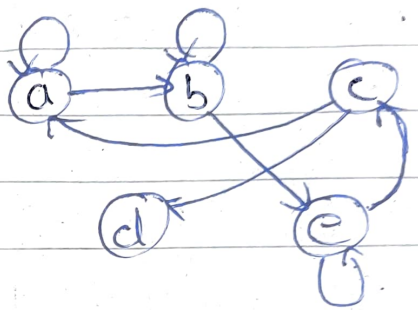
Advanced Data Structure

Finding number of islands in a 2D matrix using disjoint set data structure.

```
    0  1  2  3  4
a 0 [[1, 1, 0, 0, 0]
b 1  [0, 1, 0, 0, 1]
c 2  [1, 0, 0, 1, 1]
d 3  [0, 0, 0, 0, 0]
e 4  [1, 0, 1, 0, 1]]
```



1. Initialize count of islands = 0
2. Traverse each index of 2D matrix
3. If the value at the index is 1, check all its neighbours.
   If a neighbour is also equal to 1, take union of index and its neighbour
4. Define ~~parent~~ an array to store frequencies of all sets (size = row * column)
5. Now traverse the matrix again
6. If the value at index is 1, find its set
7. If the frequency of the set in above array is 0, increment the ~~se~~ result be 1

```
class DisjointSet {
 public DisjointSet() {
  }                                  // Implement
                                        Union-Find
 int find(int x) {}
 void union(int x, int y) {}
};

int countIslands(a[][]) {
   n = number of rows
   m = number of columns

// Loop for checking every cell in matrix
 for(int j=0; j<n; j++) {
    for(int k=0; k<m; k++) {

       // If cell is 0, nothing to do
        if(a[j][k]==0)
           continue;
       //else check all 8 neighbours
          for value 1
       // If value of neighbour is 1, unite to
          make one set
```

// Possible 8 conditions for 8 neighbours

1. (j+1<n && a[j+1][k]==1)
2. (j-1>=0 && a[j-1][k]==1)
3. (k+1<m && a[j][k+1]==1)
4. (k-1>=0 && a[j][k-1]==1)
5. (j+1<n && k+1<m && a[j+1][k+1]==1)

```
6 (j+1<n && k-1>=0 && a[j+1][k-1]==1)
7 (j-1>=0 && k+1<m && a[j-1][k+1]==1)
8 (j-1>=0 && k-1>=0 && a[j-1][k-1]==1)

// Create an array to note down frequency
int *c = new int[n*m];
int countIslands=0;

for(int j=0; j<n; j++){
    for(int k=0; k<m; k++){

        if(a[j][k]==1){

            //Find parent
            int x = find(j*m+k);

            // If frequency is zero, increment count
            if(c[x]==0){
                countIslands++;
                c[x]++;
            }
            else
                c[x]++;
        }
    }
}
return countIslands;
}
```