CSCE 750
11/7/23

Disjoint set systems

~~Collection~~ n items grouped into sets so that each item is in exactly one set.

Operations:

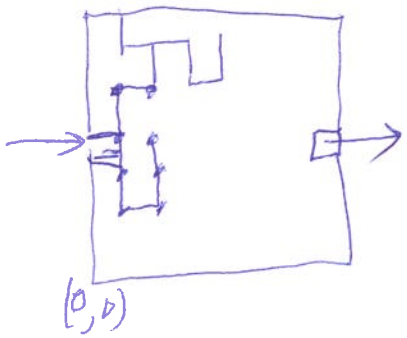
MakeSet(x) — introduce x (new item) into the system being a member of a singleton set $\{x\}$

Find(x) — return a unique representative item in the set containing x.
[x is accessed externally]

Union(x, y) — merge the set containing x with the set containing y into a single set (the union)

Note: x & y are in the same set iff Find(x) = Find(y).

Application: Building a random maze



Want: - every cell is reachable from the entrance
- unique simple path from entrance to exit.

Random Maze construction;
Items are cells (including entrance & exit cells)

~~Walls are lines~~

A wall is a line separating two adjacent cells

For each cell c,
    MakeSet(c)

~~Do n-1 t~~

merge_count := 0
while merge_count < n-1 do // n = # cells
    choose a random wall separating
        cells c_1 & c_2
    If Find(c_1) ≠ Find(c_2) then
        Union(c_1, c_2)
        merge_count ++
    end if
end while

Implementation?
Implement a set as a linked list
    Union in O(1) time for doubly linked circular list
    Find in O(n) time if use last item as rep.

Disjoint set forest