Spiral Matrix

Wednesday, January 14, 2026 11:28 PM

1. The Goal

Return all elements of a matrix in a specific spiral order: Right → Down → left → Up, repeating until all elements are visited.

2. The Core Intuition

Imagine the matrix is a room surrounded by 4 walls.

- Top wall (top): Starts at row 0.
- Bottom wall (bottom): starts at the last row.
- left wall (left): Starts at Col 0
- Right wall (right): Starts at the last Col.

The Strategy:

1. Walk along the Top wall (left to right), then move the wall down (top += 1).
2. Walk along the Right wall (top to bottom), then move the wall left (right -= 1).
3. Walk along the Bottom wall (right to left), then move the wall up (bottom -= 1).
4. Walk along the left wall (bottom to top), then move the wall right (left += 1).
5. Repeat until the walls meet.

The "Corner Check" (Crucial Step)

- The Trap: when you move the walls inward, they might cross each other before you finish a full cycle
- The fix: Before doing step 3 (Right to left) and 4 (Bottom to Top), you must check if the walls have already crossed.
  - If top > bottom, stop
  - If left > right, stop

Input: 3 × 3 matrix

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[1, 2, 3]
[4, 5, 6]
[7, 8, 9]
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Setup: top = 0, bottom = 2, left = 0, right = 2

Step	Action	Elements Added	Wall Update	Current Walls
1	Left → Right	1, 2, 3	top becomes 1	T:1, B:2, L:0, R:2
2	Top → Bottom	6, 9	right becomes 1	T:1, B:2, L:0, R:1
3	Right → Left	8, 7	bottom becomes 1	T:1, B:1, L:0, R:1
4	Bottom → Top	4	left becomes 1	T:1, B:1, L:1, R:1
5	Left → Right	5	top becomes 2	Stop (top > bottom)

Complexity Cheat Sheet

- Time Complexity: O(m×n)
  - we visit every cell exactly once.
- Space Complexity: O(1)
  - we only store the result list (Op don't usually count as auxiliary space). If we count output, it is O(m×n).