

CSE 373 Optional Section Union Find, Homework 4

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Agenda

- Candy
- Interview Question
- Geopolitical Union Find
- Homework 4

Interview Question

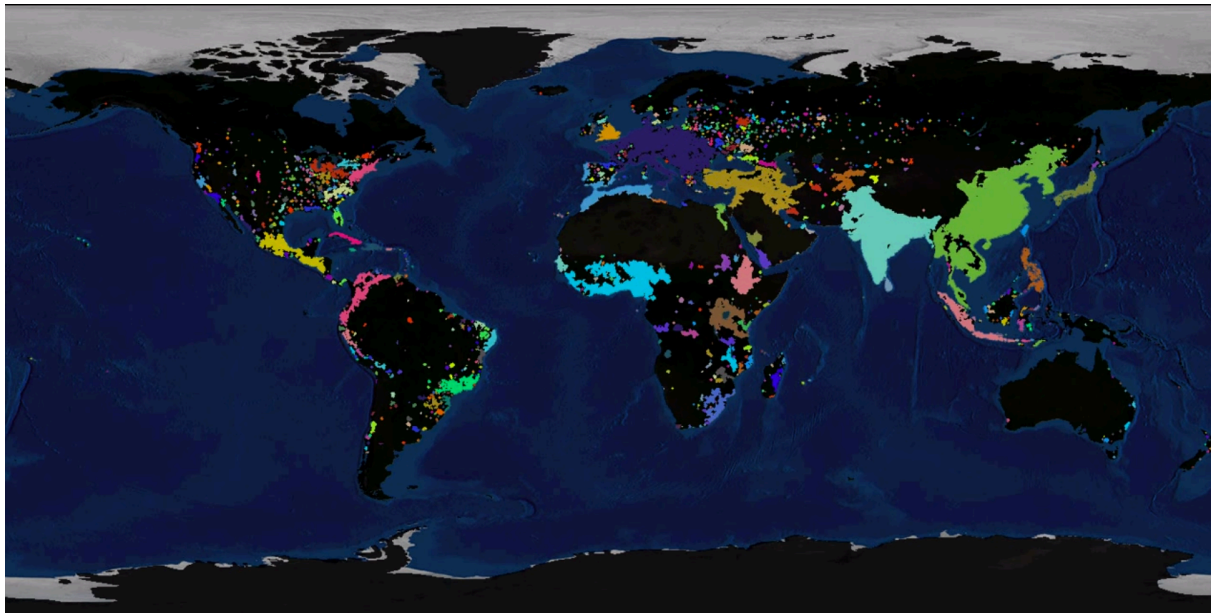
- **Social network connectivity.** Given a social network containing N members and a log file containing M timestamps at which times pairs of members formed friendships, design an algorithm to determine the earliest time at which all members are connected (i.e., every member is a friend of a friend of a friend ... of a friend). Assume that the log file is sorted by timestamp and that friendship is an equivalence relation. The running time of your algorithm should be $M \log N$ or better and use extra space proportional to N .

Interview Question 2

- **How can I test if a singly-linked list is a palindrome?**

Geopolitical Union Find

- http://www.youtube.com/watch?v=NvQtlusaEqM&list=PLOzUGhfPIMJzUf9_yqnNWKuNUjlTK0YCv&index=1



Homework 4

- What numbers do we care about?
 - How many rooms are in the maze?
 - Height or Number of Rows
 - Width or Number of Columns
 - How many interior walls
 - How many exterior walls
- What are dimensions of any 2D collections?

Homework 4

- By the numbers
 - For a maze with 4 rows and 5 columns:
 - 20 total rooms
 - 49 walls
 - 31 interior walls
 - 16 vertical interior walls (4 x 4)
 - 15 horizontal interior walls (3 x 5)

Homework 4

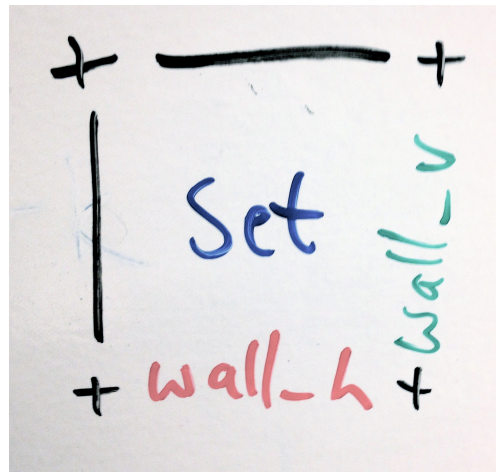
- By the numbers
 - For a maze with 3 rows and 7 columns:
 - 21 total rooms
 - 52 walls
 - 32 interior walls
 - 18 vertical interior walls (3 x 6)
 - 14 horizontal interior walls (2 x 7)

Homework 4

- What data structures do we want?
 - A UnionFind array that has each room's set
 - Something to keep track of walls
 - Recommendation:
 - Have two arrays, one for vertical and one for horizontal

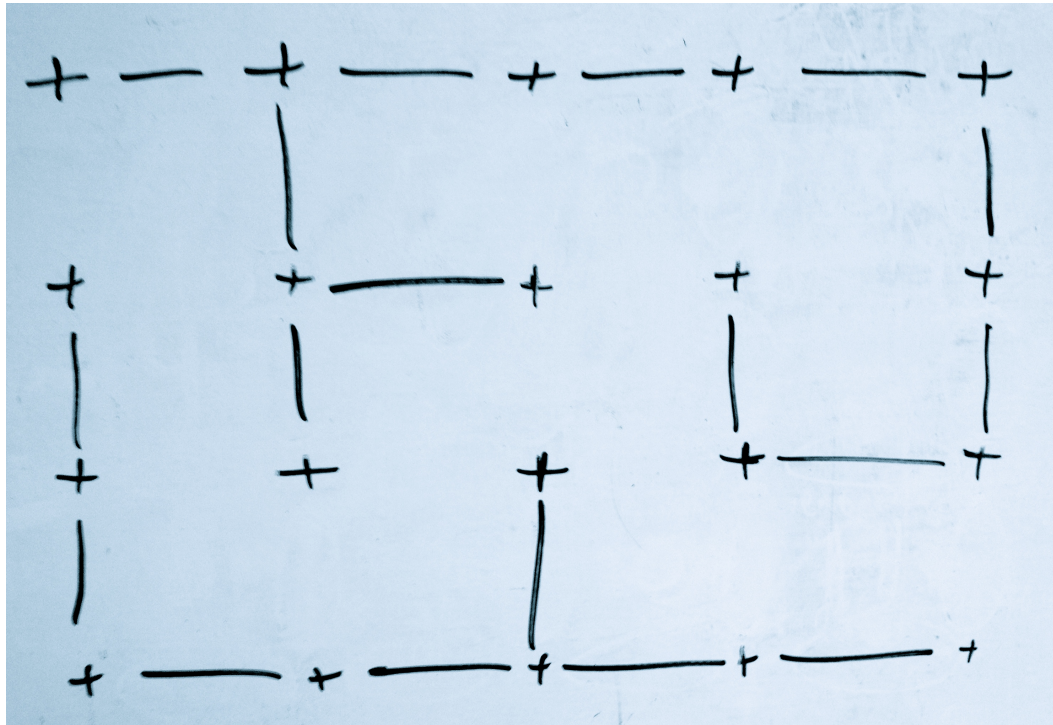
Homework 4

- How to visualize the selection.
 - Each room is responsible for knowing its set and its walls left of and below it.



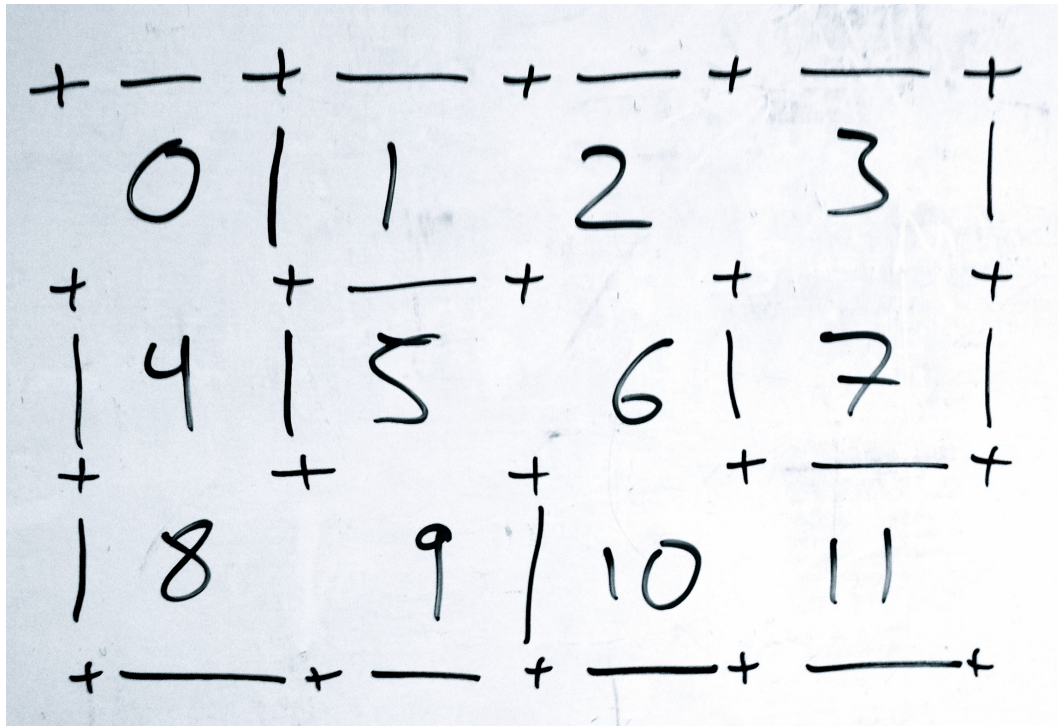
Homework 4

- Thereby for a maze (height = 3, width = 4):



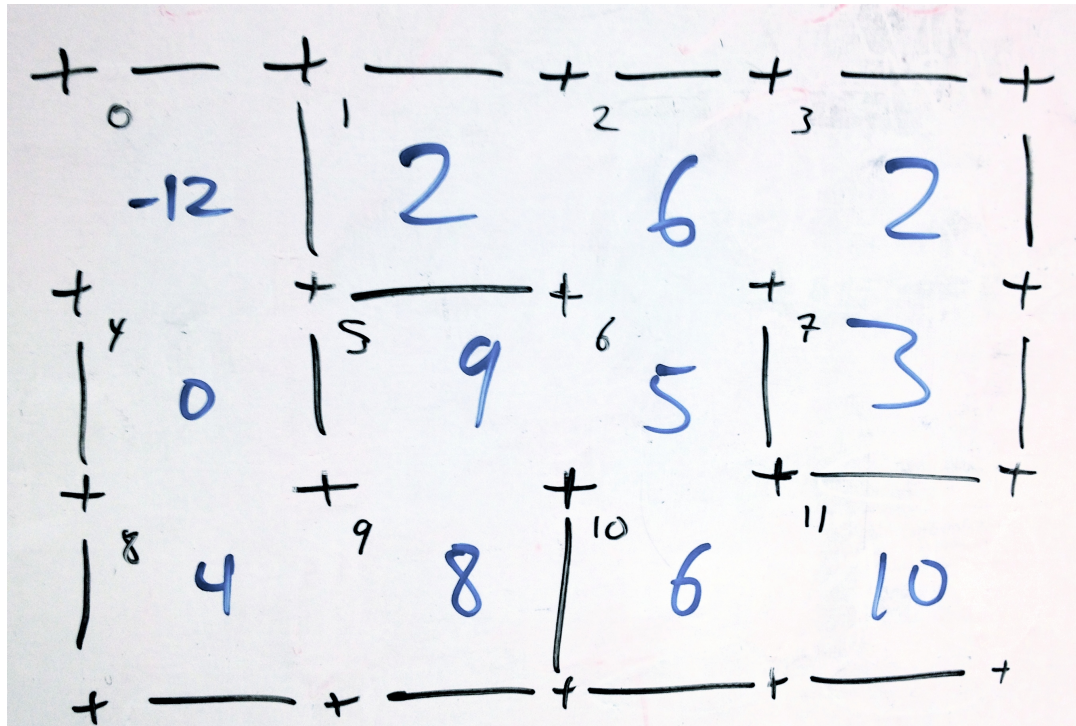
Homework 4

- The rooms are numbered like this:



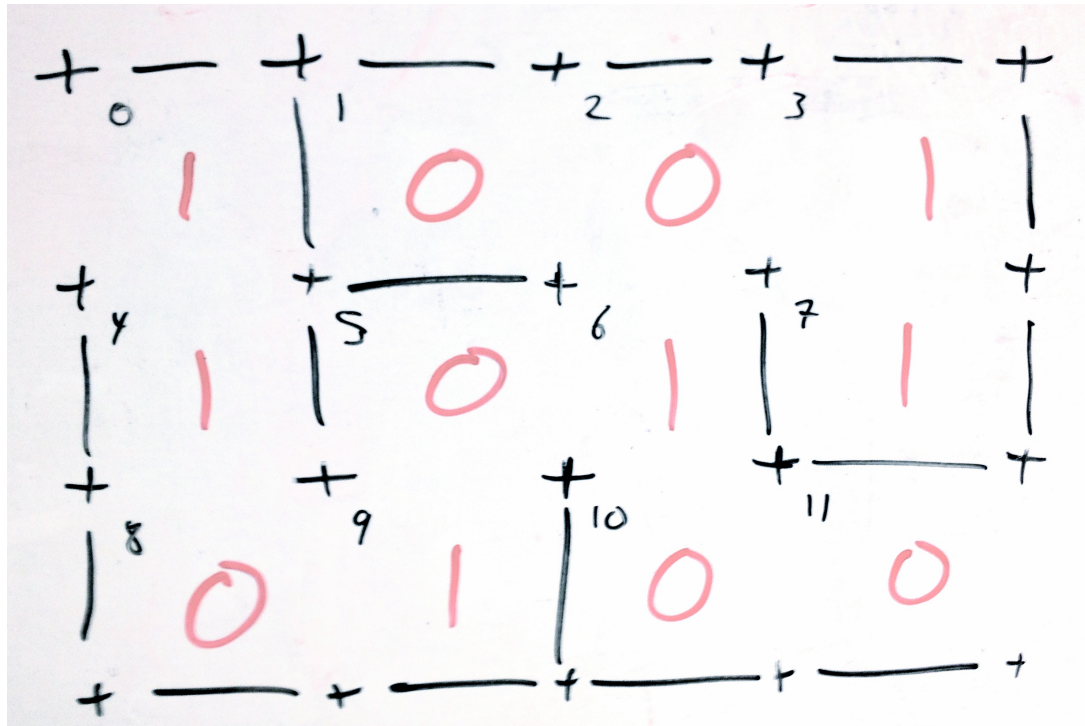
Homework 4

- After uniting all of the nodes, the UnionFind array looks like this:



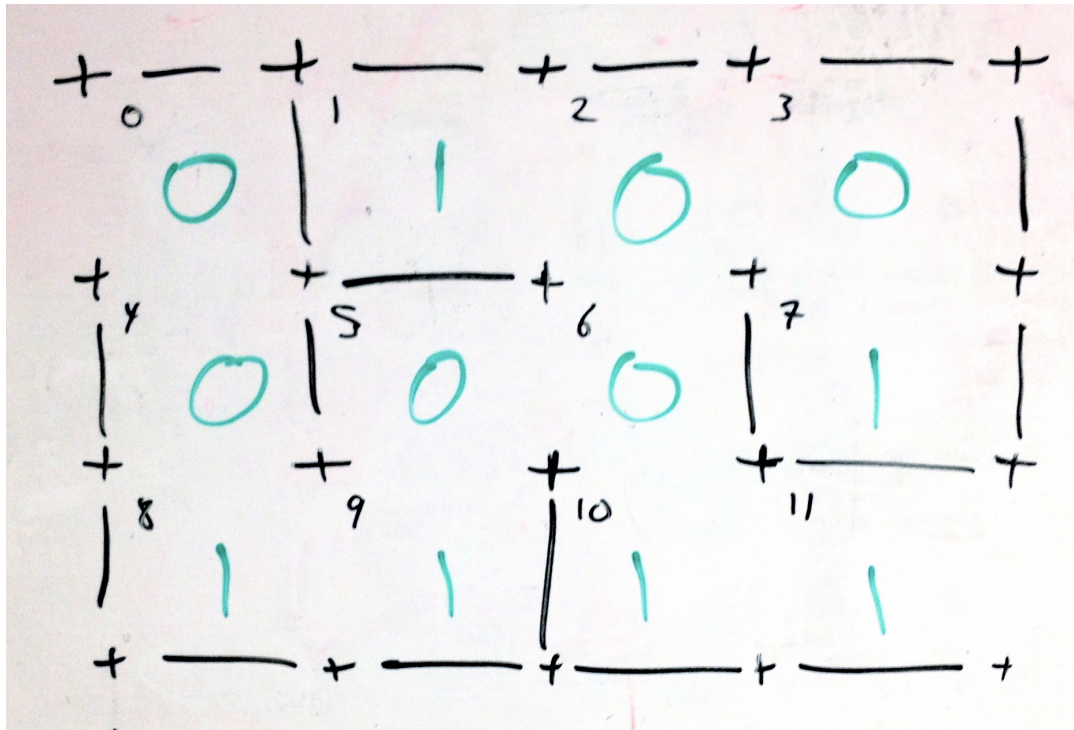
Homework 4

- The walls to the left of each room are valued as such (1 means that the wall is in the maze)



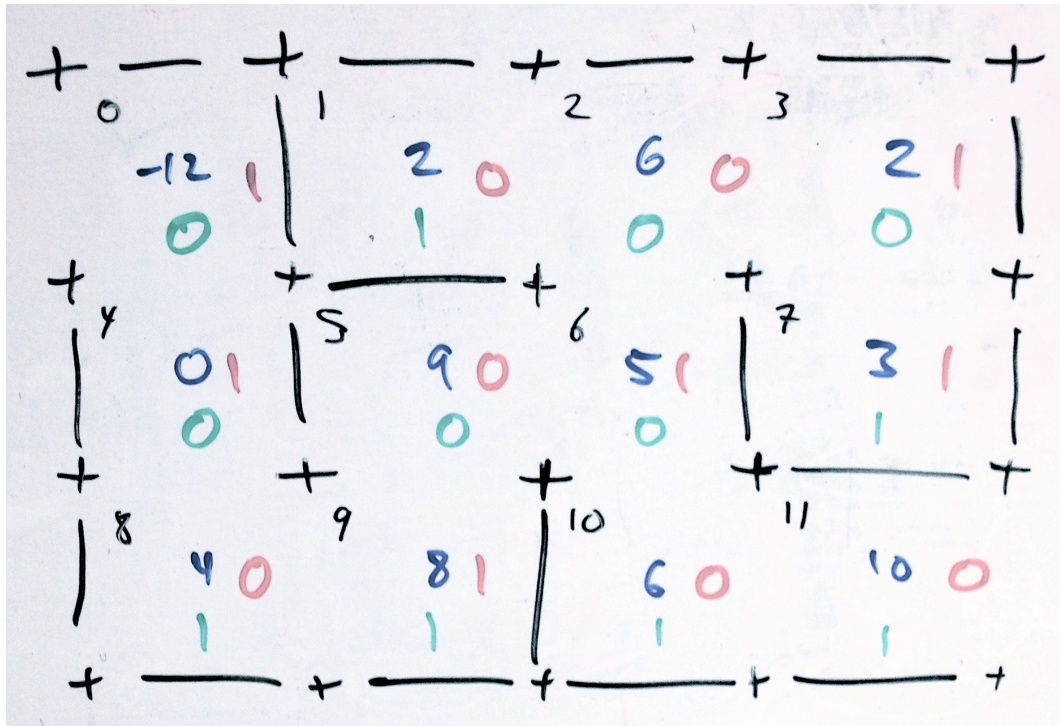
Homework 4

- Likewise, for the horizontal walls below each room:



Homework 4

- All together, the numbers for the rooms and the walls look like this:



Homework 4

- With 3 arrays that look like this:

index	0	1	2	3	4	5	6	7	8	9	10	11
set	-12	2	6	2	0	9	5	3	4	2	6	10
wall_h	0	1	0	0	0	0	0	1	1	1	1	1
wall_v	1	0	0	1	1	0	1	1	0	1	0	0

Homework 4

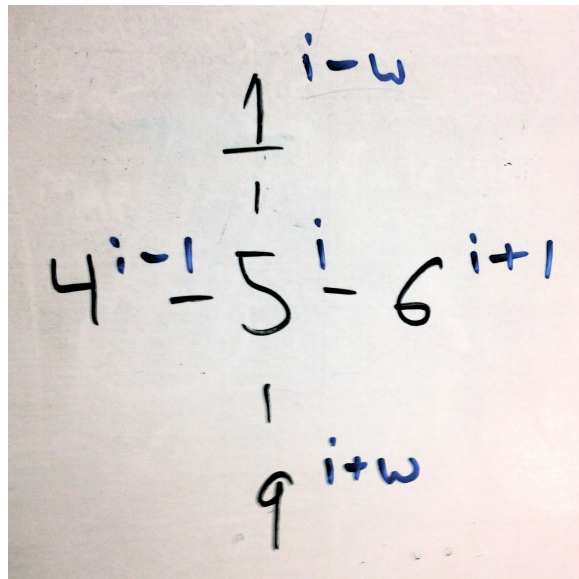
- Now that you have your data structures you want to make your mazes!
- Find walls to remove
 - Find at random, rooms, walls, and/or neighbors
 - Make sure you want to remove it
 - Its neighbors are disjoint but adjacent
 - Its not exterior
 - Remove it, mark it in your array for vertical or horizontal walls arrays, and check if you should continue removing walls

Homework 4

- To show your mazes:
 - Make the top row of walls
 - For each row
 - Make a row of rooms and vertical walls
 - Make a row of horizontal walls below this row of rooms
 - Make sure that you have an opening at the entrance and exit

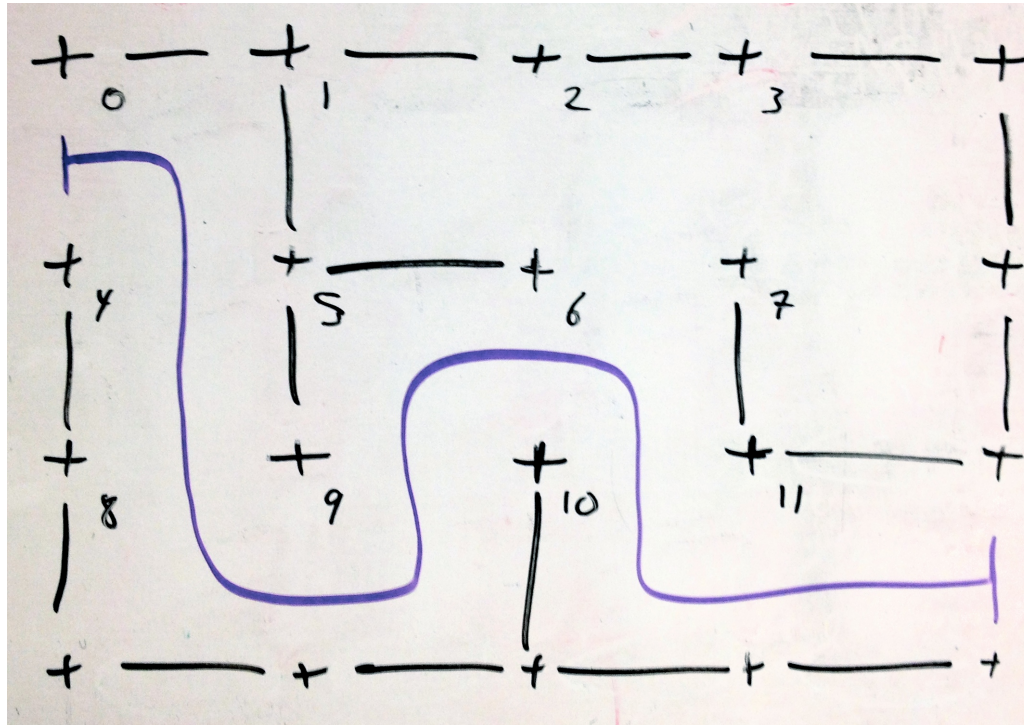
Homework 4

- Checking for adjacency where w is the width and i is the index of your room. Make sure to not modify or jump over exterior walls.



Homework 4

- The solution is 0 4 8 9 5 6 10 11



Homework 4

- If you remove any interior wall there will be a cycle:

