

## Lecture 23

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- ◆ Logistics
  - HW7 due Friday
  - Lab8 going on
- ◆ Last lecture
  - Moore and Mealy machines
- ◆ Today
  - A bigger FSM example: Hungry Robot Ant in Maze

## The “WHY” slide

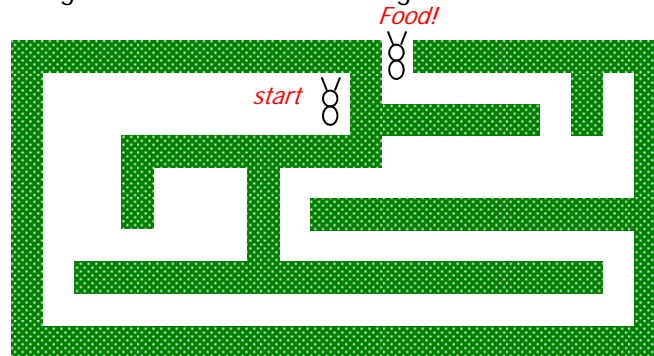
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- ◆ Bigger FSM example
  - Many things in the world are finite state machines (are we humans?) and most of them are far bigger and more complex than the examples we had so far. It is good to be able to understand and solve for a project-level FSM problem that's a lot more realistic to FSMs that you may design in industry or in grad school.

## Robotic ant in a maze

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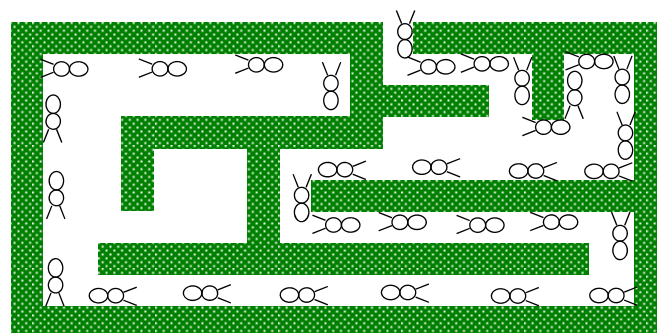
- ◆ Robot ant, physical maze
  - Maze has no islands
  - Corridors are wider than ant
  - Design the robotic ant's brain to get to the food!



## Robot ant specifics

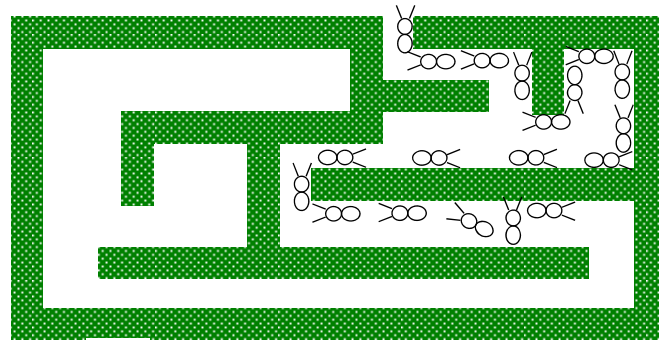
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- ◆ Sensors: L and R antennae, 1 if touching wall
- ◆ Actuators: F - forward step, TL/TR - turn left/right
- ◆ Goal: find way out of maze to get to food.
- ◆ Strategy: keep the wall on the right



## Example: ant brain (special case 1)

- ◆ Left (L) Antenna touching the wall

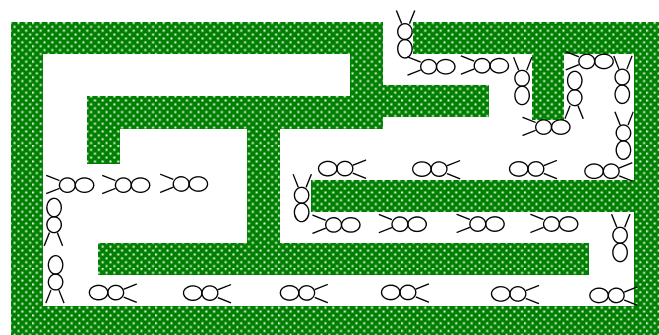


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## Example: ant brain (special case 2)

- ◆ Ant Lost

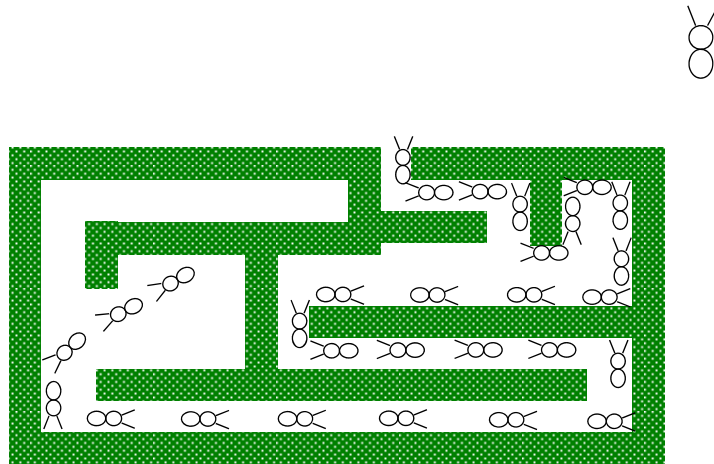


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## Example: ant brain (special case 2)

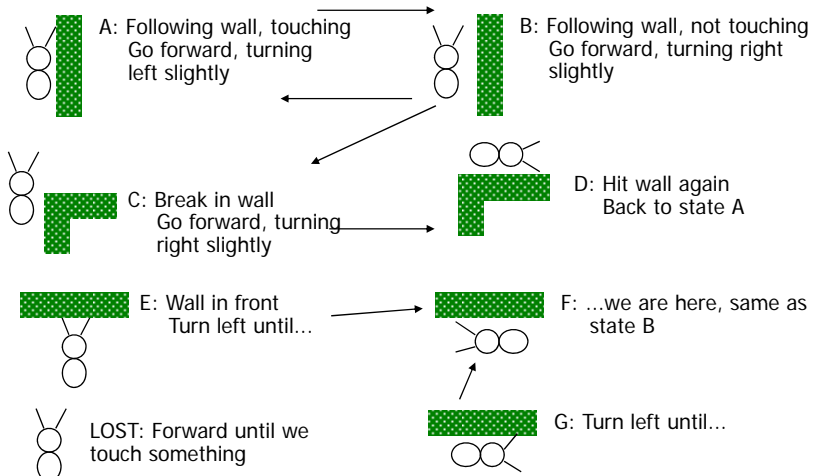
### ◆ Ant Lost (another example)



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## Robot Ant behavior



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## Notes & strategy

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### ◆ Notes

- Maze has no islands
- Corridors are wider than ant
- Don't worry about startup
- Assume a Moore machine
- Assume D flip-flops

### ◆ Strategy

- Keep the wall on the right

## Design the ant-brain FSM

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1. State diagram
2. State-transition table
3. State minimization
4. State encoding
5. Next-state logic minimization
6. Implement the design

## Notations

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### ◆ Sensors on L and R antennae

- Sensor = "1" if touching wall; "0" if not touching wall
  - ☛ L'R' ≡ no wall
  - ☛ L'R ≡ wall on right
  - ☛ LR' ≡ wall on left
  - ☛ LR ≡ wall in front

### ◆ Movement

- F ≡ forward one step
- TL ≡ turn left slightly
- TR ≡ turn right slightly

## 1. State Diagram

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