ICS 101 Fall 2011

Introduction to Artificial Intelligence

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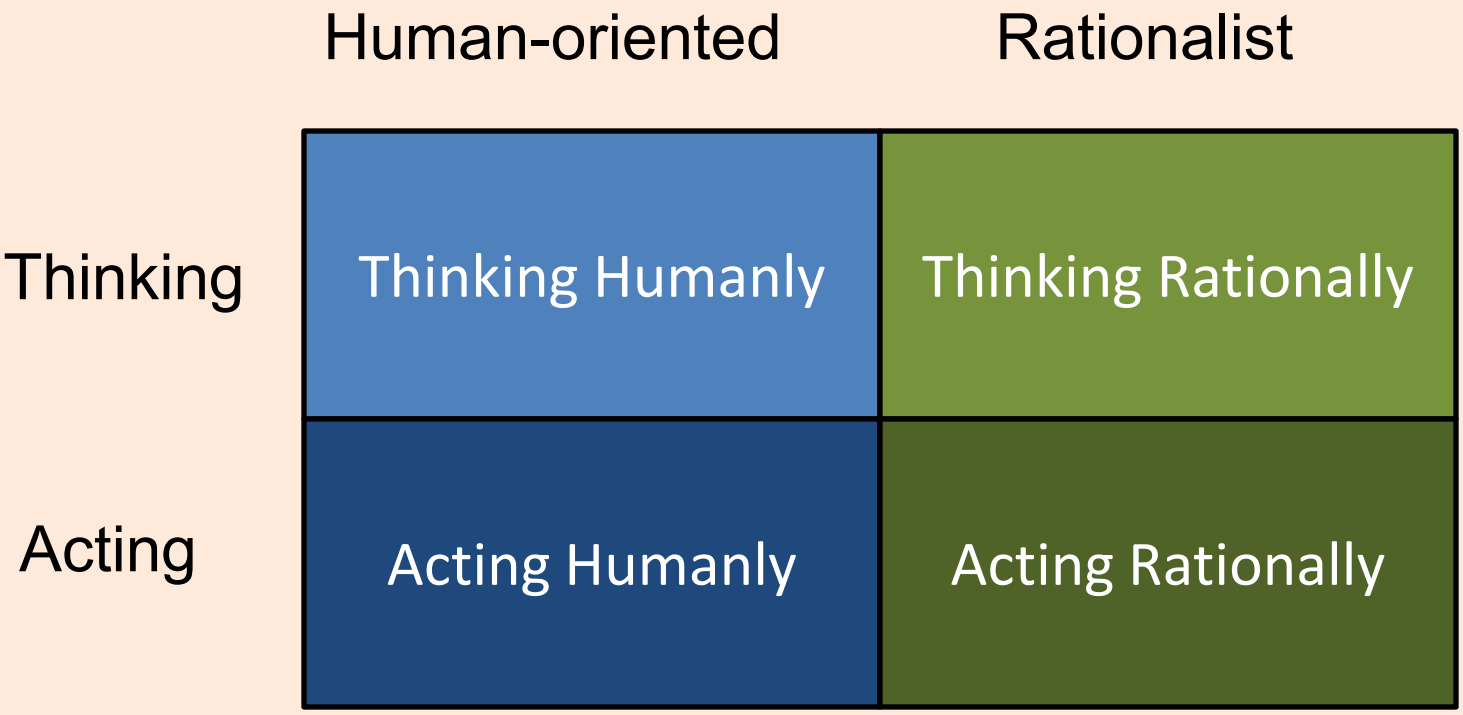
What is Artificial Intelligence ?

What is human intelligence ?

What are signs (activities, abilities etc) of human intelligence ?

Exercise 1: Write down four examples in your worksheet

Approaches to A.I.



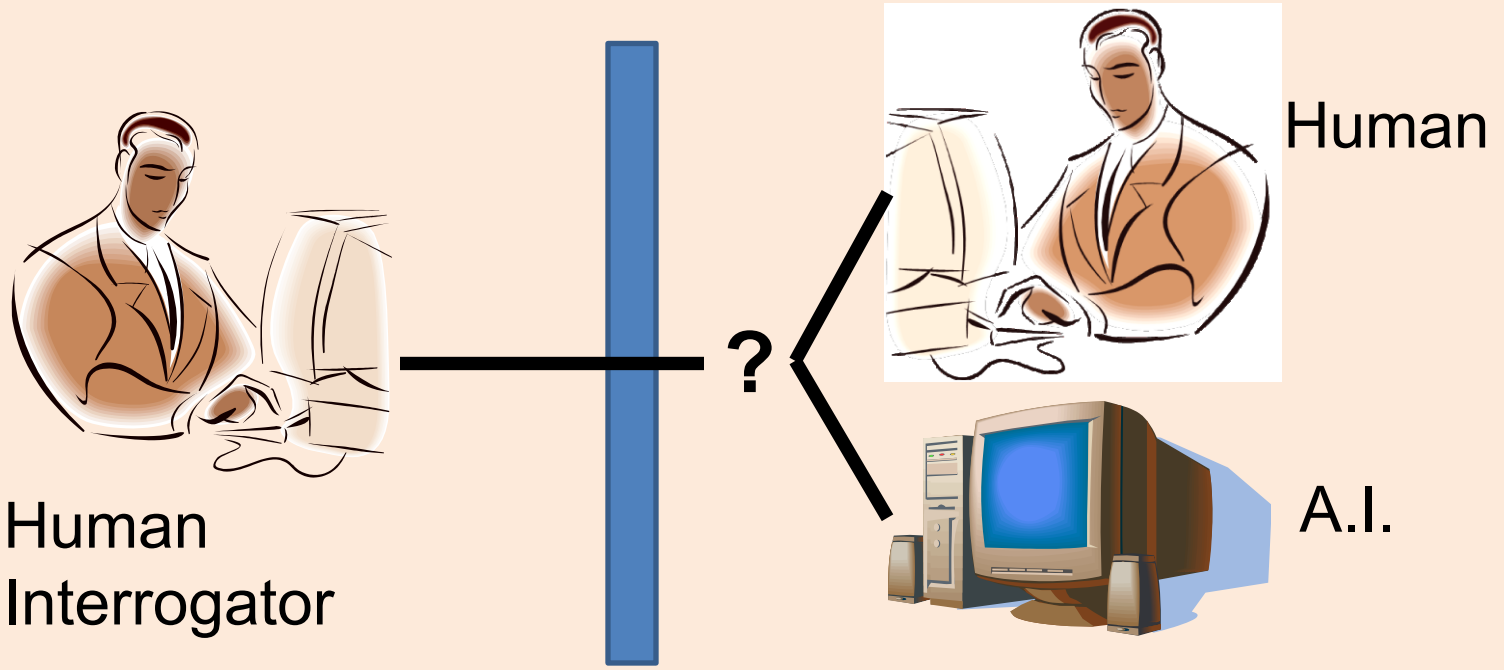
Definitions of AI (a)

- "The exciting new effort to make computer think ... machines with minds, in the full and literal sense." (Haugeland, 1985)
- "[The automation of] activities that associate with human thinking, activities such as decision-making, problem solving, learning ..." (Bellman, 1978)
- "The art of creating machines that perform functions that require intelligence when performed by people." (Kurzweil, 1990)
- "The study of how to make computers do things, at the moment, people are better." (Rich and Knight, 1991)

Definitions of AI (b)

- "The study of mental faculties through the use of computational models." (Charniak and McDermott, 1985)
- "The study of the computations that make it possible to perceive, reason, and act." (Winston, 1992)
- "Computational Intelligence is the study of the design of intelligent agents."(Poole et al., 1998)
- "AI ... is concerned with intelligent behavior in artifacts." (Nilsson, 1998)

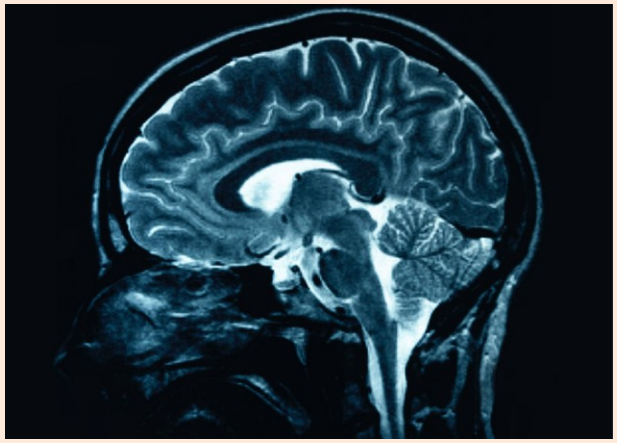
Acting Humanly: Turing Test (1950)



- Operational test of intelligence
- Anticipated all major arguments against AI in following 50 years
- Suggested major components of AI: knowledge, reasoning, language understanding, learning

Thinking Humanly : Cognitive Science

- AI thinks like humans do
- How do humans think ?
- How can we find out ?
  - Introspection
  - Psychological experiments
  - Brain imaging



- The goal is to formulate computer programs that mimic how humans think and hence achieve AI!

Thinking Rationally

- Aristotle: what are correct arguments/thought processes?
  - **Syllogism**:
    - Socrates is a man;
    - All men are mortal
    - Therefore Socrates is mortal
  - Field of logic
- AI programs represent knowledge using formal logic and solves problems using logical inference/reasoning.

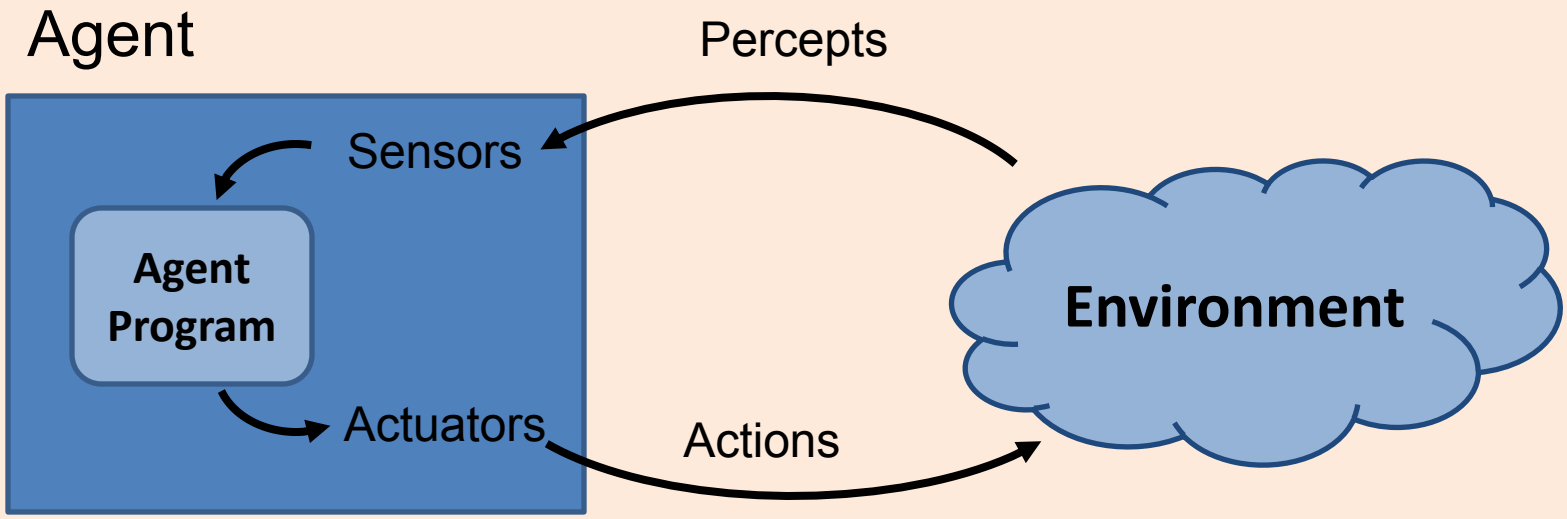
Acting Rationally

- Acting rationally == doing the ***right thing***
- What is the "right thing" ?
  - Logical / rational
  - maximize goal achievement, given the available information
- This approach is the focus of many AI efforts!
- AI programs are **rational agents** : programs that act so as to achieve the best outcome or best expected outcome

AI Today

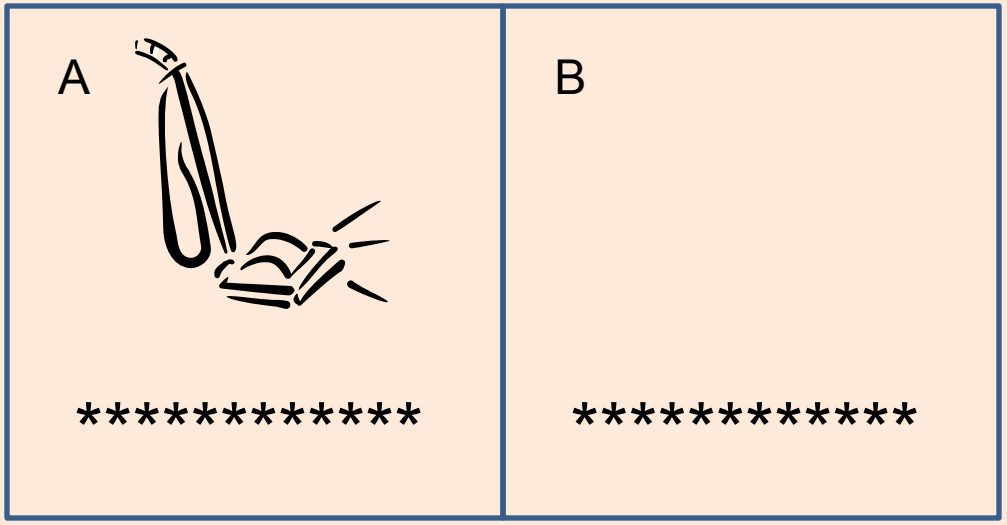
- Robotic Vehicles: Google Self-Drive Car
- Speech Recognition: Call routing, Call center
- Autonomous planning: Mars Rover
- Game Playing: Deep Blue, Watson
- Spam Fighting
- Logistic Planning: Dynamic Analysis & Replanning Tool (DART)
- Robotics : Roomba
- Machine Translation

Intelligent Agents



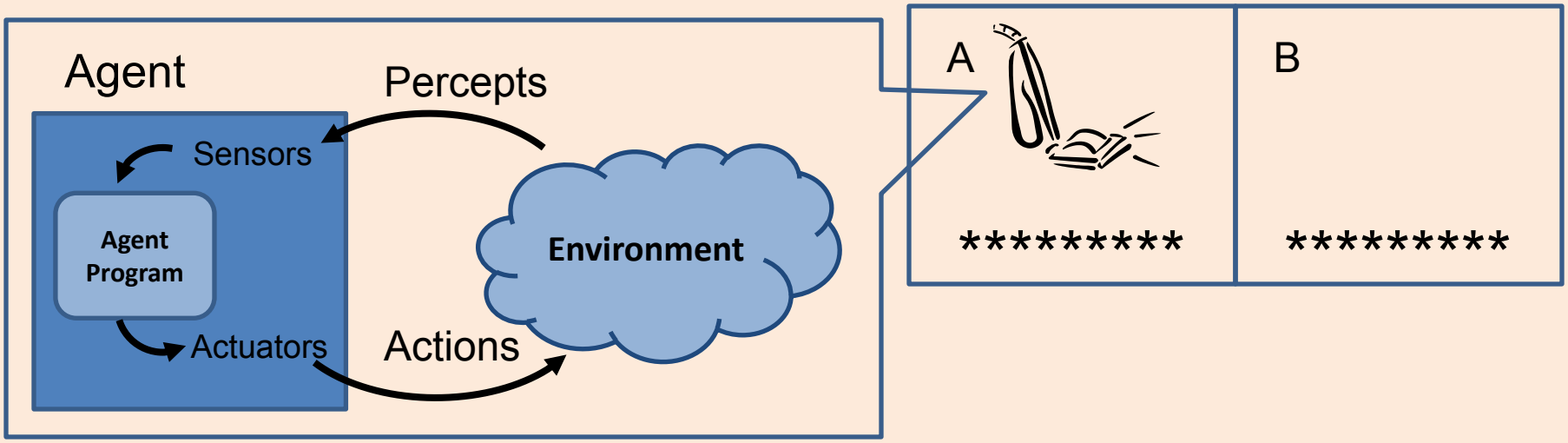
- Perceives its environment through sensors
- Acts upon the environment through actuators
- **Percepts** – perceptual input at any given instant
- **Agent program** implements how to map a sequence of percepts to an action

Example: Vacuum Robot



- Vacuum Robot ("agent") needs to keep two rooms A & B clean. It can sense which room it is in and whether the carpet in that room is dirty. It can either go Right, go Left, or Suck.

Example: Vacuum Robot Agent Program



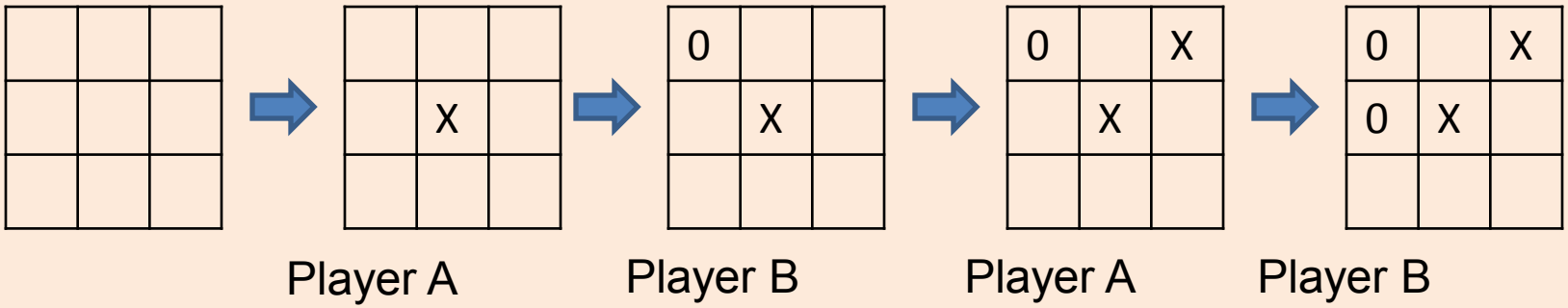
Percept Sequence	Action
[A,Clean]	Go Right
[A, Dirty]	Suck
[B, Clean]	Go Left
[B, Dirty]	Suck
[A, Clean], [A, Clean]	Go Right

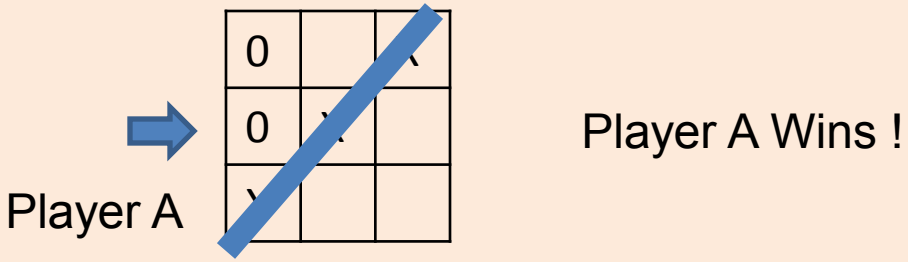
Representation & Search

- Newell & Simon argue that intelligent activity (human or machine) is achieved by:
  - **Representing** significant aspects of a problem using symbol patterns
  - **Generating potential solutions** by applying operations on the representation
  - **Selecting a solution** by searching among these possibilities

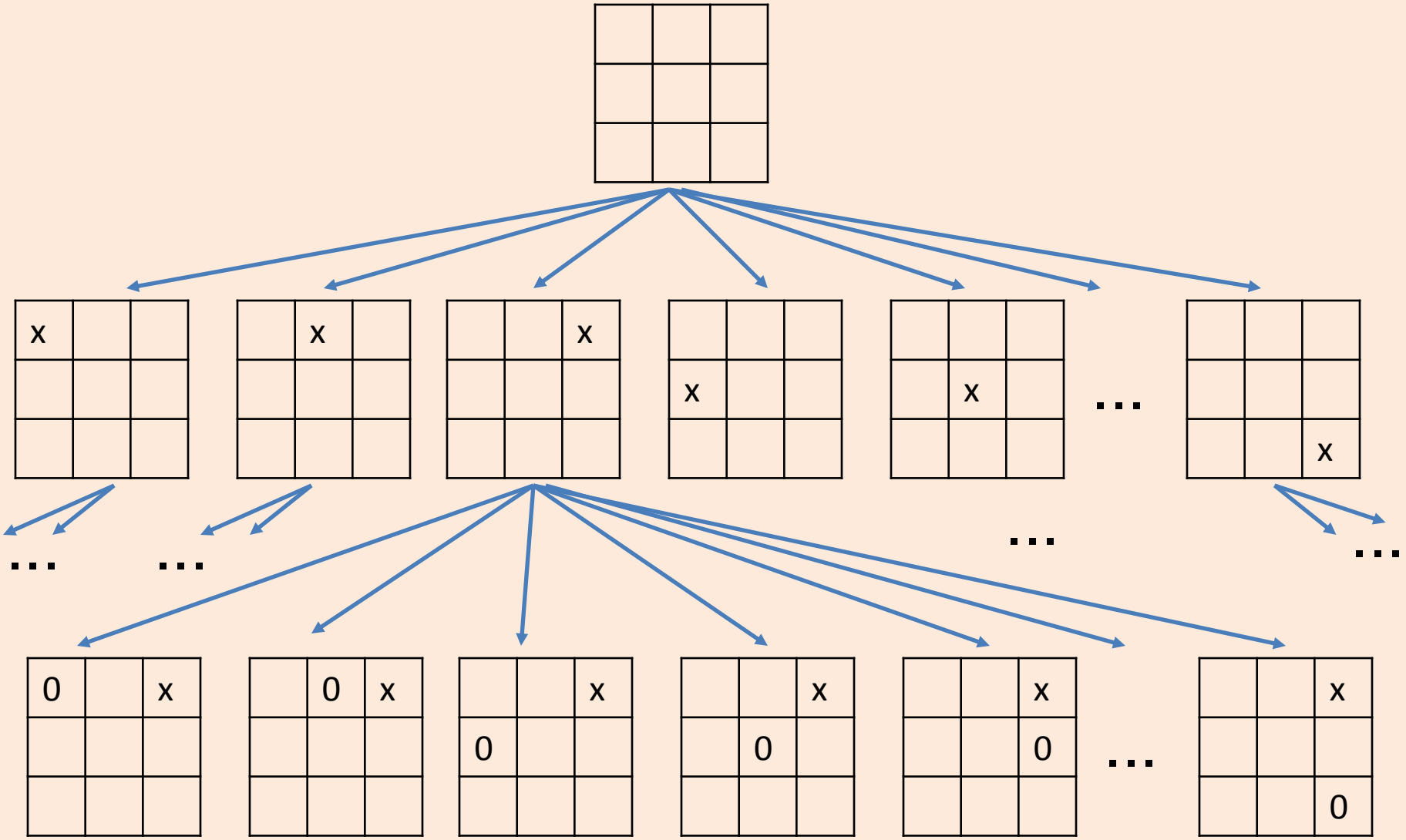
Example: Tic-Tac-Toe

- 2 Player Game: Each gets a symbol 0 or X
- Each player tries to get 3 of his/her symbol in a row/column/diagonal in a 3 by 3 grid.





Example: State Space for Tic-Tac-Toe



Exercise

- Draw the state space for the vacuum robot starting from the following initial state for the next two state transitions.