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
Solve the maze!

How did you figure it out?
One approach

What now?

One approach

Three choices

One approach

Pick one!

What now?

One approach

Still three options!
One approach

Still three options!
Which would you explore/pick?

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

One approach

Keep exploring

One approach

Keep exploring
One approach

What now?

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

How do we know not to go straight?

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

Now what?

Search problems

What information do we need to figure out a solution?
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”

State space example

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

How many more states are there?
State space example

Now what?

State space example

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

Could we have found the exit any other way?
How do we start?

1. Add start to to_visit
2. Take a state off the to_visit list
3. If it’s the goal state, we’re done!
4. If it’s not the goal state, add all of the next states to the to_visit list
5. Repeat

Is it a goal state?

1. Take a state off the to_visit list
2. If it’s the goal state, we’re done!
3. If it’s not the goal state, add all of the next states to the to_visit list
4. 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
- repeat

Is it a goal state?

Dead-end. What do we do now?

List keeps track of where to go next, i.e. the states we know about but haven't explored.
Is it a goal state?

- 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
- take a state off the to_visit list
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Is it a goal state?

to_visit

- take a state off the to_visit list
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  Add all of the next states to the to_visit list
- repeat

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

to_visit

What would happen if we used a queue?
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

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

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

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

Why not 1, 2, 5?

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

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

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