

Rat in a maze



Count all the ways to reach the destination in a maze.



Enumeration backtracking

We have a 2D maze where 0 represents clear path (path which we can travel) and -1 represents blockage.

	0	1	2	3
0	0	0	0	0
1	0	-1	0	0
2	-1	0	0	0
3	0	0	0	0

Source (0,0) → Destination (3,3)

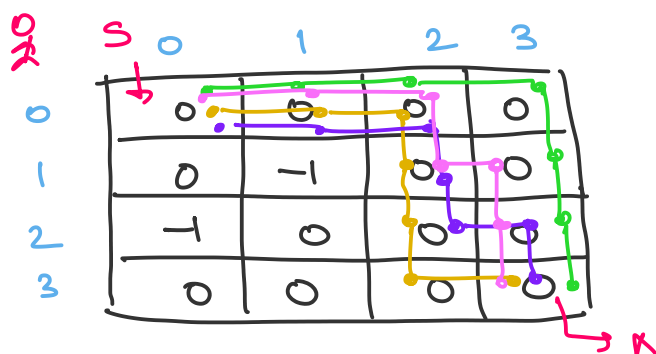
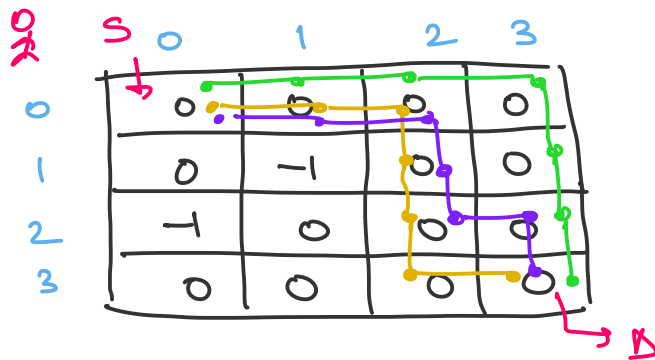
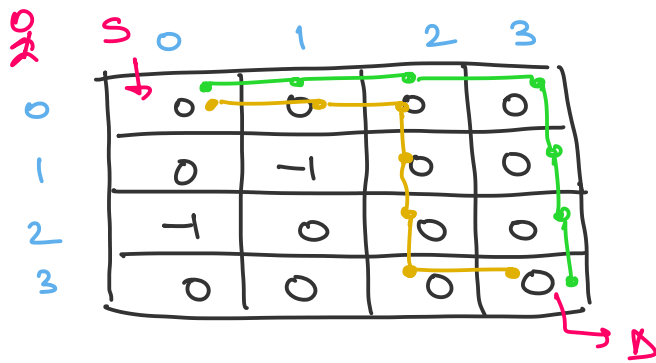
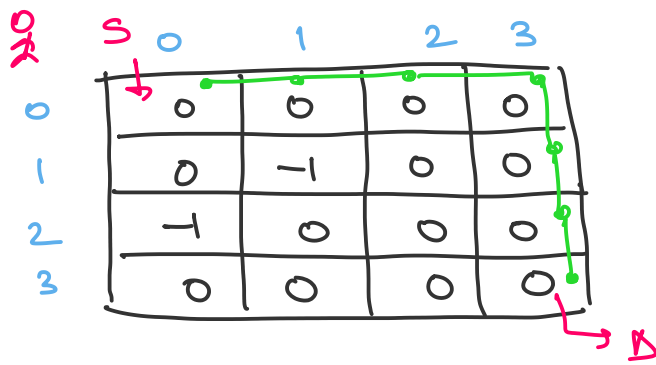
maze

Source - Starting point -  $\text{maze}[0][0]$

Destination - Exit point -  $\text{maze}[n-1][n-1]$

Source -  $\text{maze}[0][0]$

Destination -  $\text{maze}[3][3]$



Total paths = 4

- Green
- Yellow
- Purple
- Pink

	S	0	1	2	3
0	↓	0	0	0	0
1	↓	0	-1	0	0
2	-1	0	0	0	0
3	0	0	0	0	0

we can move in 2 directions

- ↗ Right
- ↘ Bottom

$(0, 0)$   $\xrightarrow{\text{Right}}$   $(0, 1)$   
 $(i, j)$   $\xrightarrow{\text{Right}}$   $(i, j+1)$

$(2, 0)$   $\xrightarrow{\text{Right}}$   $(2, 1)$   
 $(i, j)$   $\xrightarrow{\text{Right}}$   $(i, j+1)$

$(1, 2)$   $\xrightarrow{\text{Left}}$   $(1, 1)$   
 $(i, j)$   $\xrightarrow{\text{Left}}$   $(i, j-1)$

$(1, 0)$   $\xrightarrow{\text{Bottom}}$   $(2, 0)$   
 $(i, j)$   $\xrightarrow{\text{Bottom}}$   $(i+1, j)$

$$\begin{array}{ccc} (0,3) & \xrightarrow{\text{Bottom}} & (1,3) \\ (i,j) & & (i+1,j) \end{array}$$

$$\begin{array}{ccc} (2,2) & \xrightarrow{\text{Top}} & (1,2) \\ (i,j) & & (i-1,j) \end{array}$$

we need to take care of 2 things-

1. Increment the count if path is possible in bottom or right direction.  
 $(i, j+1)$        $(i+1, j)$

2. Check for the blockage

$$\text{maze}[i][j] == -1$$



Blockage



we cannot move

$$\text{if } (\text{maze}[i][j] > 0)$$



clear path

## Base case

1. Return if source is blocked

if (maze[0][0] == -1)

↓  
return

2. If the destination is blocked then return 0.

if (maze[n-1][n-1] == -1)

## Steps—

1. If current cell has a blockage then do not change.

if (maze[i][j] == -1)

↓  
continue

2. If we can move to maze[i][j] from maze[i-1][j] then increment the count.

if (maze[i-1][j] > 0)

{

$$\text{maze}[i][j] = \text{maze}[i][j] \\ + \text{maze}[i-1][j]$$

}

3. If we can move to maze[i][j] from maze[i][j-1] then increment the count.

if (maze[i][j-1] > 0)

{

$$\text{maze}[i][j] = \text{maze}[i][j] \\ + \text{maze}[i][j-1]$$

}