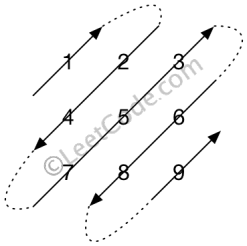
Diagonal Traverse

Given a matrix of M x N elements (M rows, N columns), return all elements of the matrix in diagonal order as shown in the below image.

Example:

```
Input:
[
 [ 1, 2, 3 ],
 [ 4, 5, 6 ],
 [ 7, 8, 9 ]
]
Output:  [1,2,4,7,5,3,6,8,9]
Explanation:
```



Note:

1. The total number of elements of the given matrix will not exceed 10,000.

Solution 1

I don't think this is a hard problem. It is easy to figure out the walk pattern.
Anyway...
Walk patterns:

- If out of `bottom border` (row >= m) then row = m - 1; col += 2; change walk direction.
- if out of `right border` (col >= n) then col = n - 1; row += 2; change walk direction.
- if out of `top border` (row < 0) then row = 0; change walk direction.
- if out of `left border` (col < 0) then col = 0; change walk direction.
- Otherwise, just go along with the current direction.

Time complexity: O(m * n), m = number of rows, n = number of columns.
Space complexity: O(1).

```
public class Solution {
    public int[] findDiagonalOrder(int[][] matrix) {
        if (matrix == null || matrix.length == 0) return new int[0];
        int m = matrix.length, n = matrix[0].length;

        int[] result = new int[m * n];
        int row = 0, col = 0, d = 0;
        int[][] dirs = {{-1, 1}, {1, -1}};

        for (int i = 0; i < m * n; i++) {
            result[i] = matrix[row][col];
            row += dirs[d][0];
            col += dirs[d][1];

            if (row >= m) { row = m - 1; col += 2; d = 1 - d;}
            if (col >= n) { col = n - 1; row += 2; d = 1 - d;}
            if (row < 0)  { row = 0; d = 1 - d;}
            if (col < 0)  { col = 0; d = 1 - d;}
        }

        return result;
    }
}
```

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Solution 2

Put all diagonal sequences from top-right to bottom-left to an array and then combine all sequence together by reversing odd sequences.

```
class Solution {
public:
    vector<int> findDiagonalOrder(vector<vector<int>>& matrix) {
        int m = matrix.size();
        if (m == 0) return vector<int>();
        int n = matrix[0].size();
        vector<vector<int>> tmp (m+n-1);
        for (int i = 0; i < m+n-1 ; i++) {
            int row = max(0, i-n+1);
            int col = min(i, n-1);
            for (; col >= 0 && row < m; row++, col--) {
                tmp[i].push_back(matrix[row][col]);
            }
        }
        vector<int> res;
        for (int i = 0; i< tmp.size(); i++) {
            if (i % 2) res.insert(res.end(), tmp[i].begin(), tmp[i].end());
            else res.insert(res.end(), tmp[i].rbegin(), tmp[i].rend());
        }
        return res;
    }
};
```

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Solution 3

```
public int[] findDiagonalOrder(int[][] matrix) {
 if (matrix.length == 0) return new int[0];
 int h = matrix.length, w = matrix[0].length, id = 0;
 int[] res  = new int[h*w];
 for (int i = 0; i < h+w; i++) {
  // find lower bound and upper bound
  int lb = (int)Math.max(0, i-w+1), ub = (int)Math.min(i,h-1);
  if (i%2 == 0) for (int j = ub; j >= lb; j--) res[id++] = matrix[j][i-j];
  else for (int j = lb;j <= ub; j++) res[id++] = matrix[j][i-j];
 }
 return res;
}
```

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