SEARCH

David Kauchak
CS51A – Spring 2022

1

Admin

Assignment 7

Assignment 8

Ethics readings

2

What is AI?

Think like a human Cognitive Modeling	**Think rationally** Logic-based Systems
Act like a human Turing Test	**Act rationally** Rational Agents

3

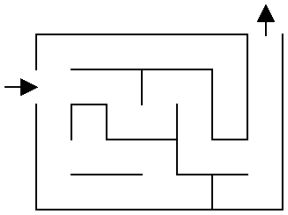
What is AI?

Think like a human Cognitive Modeling	**Think rationally** Logic-based Systems
Act like a human Turing Test	**Act rationally** Rational Agents

Next couple of weeks

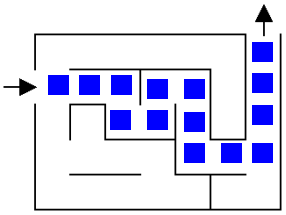
4

Solve the maze!



5

Solve the maze!



6

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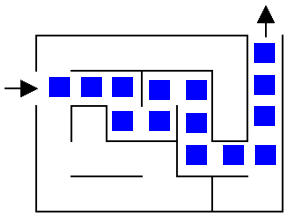
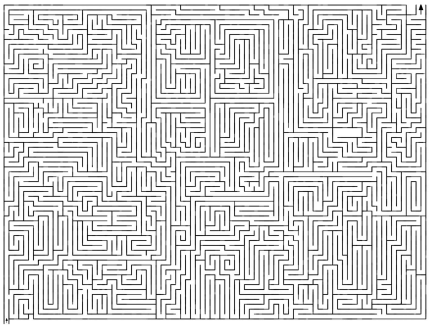


How did you figure it out?

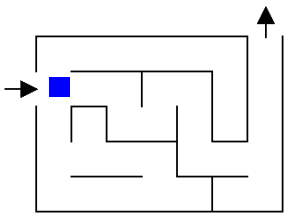
7

Solve the maze!



8

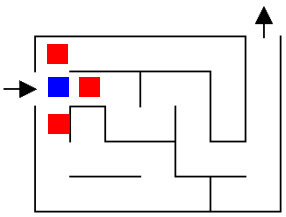
One approach



What now?

9

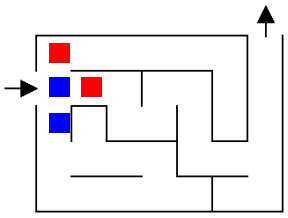
One approach



Three choices

10

One approach

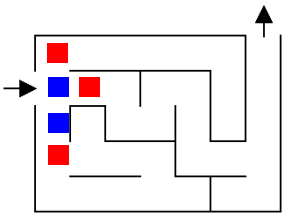


Pick one!

What now?

11

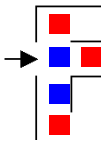
One approach



Still three options!

12

One approach

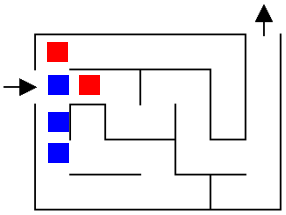


Still three options!

Which would you explore/pick?

13

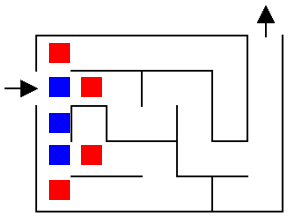
One approach



Most people go down a single path until they realize that it's wrong

14

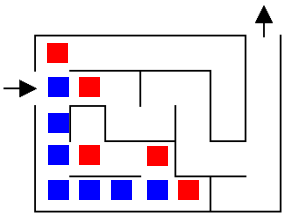
One approach



Keep exploring

15

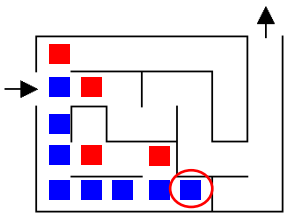
One approach



Keep exploring

16

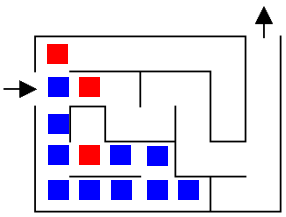
One approach



What now?

17

One approach



Are we stuck?

No. Red positions are just possible options we haven't explored

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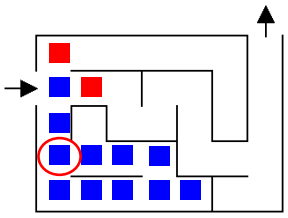
One approach



How do we know
not to go straight?

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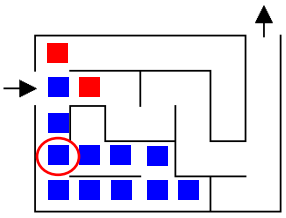
One approach



Have to be careful and keep track of
where we've been if we can loop

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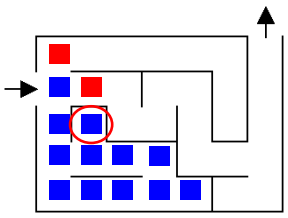
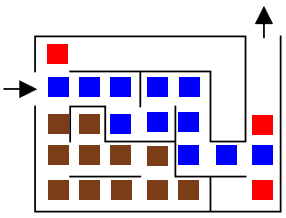
One approach



Now what?

21

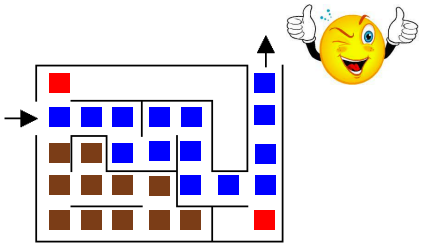
One approach



Now what?

22

One approach



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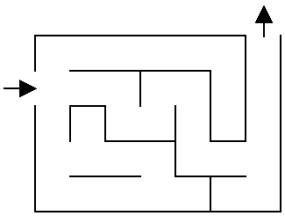
Search problems



What information do we need to figure out a solution?

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Search problems

Where to start

Where to finish (goal)

What the "world" (in this case a maze) looks like

- We'll define the world as a collection of *discrete* states
- States are connected if we can get from one state to another by taking a particular action
- This is called the "state space"

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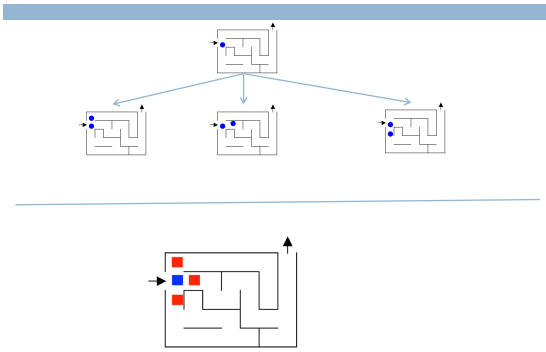
State space example



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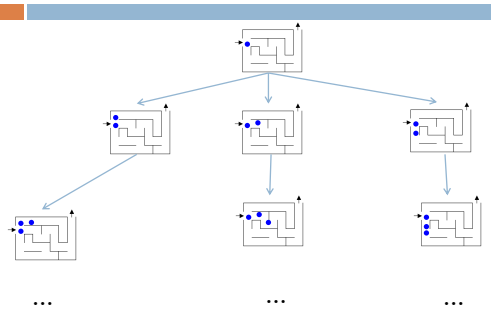
State space example



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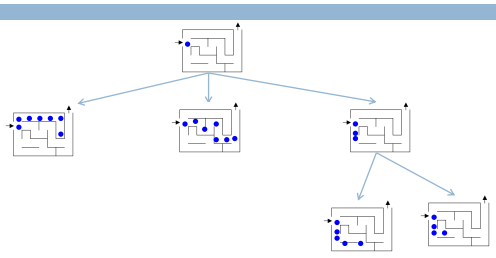
State space example



For a given problem, still could have different state-spaces

How many more states are there?

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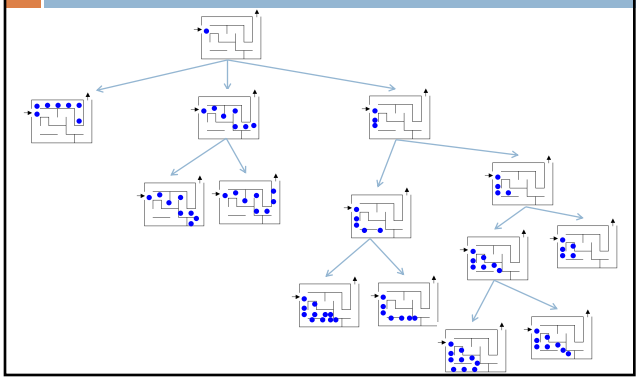
State space example



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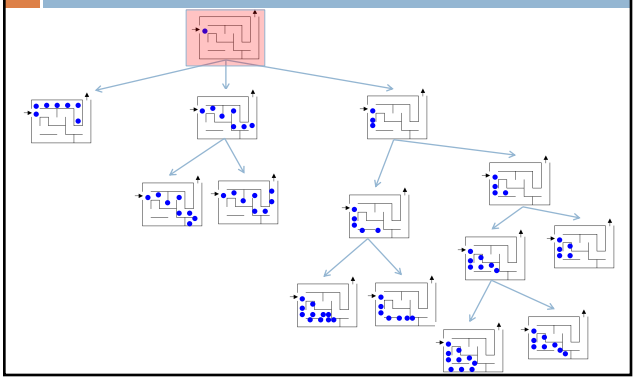
State space example



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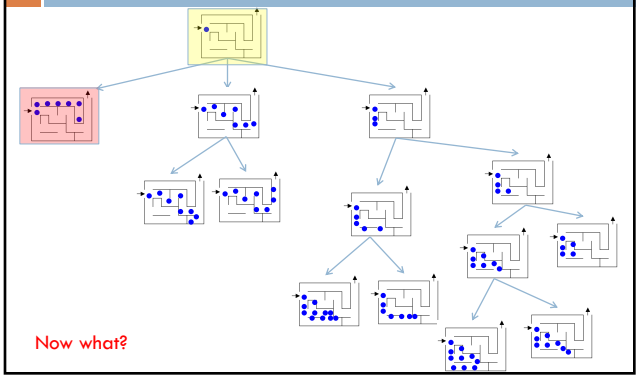
State space example



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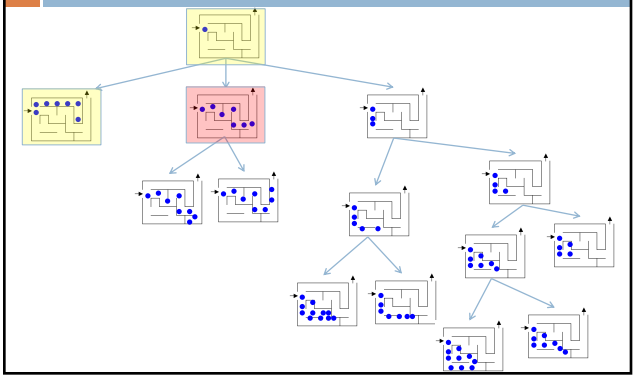
State space example



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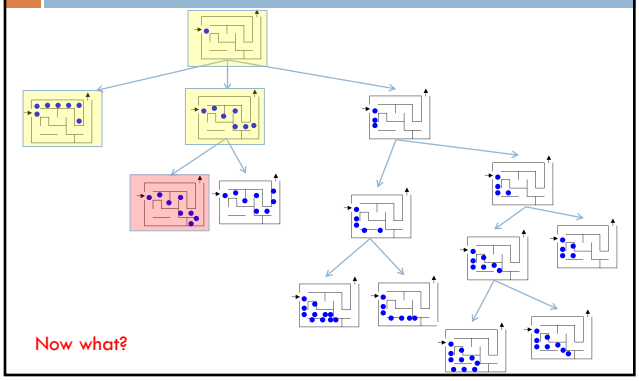

Now what?

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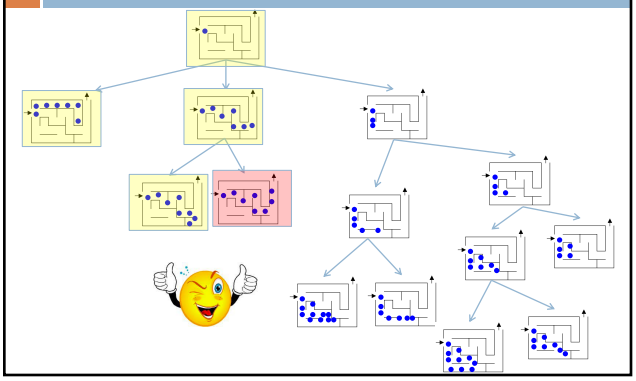
State space example



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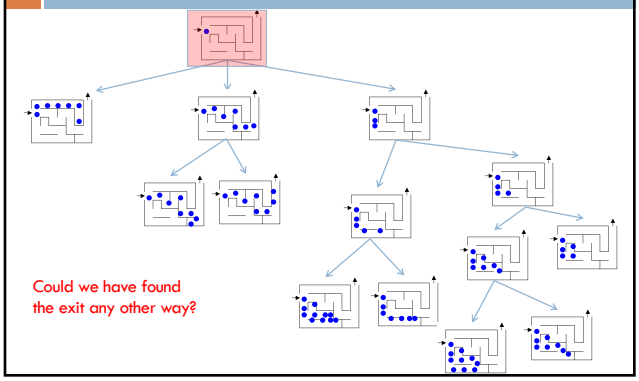

Could we have found the exit any other way?

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Search algorithm

Keep track of a list of states that we *could* visit, we'll call it "to_visit"

General idea:

- take a state off the to_visit list
- if it's the goal state
  - we're done!
- if it's not the goal state
  - Add all of the next states to the to_visit list
- repeat

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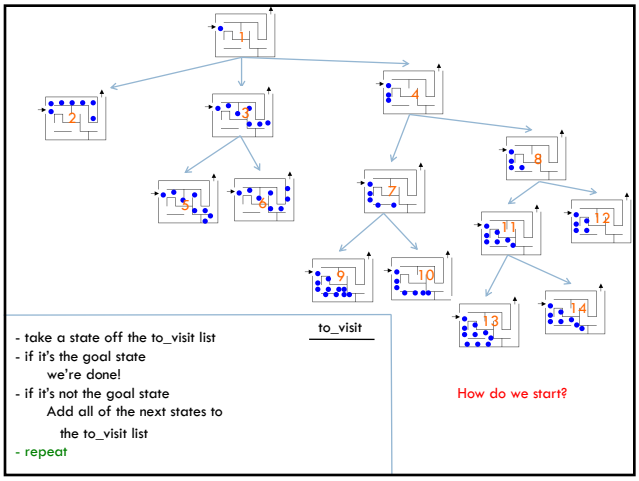
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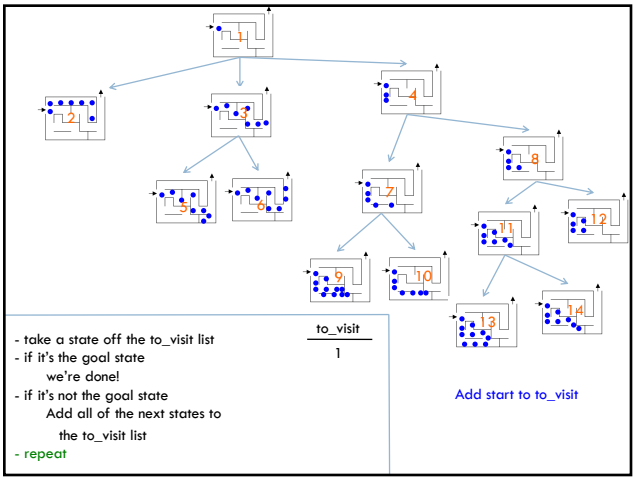
to_visit
How do we start?

37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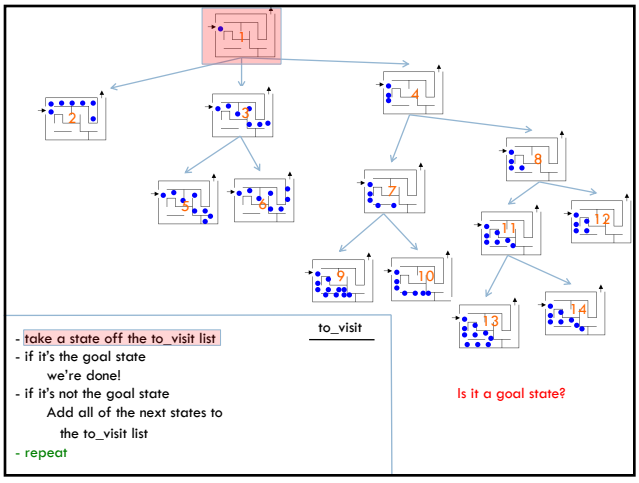
- repeat
to_visit
1
Add start to to_visit

38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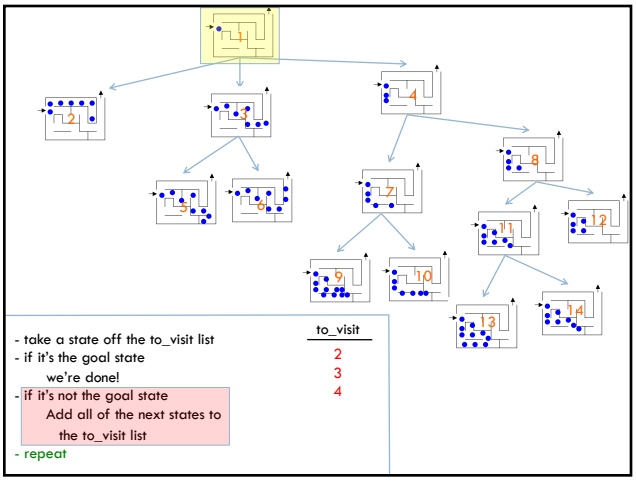
Is it a goal state?

39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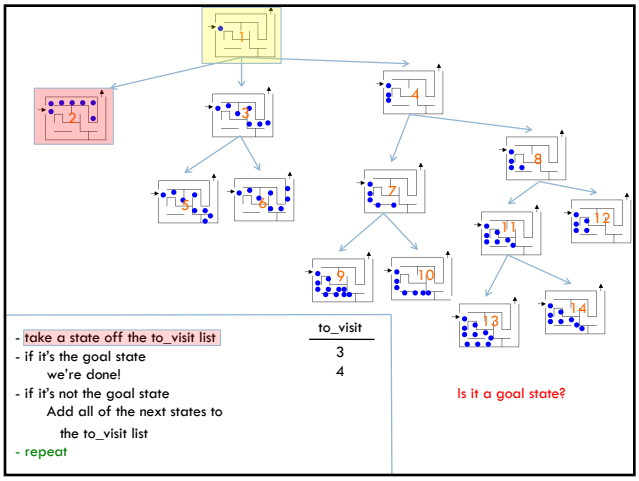
2
3
4

40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3
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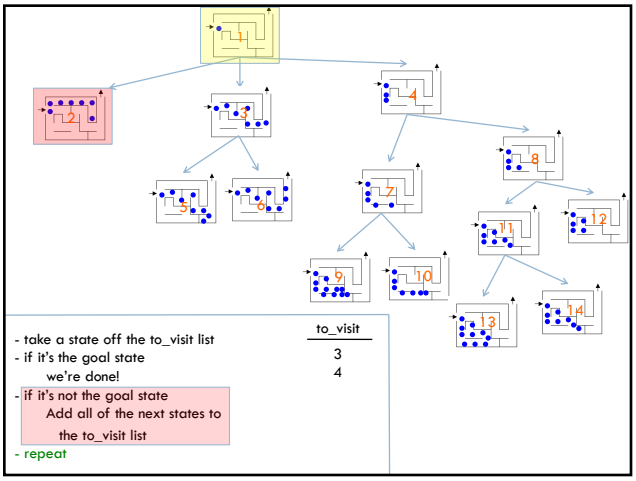
Is it a goal state?

41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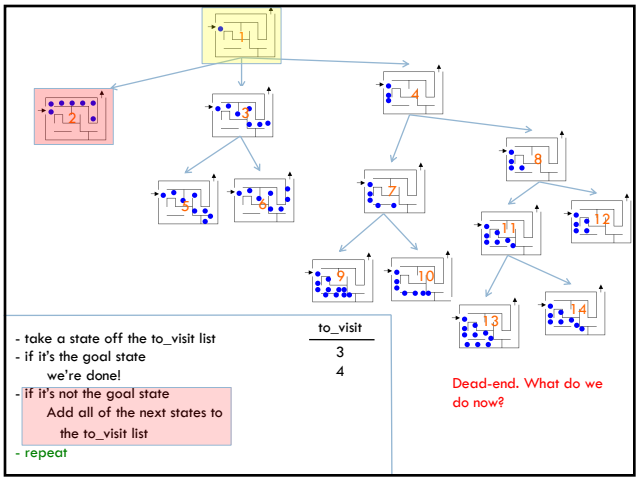
42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Dead-end. What do we
do now?

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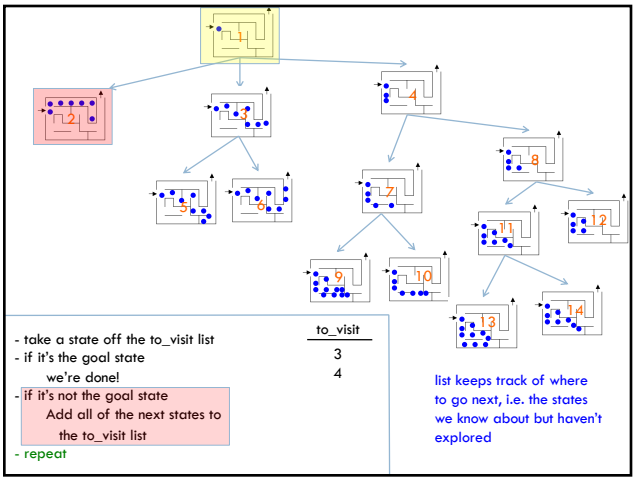
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3
4
list keeps track of where
to go next, i.e. the states
we know about but haven't
explored

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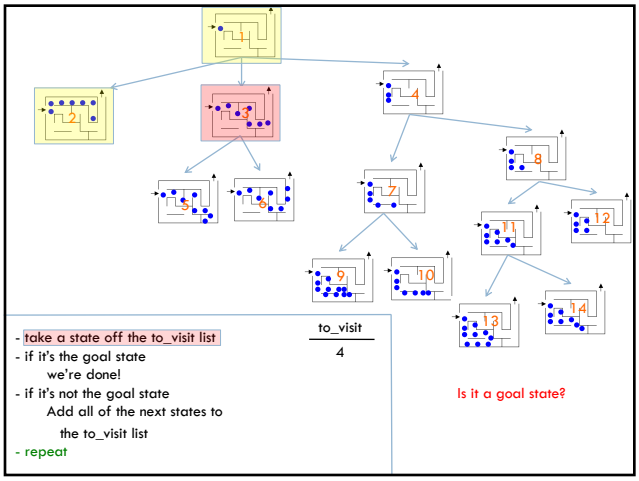
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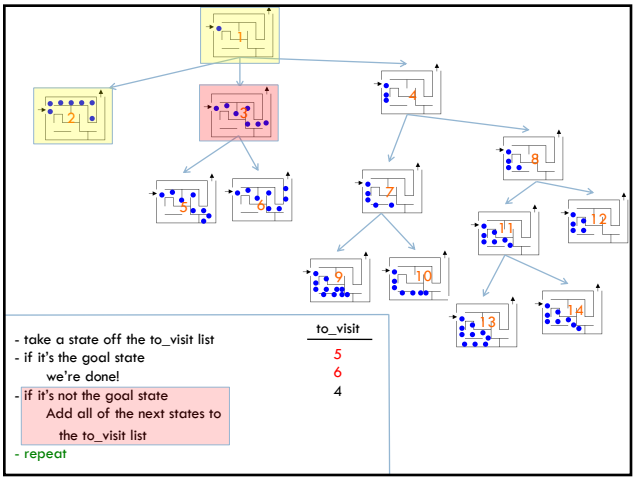
Is it a goal state?

45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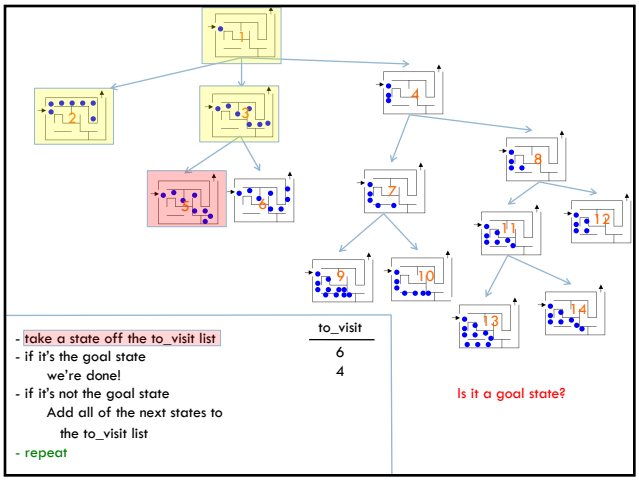
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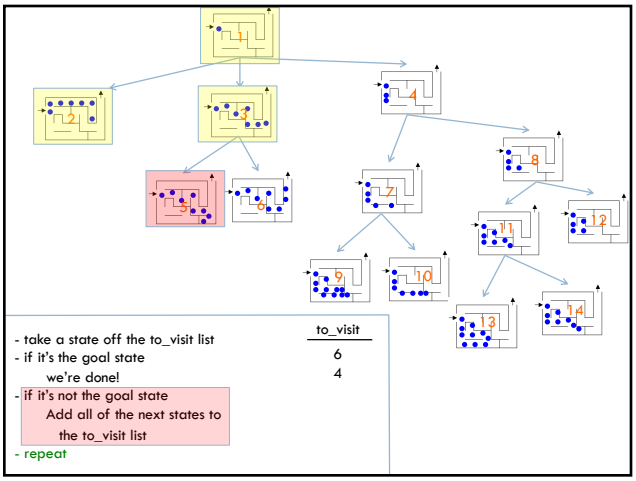
Is it a goal state?

47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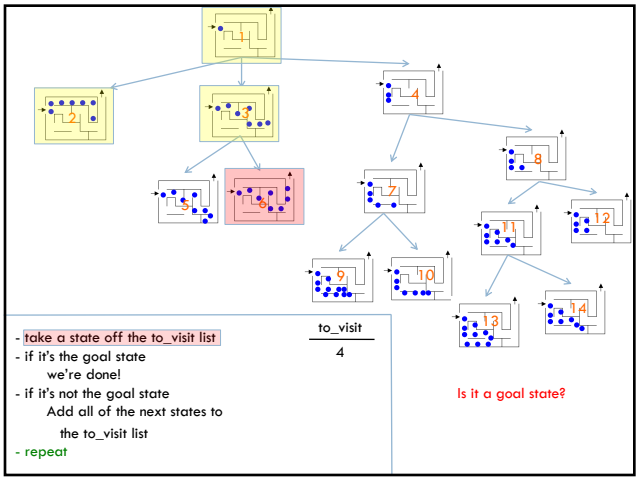
48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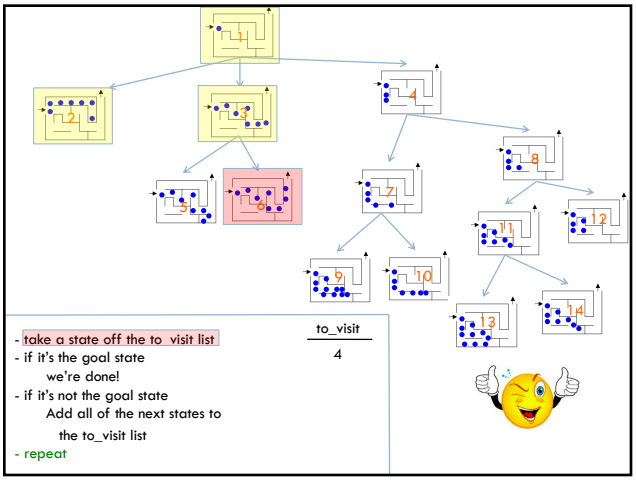
Is it a goal state?

49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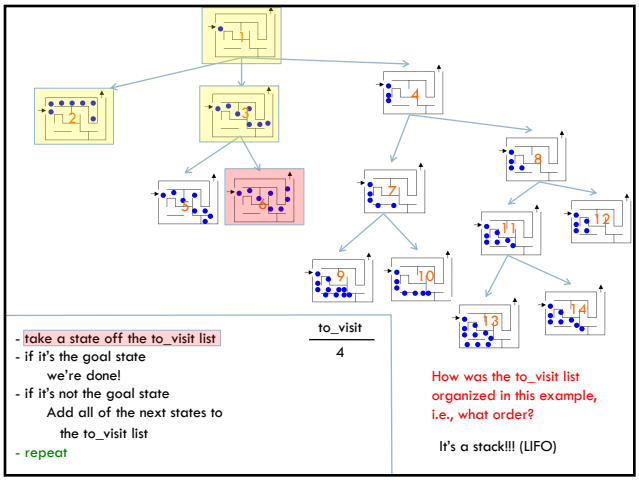
50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to_visit
4
How was the to_visit list organized in this example, i.e., what order?
It's a stack!!! (LIFO)

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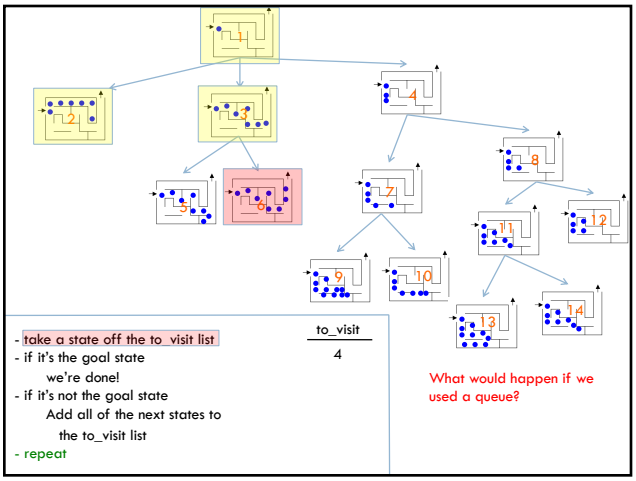
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What would happen if we used a queue?

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Search algorithms

add the start state to to_visit

Repeat
- take a state off the to_visit list
- if it's the goal state
  - we're done!
- if it's not the goal state
  - Add all of the next states to the to_visit list

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Search algorithms

add the start state to to_visit

Repeat
- take a state off the to_visit list
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- if it's not the goal state
  - Add all of the next states to the to_visit list

Depth first search (DFS): to_visit is a stack
Breadth first search (BFS): to_visit is a queue

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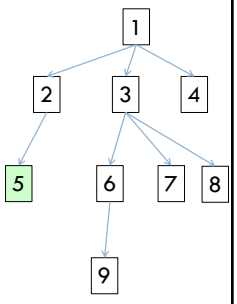
What order will BFS and DFS visit the states assuming states are added to to_visit left to right?

add the start state to to_visit

Repeat
- take a state off the to_visit list
- if it's the goal state
  - we're done!
- if it's not the goal state
  - Add all of the successive states to the to_visit list



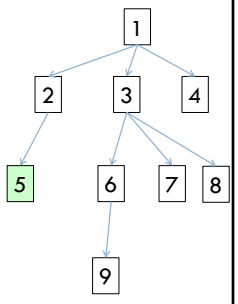
Depth first search (DFS): to_visit is a stack
Breadth first search (BFS): to_visit is a queue

55

What order will BFS and DFS visit the states?

DFS: 1, 4, 3, 8, 7, 6, 9, 2, 5

Why not 1, 2, 5?

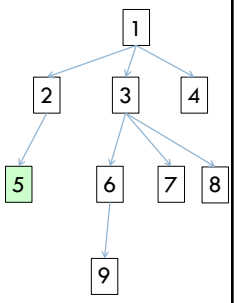


Depth first search (DFS): to_visit is a stack
Breadth first search (BFS): to_visit is a queue

56

What order will BFS and DFS visit the states?

DFS: 1, 4, 3, 8, 7, 6, 9, 2, 5

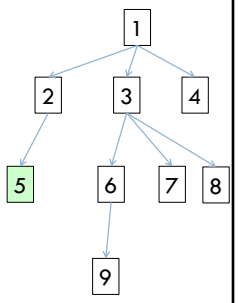


Depth first search (DFS): to_visit is a stack
Breadth first search (BFS): to_visit is a queue

57

What order will BFS and DFS visit the states?

DFS: 1, 4, 3, 8, 7, 6, 9, 2, 5

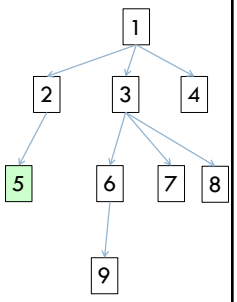


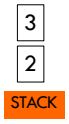
Depth first search (DFS): to_visit is a stack
Breadth first search (BFS): to_visit is a queue

58

What order will BFS and DFS visit the states?

DFS: 1, 4, 3, 8, 7, 6, 9, 2, 5





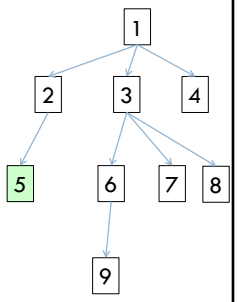
Depth first search (DFS): to_visit is a stack
Breadth first search (BFS): to_visit is a queue

59

What order will BFS and DFS visit the states?

DFS: 1, 4, 3, 8, 7, 6, 9, 2, 5

BFS: 1, 2, 3, 4, 5



Depth first search (DFS): to_visit is a stack
Breadth first search (BFS): to_visit is a queue

60