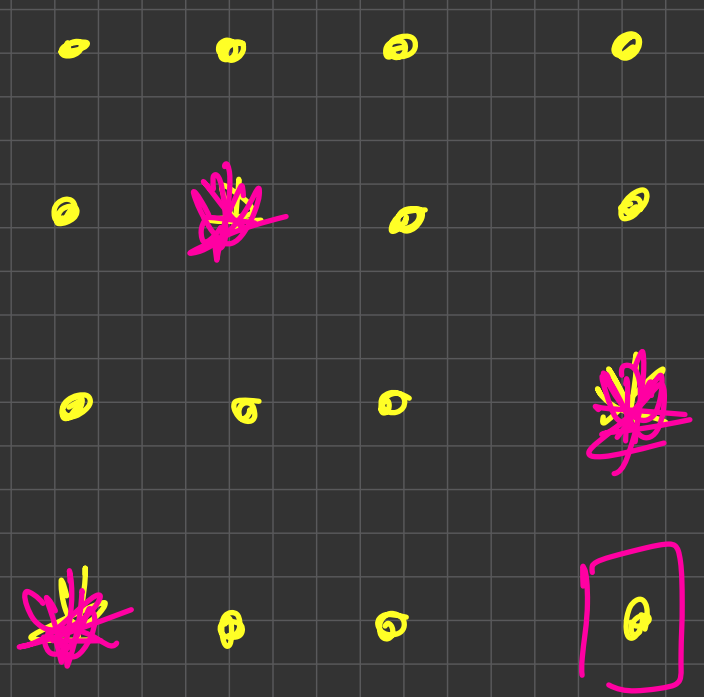
dp1[i][j] = min sum path from (0,0) to (i,j)

dp2[i][j] = min sum path from (i,j) to (n-1, m-1)

final ans : dp1[ci][cj] + dp2[ci][cj] - grid[ci][cj]



(x, y, z, a)



$dp[i][j]$ = no. of ways to go from (i, j) to $(n-1, m-1)$

state

$n \times m$

$n \times n$

transition

$$dp(i)(j) = dp(i+1)(j) + dp(i)(j+1)$$

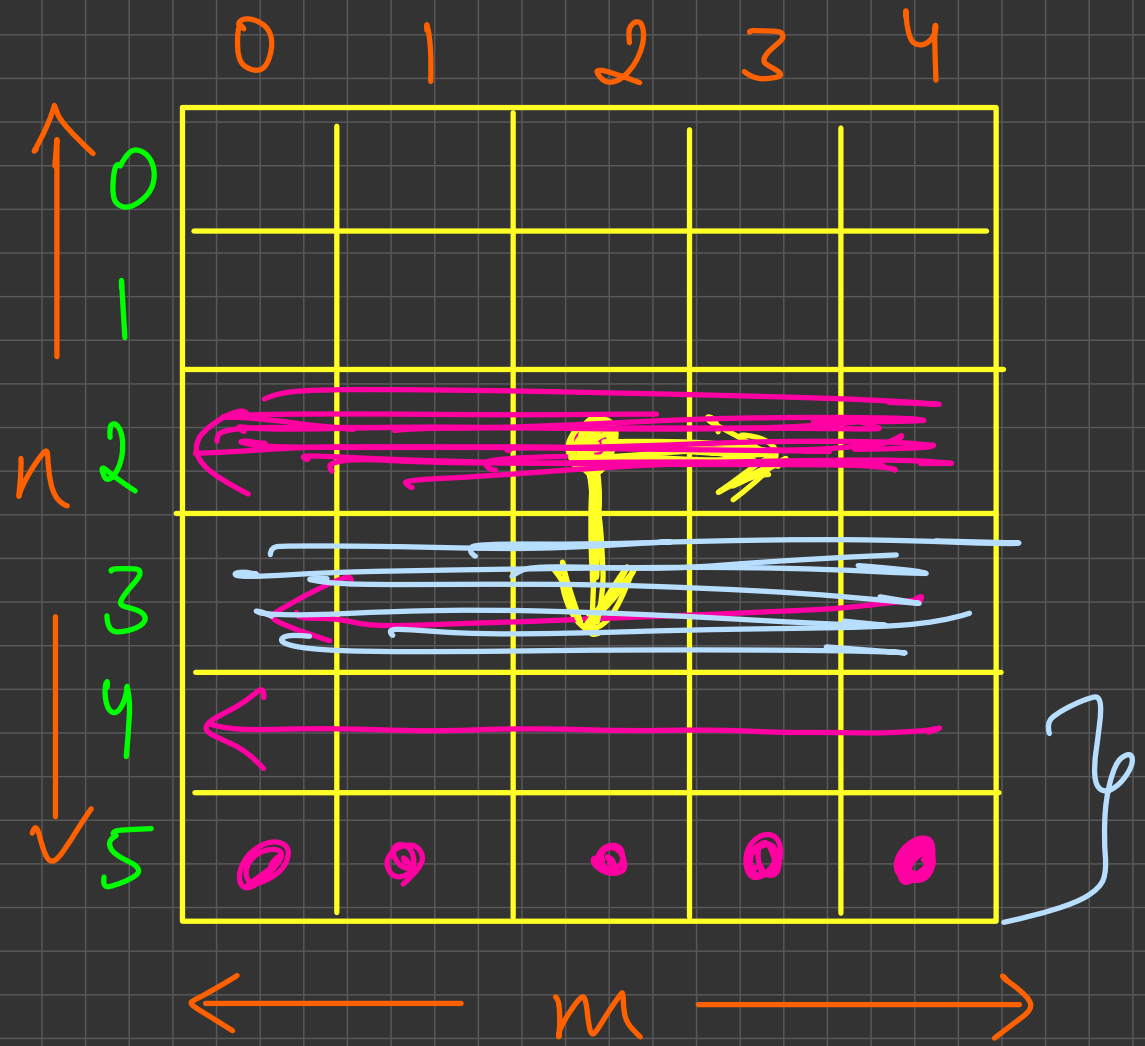
$dp(n-1)(n-1)$ { 1 o/w ; 0 obstacle

Base case

$dp(0)(0)$ find subproblem

time complexity : $O(n^2)$

space complexity : $O(n^2)$


0 1 2 3 4
0
1
n 2
3
4
5
m