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class Solution {
    public List<Integer> spiralOrder(int[][] matrix) {
        List<Integer> res = new ArrayList<>();
        if (matrix == null || matrix.length == 0 || matrix[0].length == 0)
            return res;
        int l = 0, r = matrix[0].length-1, u = 0, d = matrix.length-1;

        while (true) {
            for (int i = l; i <= r; i++) {
                res.add(matrix[u][i]);
            }
            u++;
            if (u > d) break;

            for (int i = u; i <= d; i++) {
                res.add(matrix[i][r]);
            }
            r--;
            if (r < l) break;

            for (int i = r; i >= l; i--) {
                res.add(matrix[d][i]);
            }
            d--;
            if (u > d) break;

            for (int i = d; i >= u; i--) {
                res.add(matrix[i][l]);
            }
            l++;
            if (r < l) break;
        }

        return res;
    }
}

```