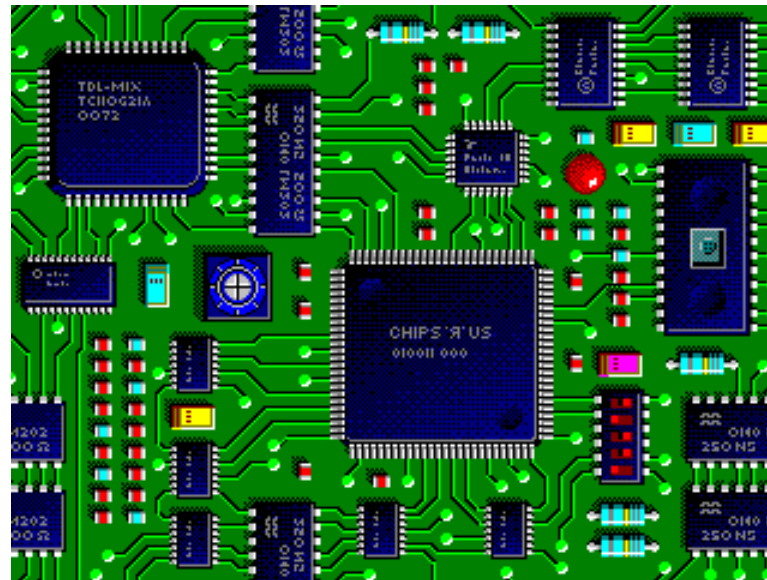


# Lee's Wire Routing Algorithm

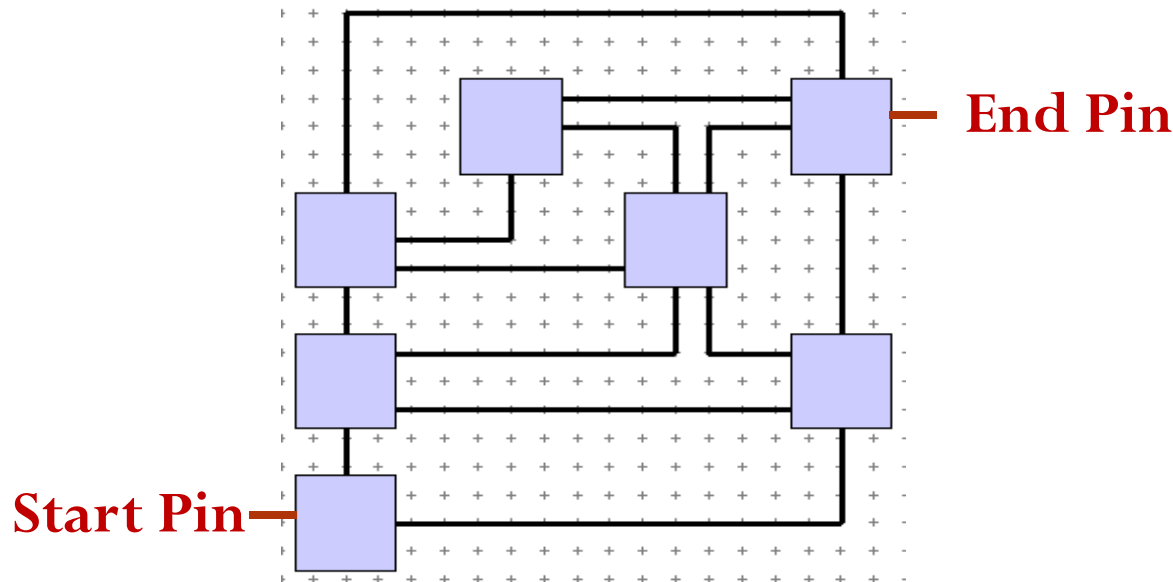
# Application of Queue: Wire Routing

- Select paths to connect all pairs of pins that need to be connected together.
- An important problem in **electronic design automation**.



# A Simplified Problem

- Condition: We have all blocks laid on the chip. We also have some of the wires routed.
- Problem: We want to connect the next pair of pins.
- Constraint: we can only draw wires **horizontally** or **vertically**.



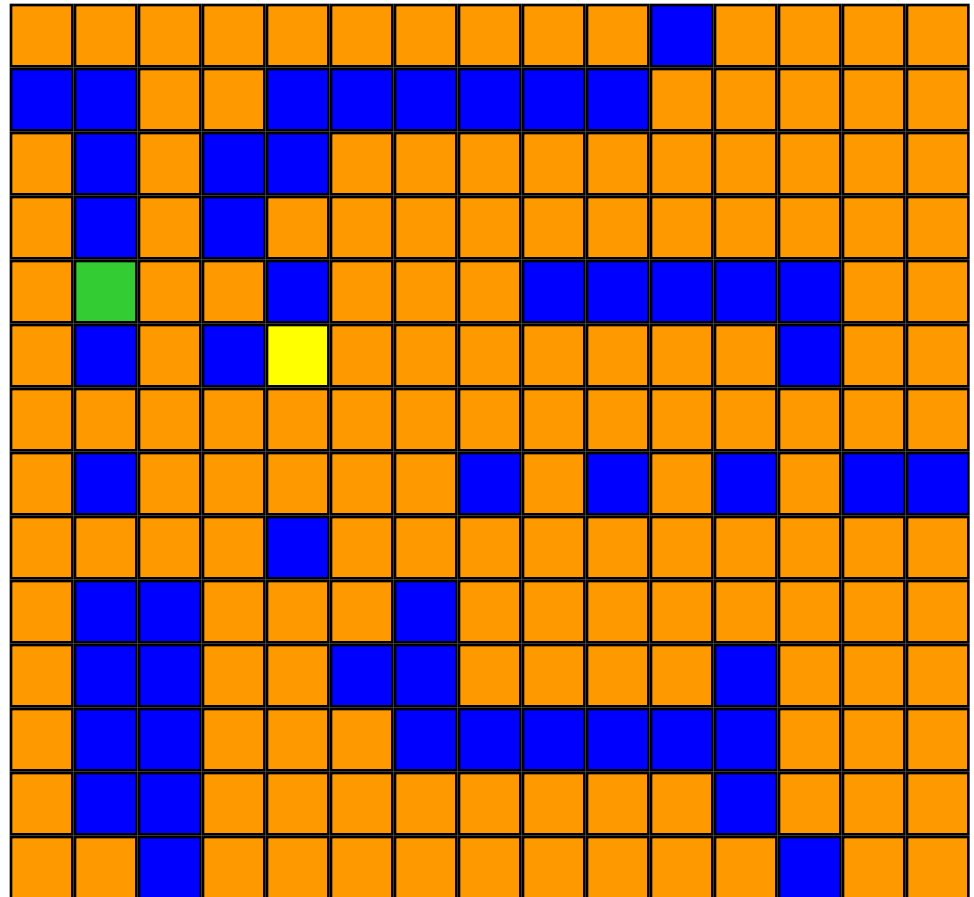
# Modeling as a Grid

 Start Pin

 End Pin

- Blue squares are **blocked** squares.
- Orange squares are **available** to route a wire.

How to find a path from the start pin to the end pin?




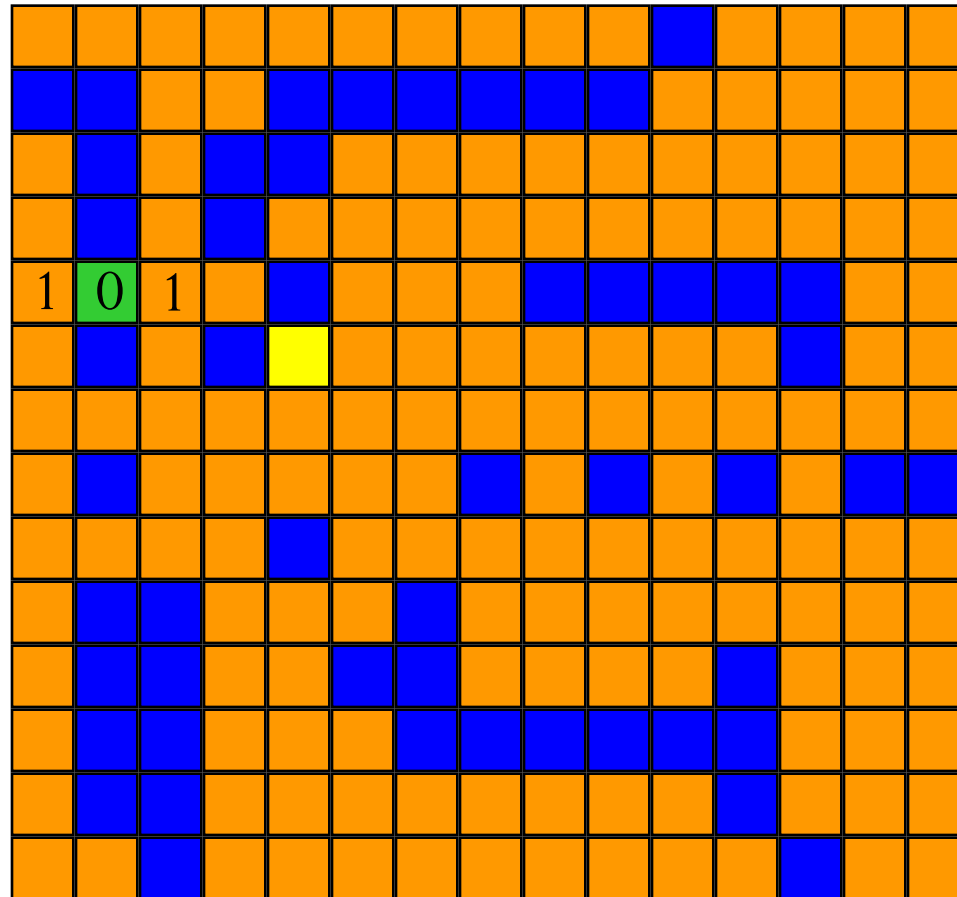
# Wire Routing: Lee's Algorithm

- A **queue** of reachable squares from the start pin is used.
- The cell of the start pin is set with a distance value of 0.
- It is enqueued into an initial empty queue.
- **While** the queue is not empty.
  - A cell is **dequeued** from the queue and made the **examine cell**.
  - Is the examine cell the end pin? If yes, path found and return.
  - Otherwise, all **unreached unblocked** squares adjacent to the **examine cell** are marked with their distance (this is 1 more than the distance value of the **examine cell**) and **enqueued**.
- When queue becomes empty but not reach end pin yet, means no path found.

# Illustration of Lee's Algorithm

 start pin

 end pin




Expand "0"

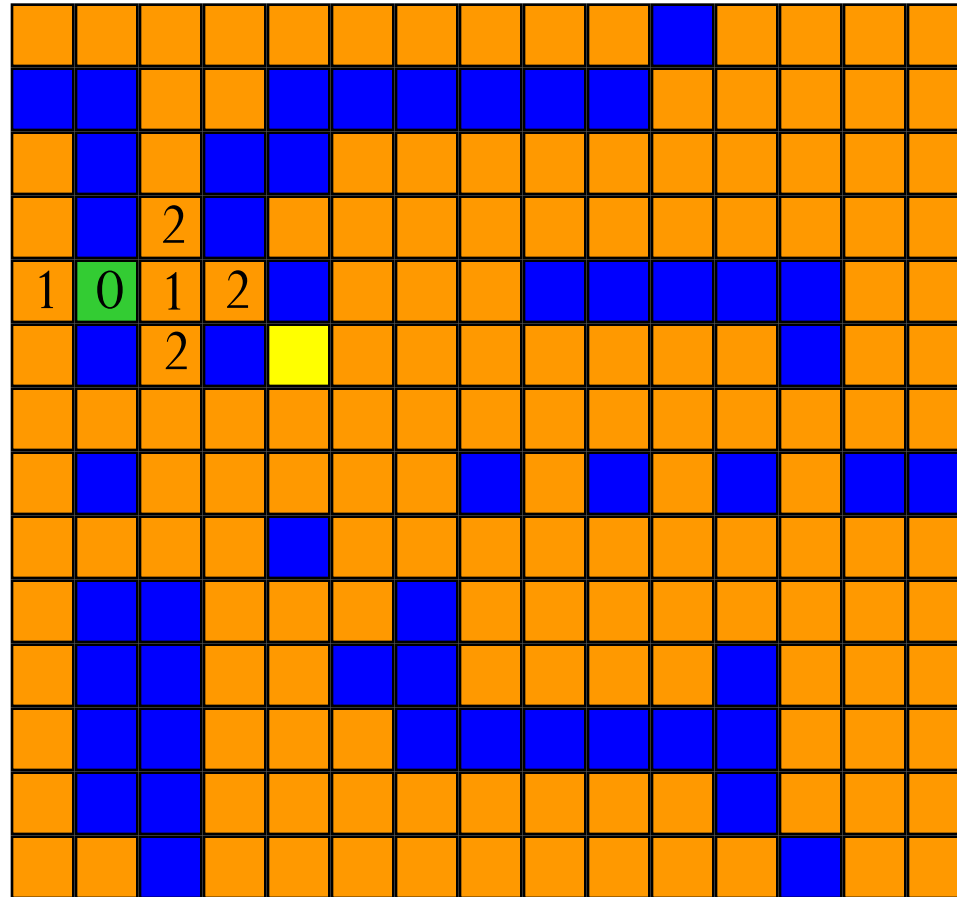
queue: 0

# Illustration of Lee's Algorithm

 start pin

 end pin

Expand right  
“1”



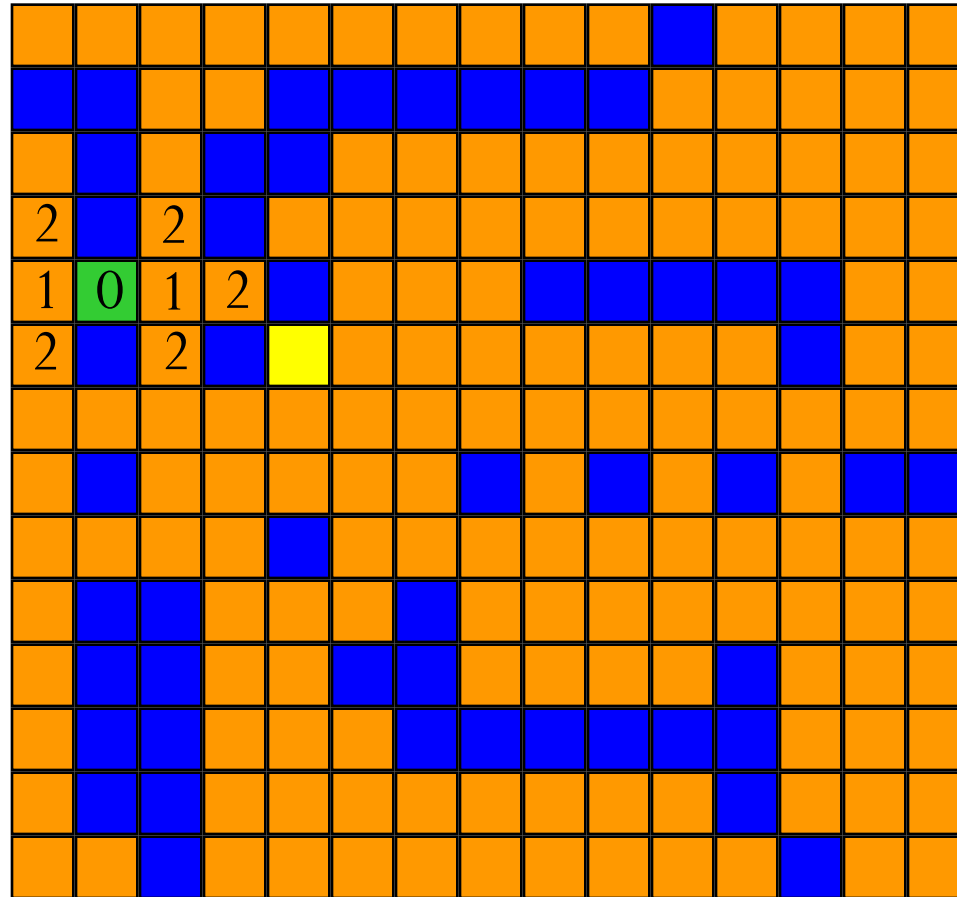
queue: 1, 1

# Illustration of Lee's Algorithm

 start pin

 end pin

Expand left  
"1"




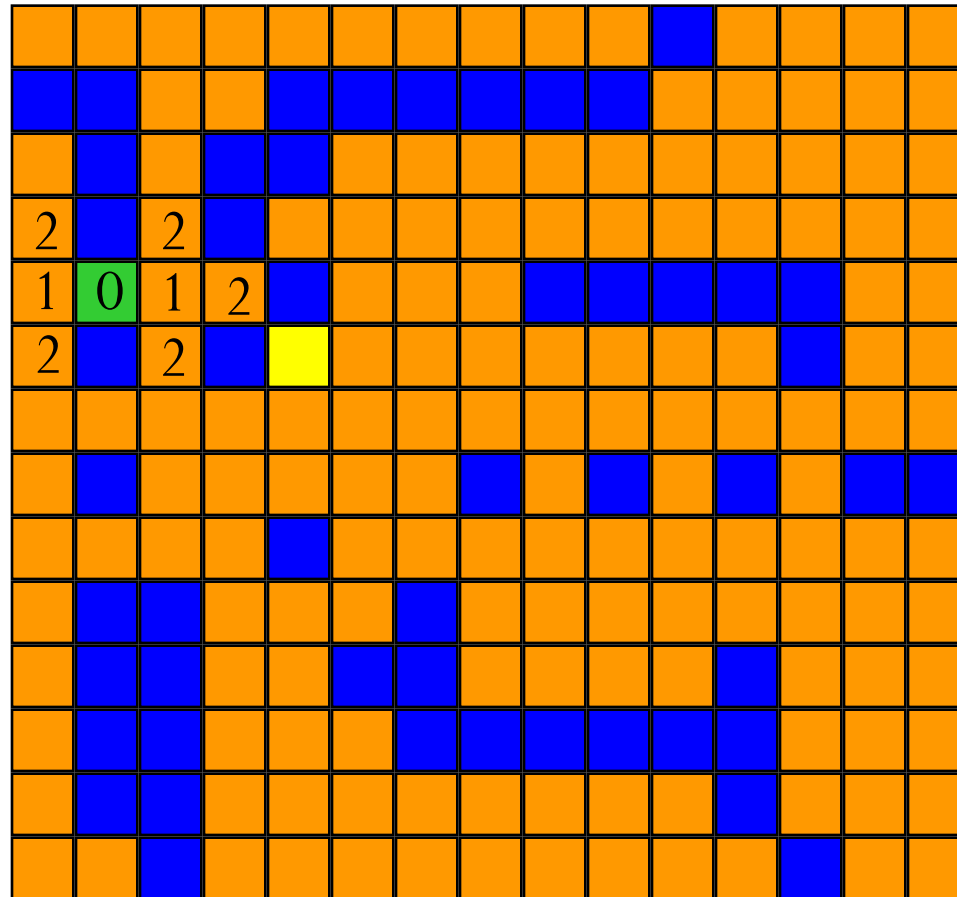
queue: 1,2,2,2



# Illustration of Lee's Algorithm

 start pin


 end pin

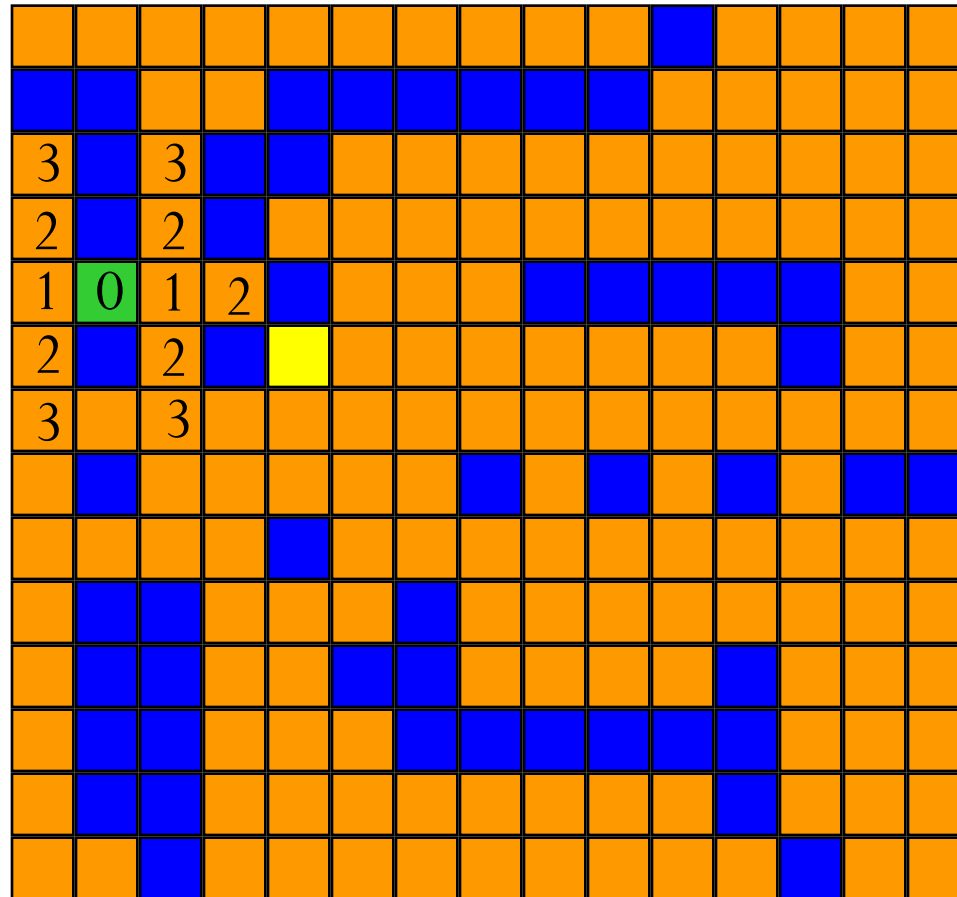


Expand and reach all squares 3 units from start.

# Illustration of Lee's Algorithm

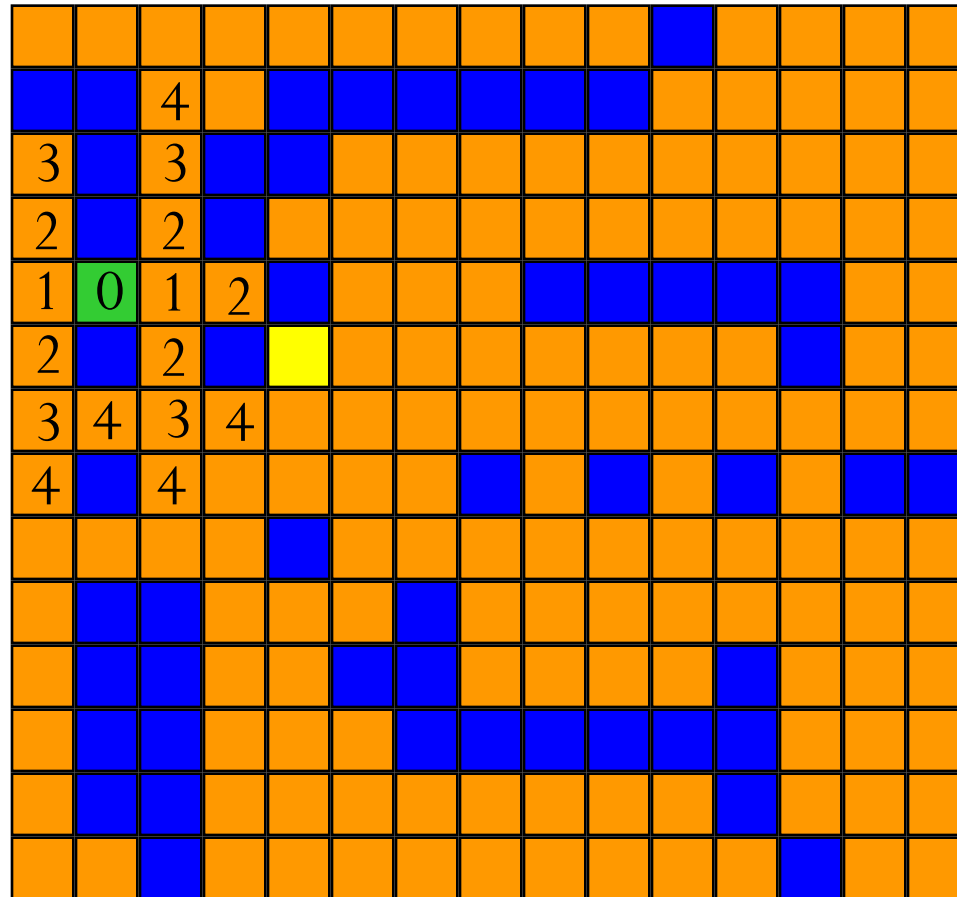
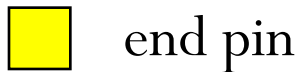
 start pin

 end pin



Expand and reach all squares 4 units from start.


# Illustration of Lee's Algorithm

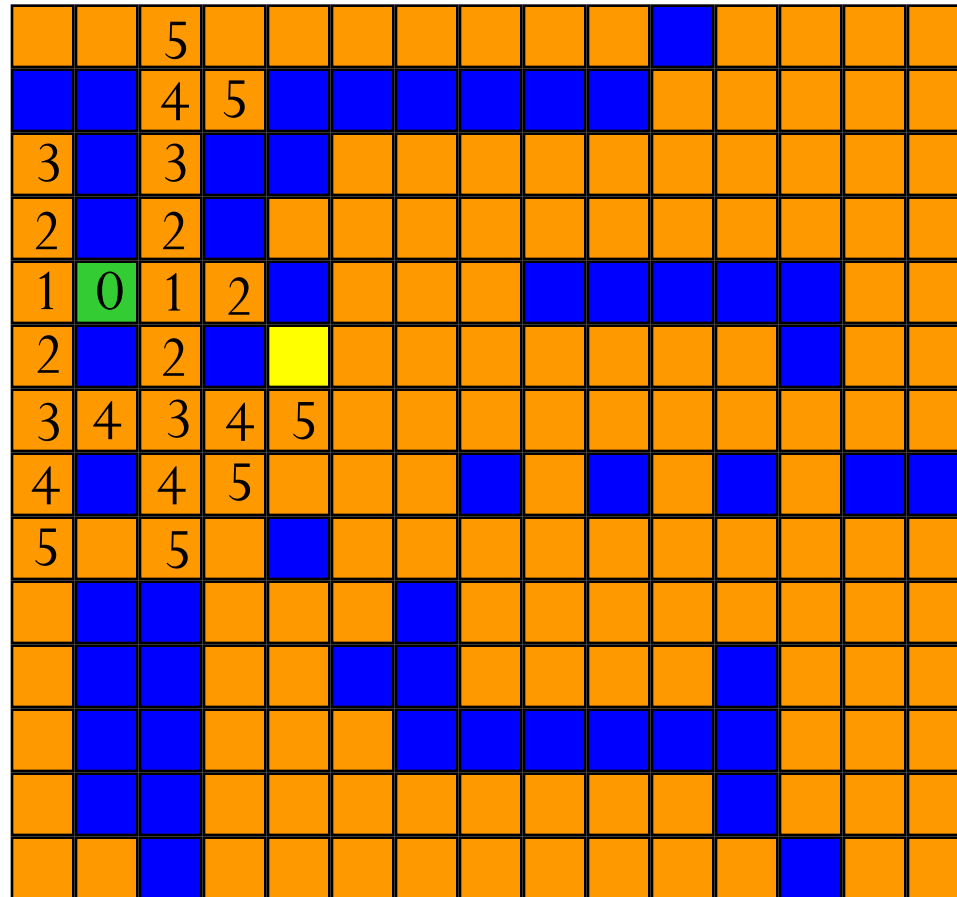


Expand and reach all squares 5 units from start.

# Illustration of Lee's Algorithm

 start pin


 end pin

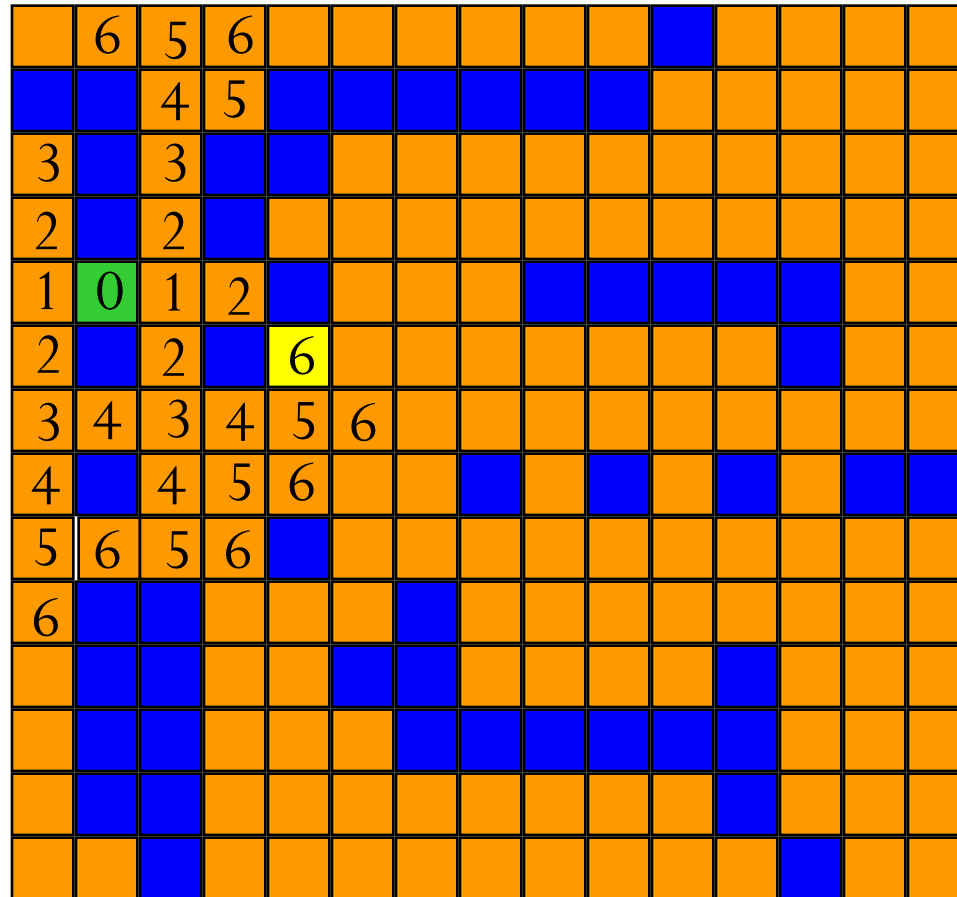


Expand and reach all squares 6 units from start.

# Illustration of Lee's Algorithm

 start pin


 end pin



End pin reached. Trace back.

# Illustration of Lee's Algorithm

 start pin

 end pin

