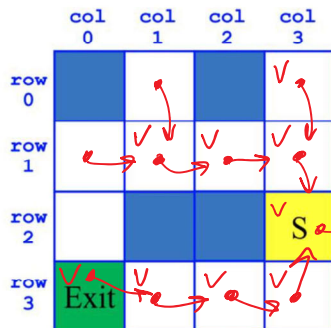


PA2 due tomorrow

## 2D Search

## Breadth-First Search (BFS)

Guaranteed shortest path



## SearchForTheExit

Initialize a Queue to hold Squares as we search  
 Mark starting square as visited  
 Enqueue starting square on Queue  
 While Queue is not empty  
   Dequeue square sq from Queue  
   Mark sq as visited  
   If sq is the Exit, we're done!  
   For each of square's unvisited neighbors (S, W, N, E):  
     Set neighbor's previous to sq  
     Enqueue neighbor to Queue

```
class Square {
    boolean visited;
    Square previous;
}
```

```
class Node {
    boolean visited;
    Node next;
}
```

Worklist

S	W	N	E
1	2	3	4

Run through the SearchForTheExit algorithm. Draw the queue.

Front → ~~(2,3)~~ ~~(3,3)~~ ~~(1,3)~~ ~~(3,2)~~ ~~(1,2)~~ ~~(0,3)~~ ~~(3,1)~~ ~~(1,1)~~  
 (3,0) (1,0) (0,1)

path → (3,0) → (3,1) → (3,2) → (3,3) → (2,3) → null  
           5          4          3          2          ↓  
           exit                                Start

use stack  
for reverse

How many nodes were visited?

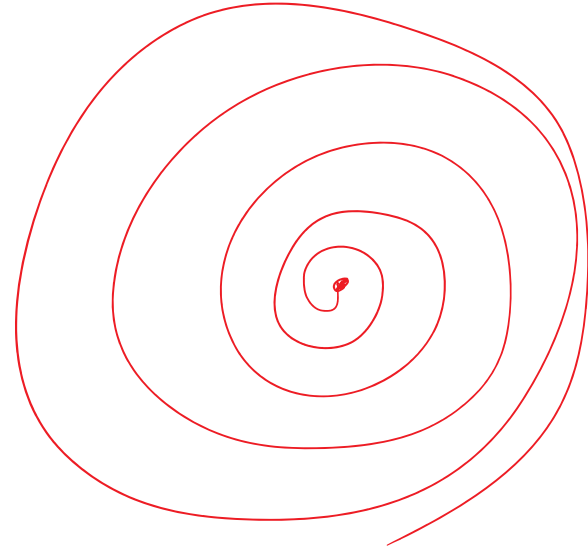
9

How many total squares were added to the queue?

11

Was this the shortest path?

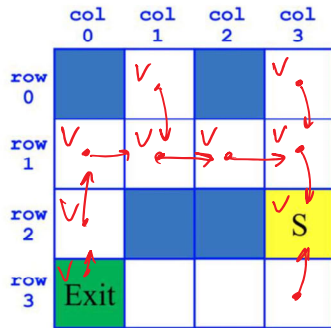
yes



## Depth-First Search (DFS)

Will always find a path. Possibly faster.

```
class Square {
    boolean visited;
    Square previous;
}
```



Work it

### SearchForTheExit

Initialize a **Stack** to hold Squares as we search  
 Mark starting square as visited  
**Push** starting square on **Stack**  
 While **Stack** is not empty  
     **Pop** square sq from **Stack**  
     Mark sq as visited  
     If sq is the Exit, we're done!  
     For each of square's unvisited neighbors (S, W, N, E):  
         Set neighbor's previous to sq  
         **Push** neighbor to **Stack**

S W N E  
 4 3 2 1

Run through the SearchForTheExit algorithm. Draw the stack.

bottom → ~~(2,3)~~ ~~(3,3)~~ ~~(1,3)~~ ~~(1,2)~~ ~~(0,3)~~ ~~(1,1)~~ ~~(1,0)~~ ~~(0,1)~~ ← top  
 (2,0) (3,0)

exit → (3,0) → (2,0) → (1,0) → (1,1) → (1,2) → (1,3) → (2,3) → null  
 7 6 5 4 3 2 1

How many nodes were visited?

9

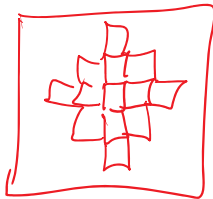
How many total squares were added to the stack?

10

Was this the shortest path?

no

BFS



DFS

