

CMSC 170

Introduction to Artificial Intelligence

2nd Semester AY 2013-2014

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Introduction to Artificial Intelligence

An AI program is called an
intelligent agent.



Agent



Environment

Agents *interact* with their environments.



Agent



Environment

Agents *interact* with their environments.



Agent



Environment

Agents *interact* with their environments.

In general...

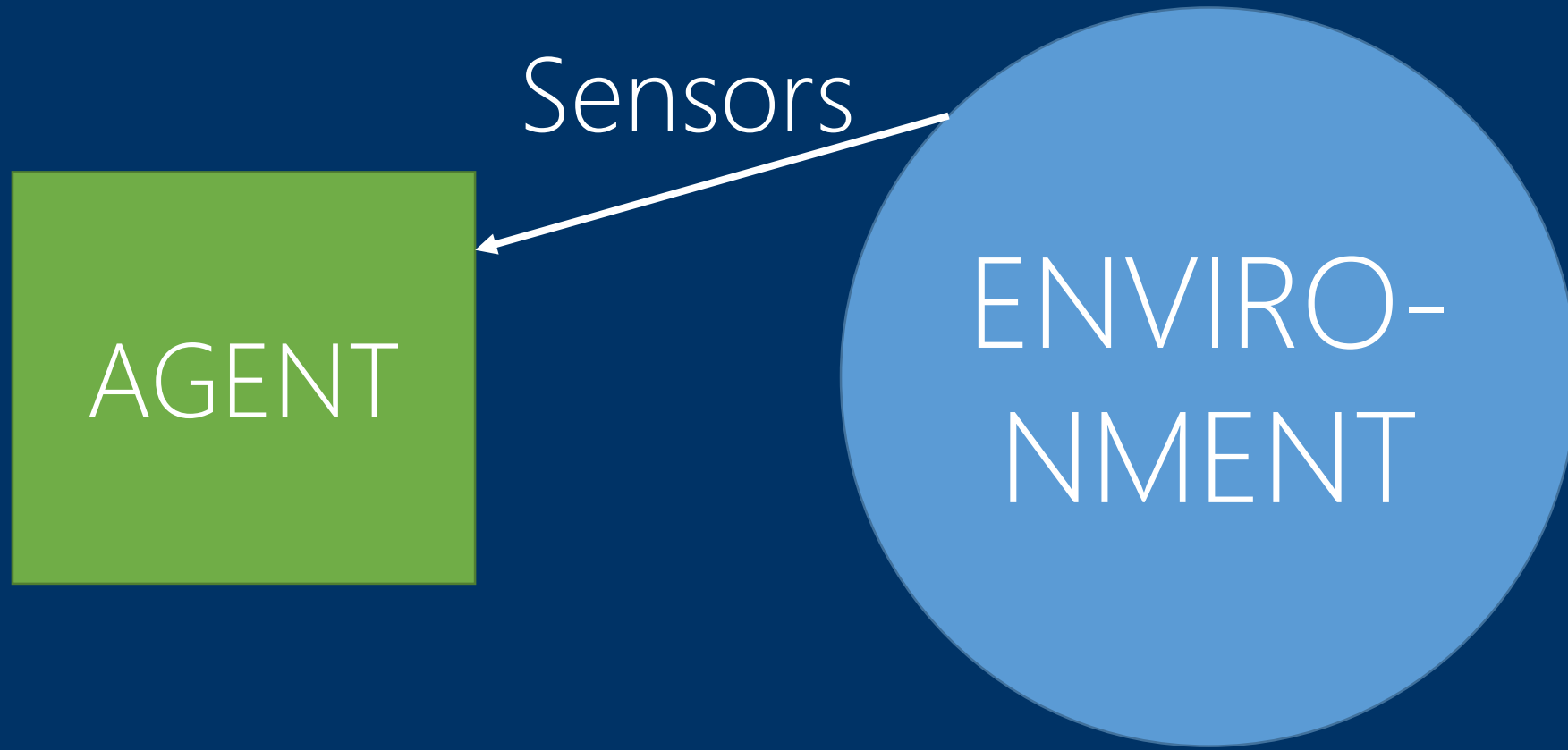


AGENT

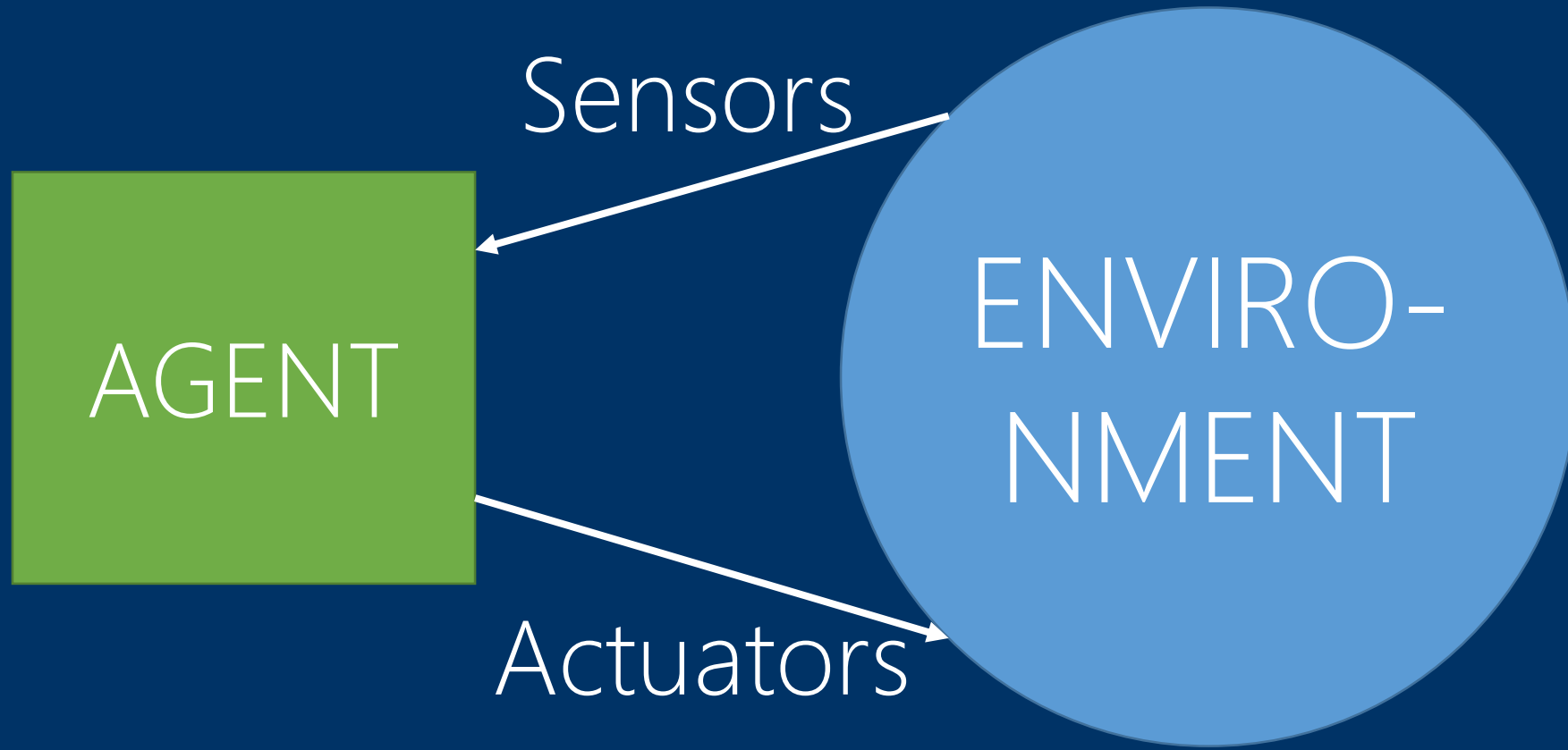


ENVIRO-
NMENT

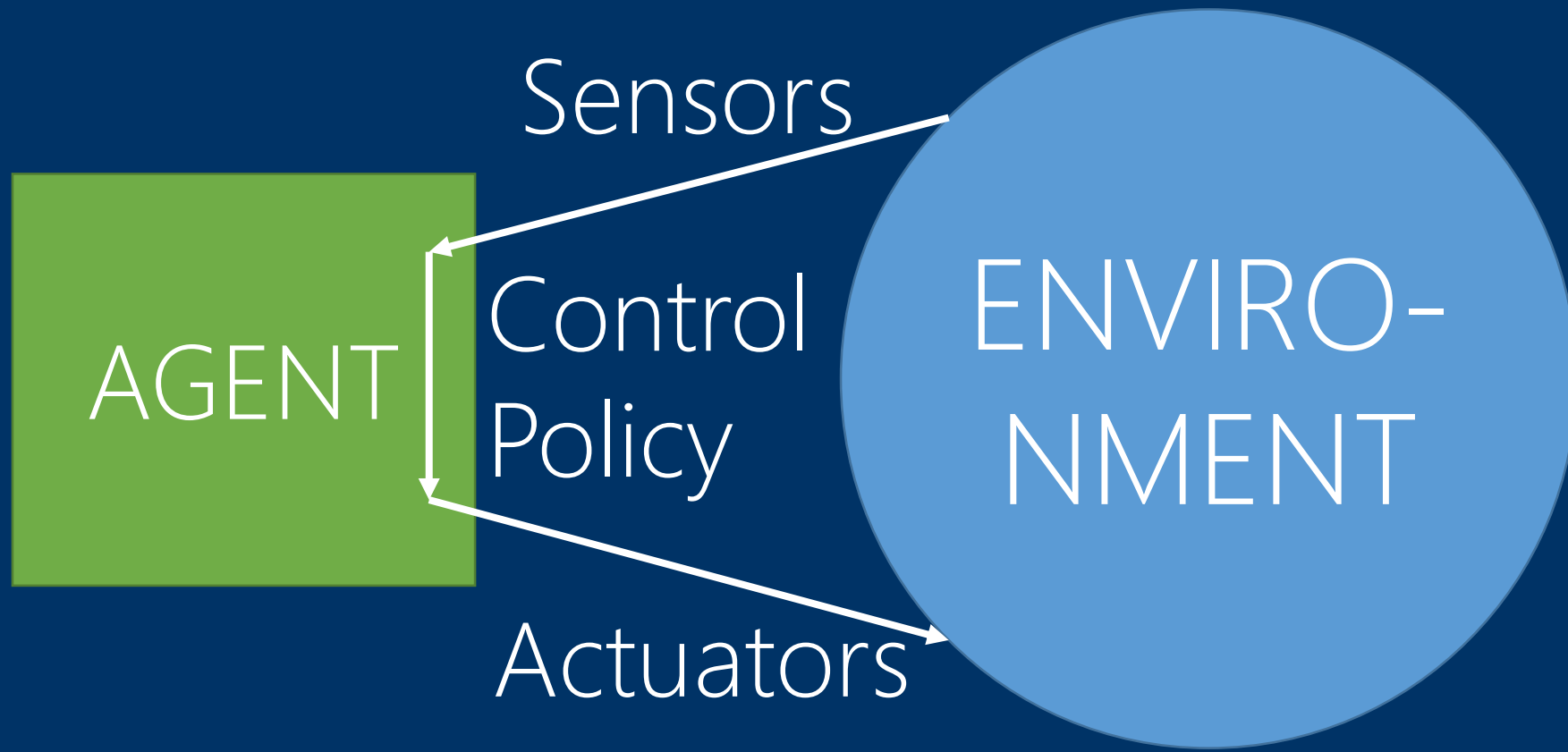
Agents perceive the *state* of the environment through its *sensors*.



Agents affect the *state* of the environment through its *actuators*.



The agent's ***control policy*** maps the input from sensors to the resulting actions by the actuators.

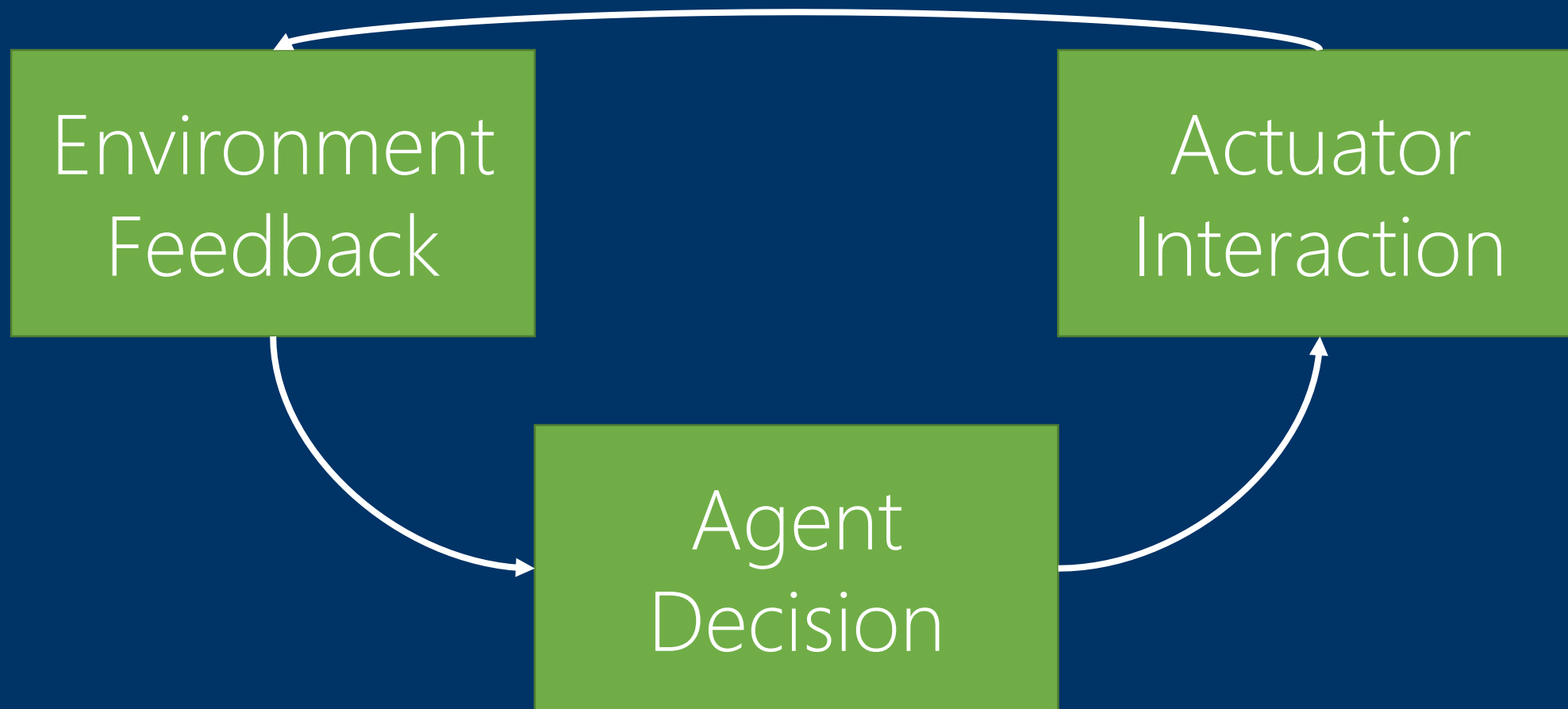


Artificial intelligence deals with
formulating/designing the
control policy.

The Big Question

How does an agent make decisions that it can carry out using its actuators based on past sensor data?

The process that we have described is
essentially a **loop** called the
Perception-Action Cycle.



Perception-Action Cycle

Applications of Artificial Intelligence

Rates/
News



Trades

Stock Broker
Agent



Stock
Market

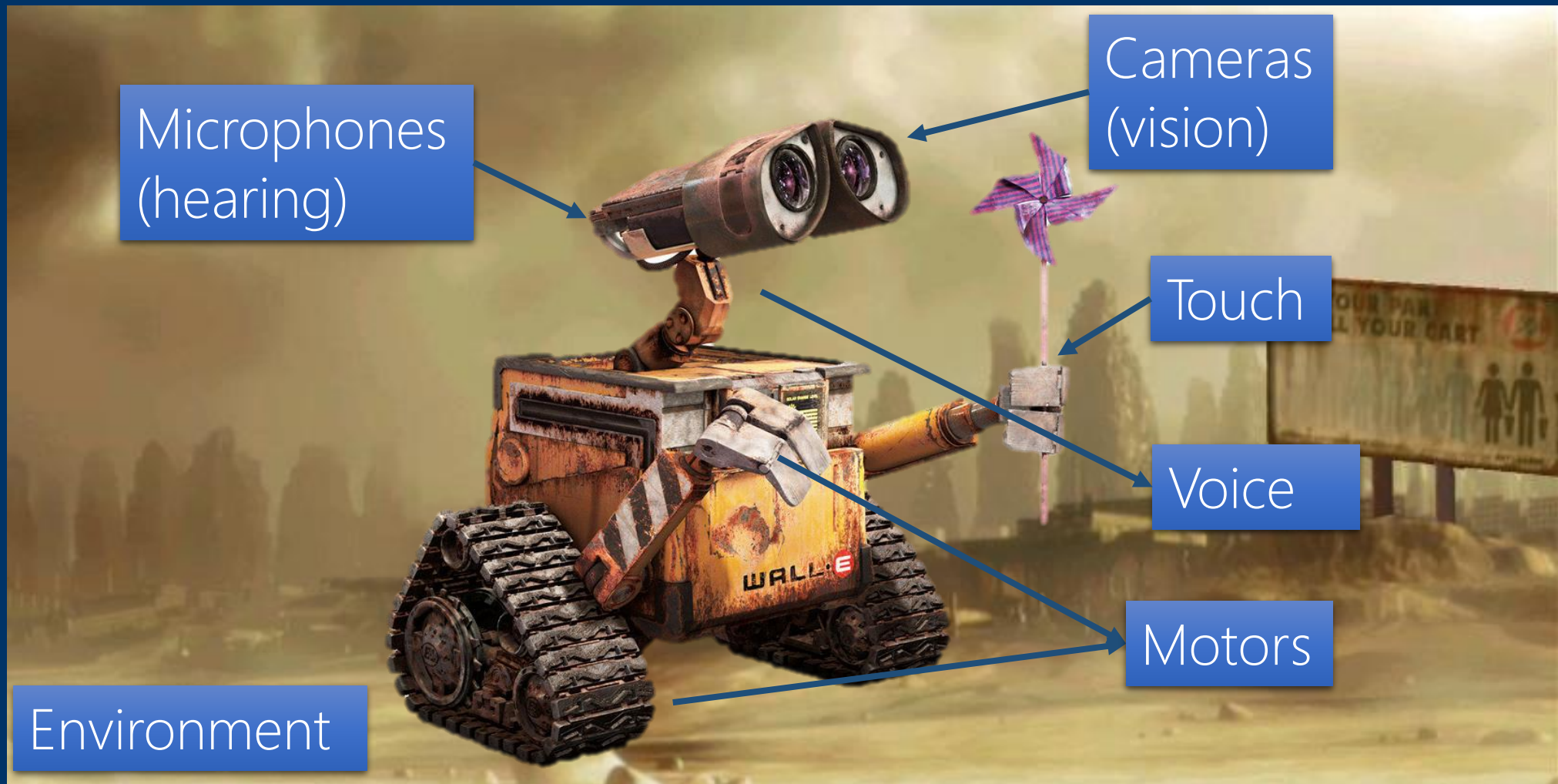


Finance

A still from the movie WALL-E showing the titular robot holding a purple pinwheel. WALL-E is a small, boxy robot with large, expressive eyes and a single arm. He is standing on a sandy, desolate landscape with a hazy, brown sky in the background. In the distance, a billboard is visible with the text "DO YOUR PART FILL YOUR CART" and an illustration of people carrying bags. The word "WALL-E" is visible on the side of his body.

Environment

Robotics



Robotics

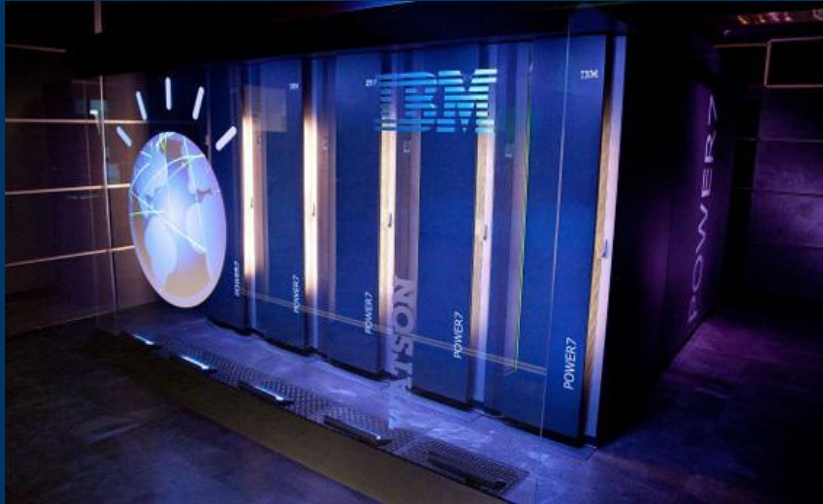


Games



Games

Vital Signs/ Test Results



Diagnosis



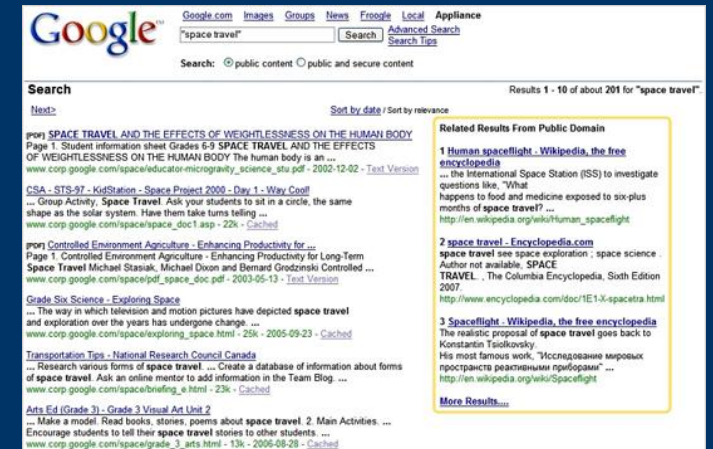
Medicine

Web
Pages



List of sites

Query

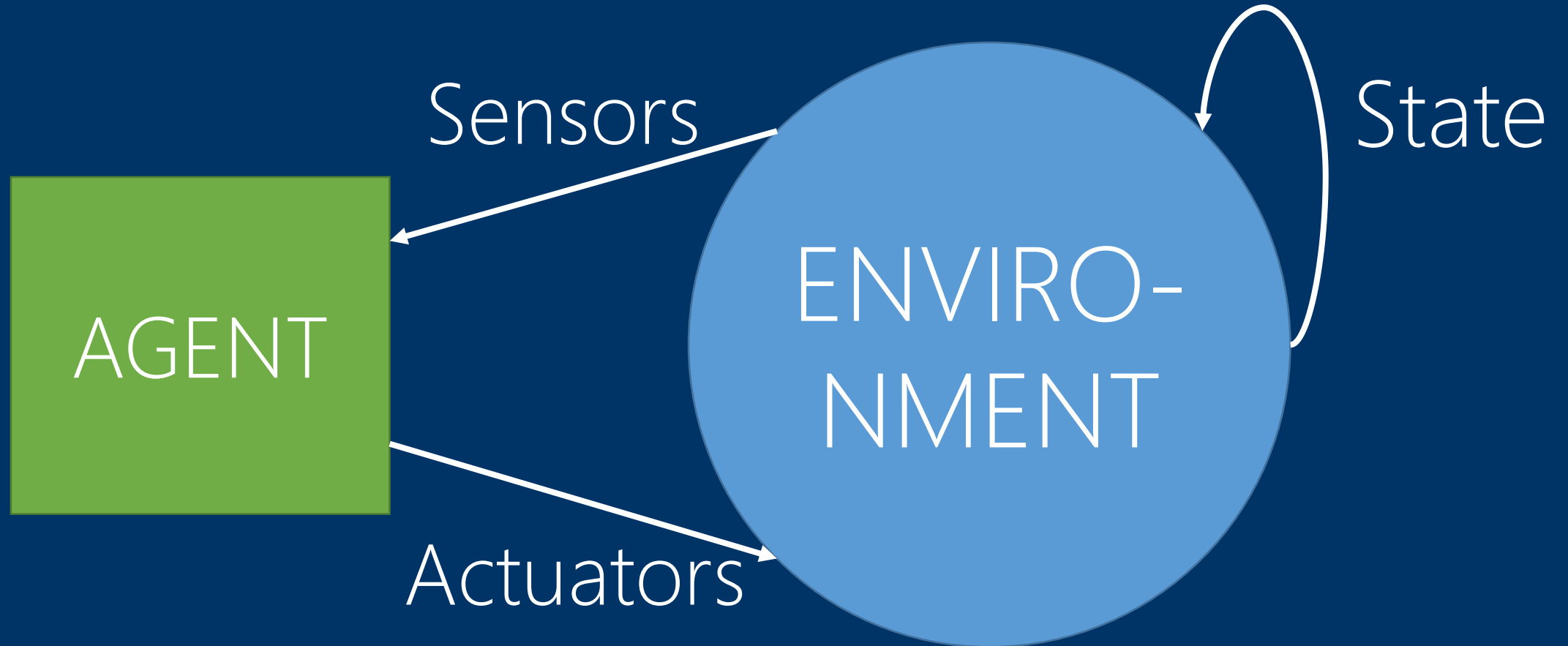


On the Web

Basic Terminology

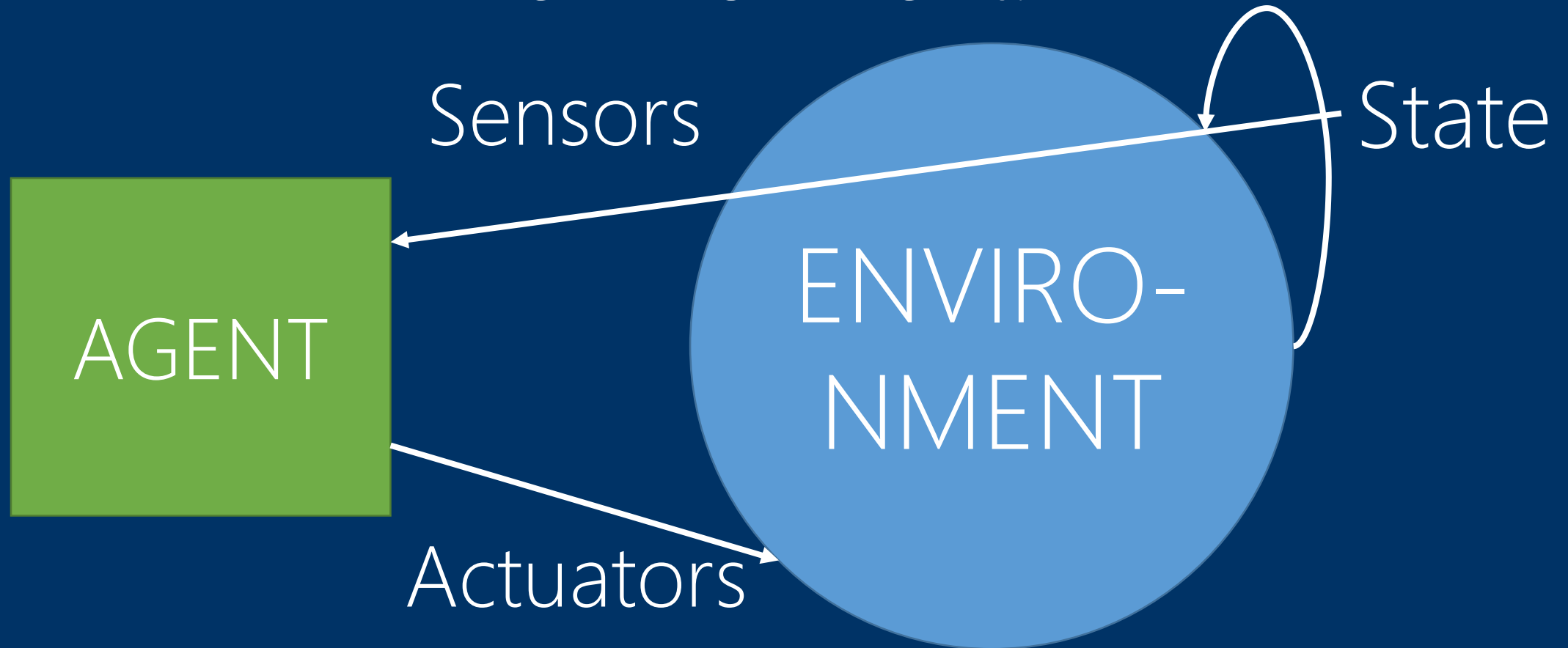
Before we continue, we will discuss some terminology that we can use to differentiate the problems that we will be encountering.

The environment has an internal *state*.

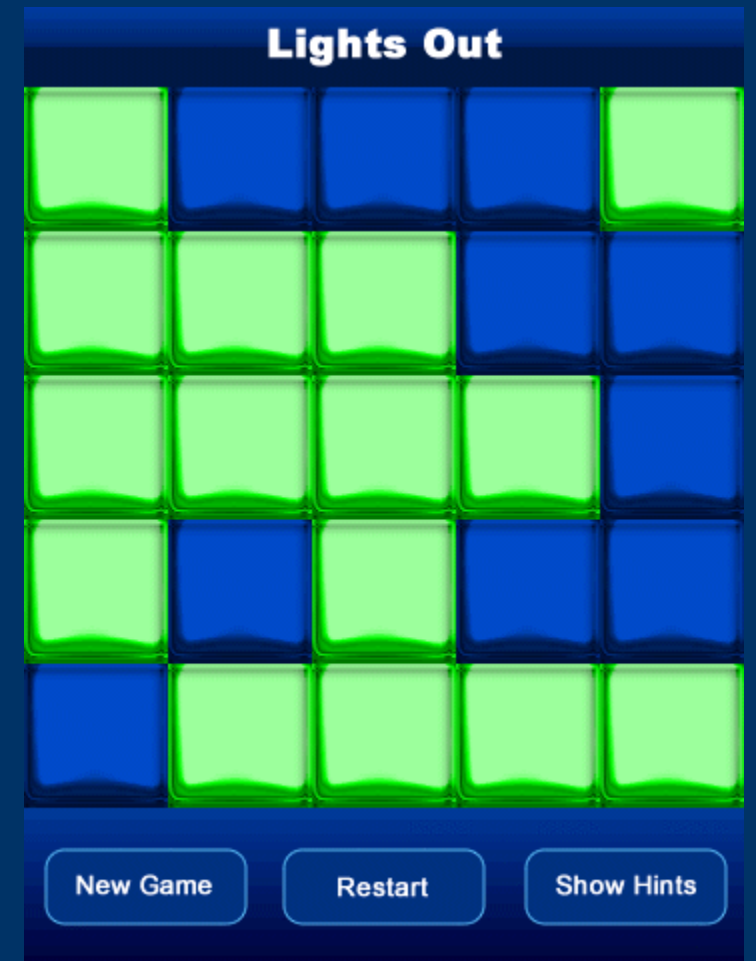
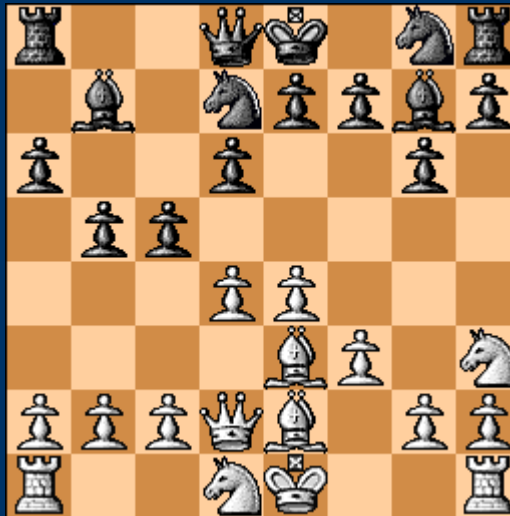
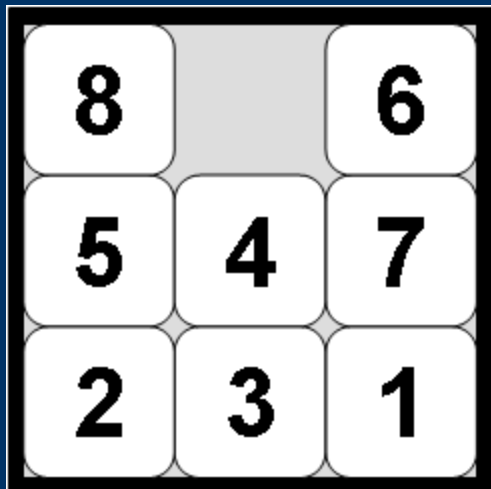


A problem has a *fully-observable* environment if the agent can sense all the information it needs to make the optimal decision.

The agent can see the **entire state** of the environment.



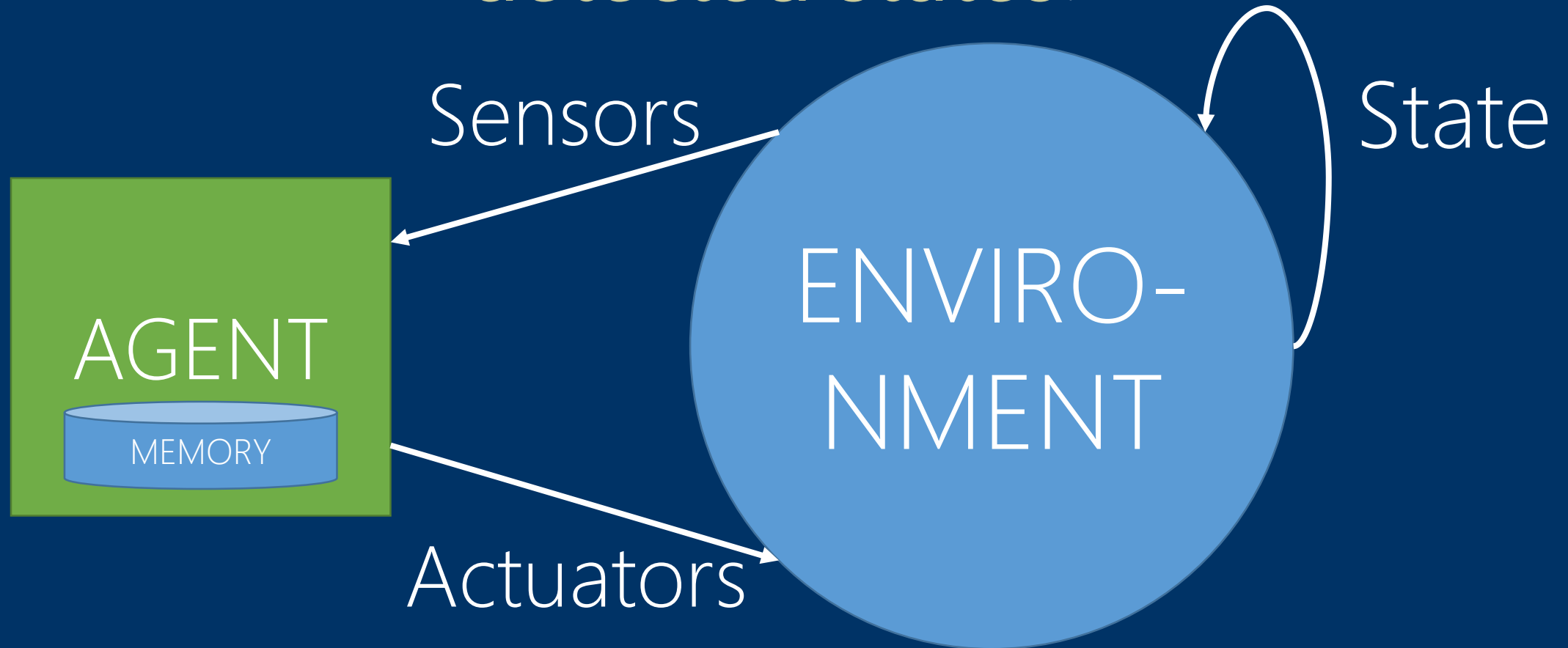
Examples



A problem has a *partially-observable* environment if the agent **needs memory of previous events** to make the best possible decision.

Basically, **not all information** needed to make the optimal decision is available.

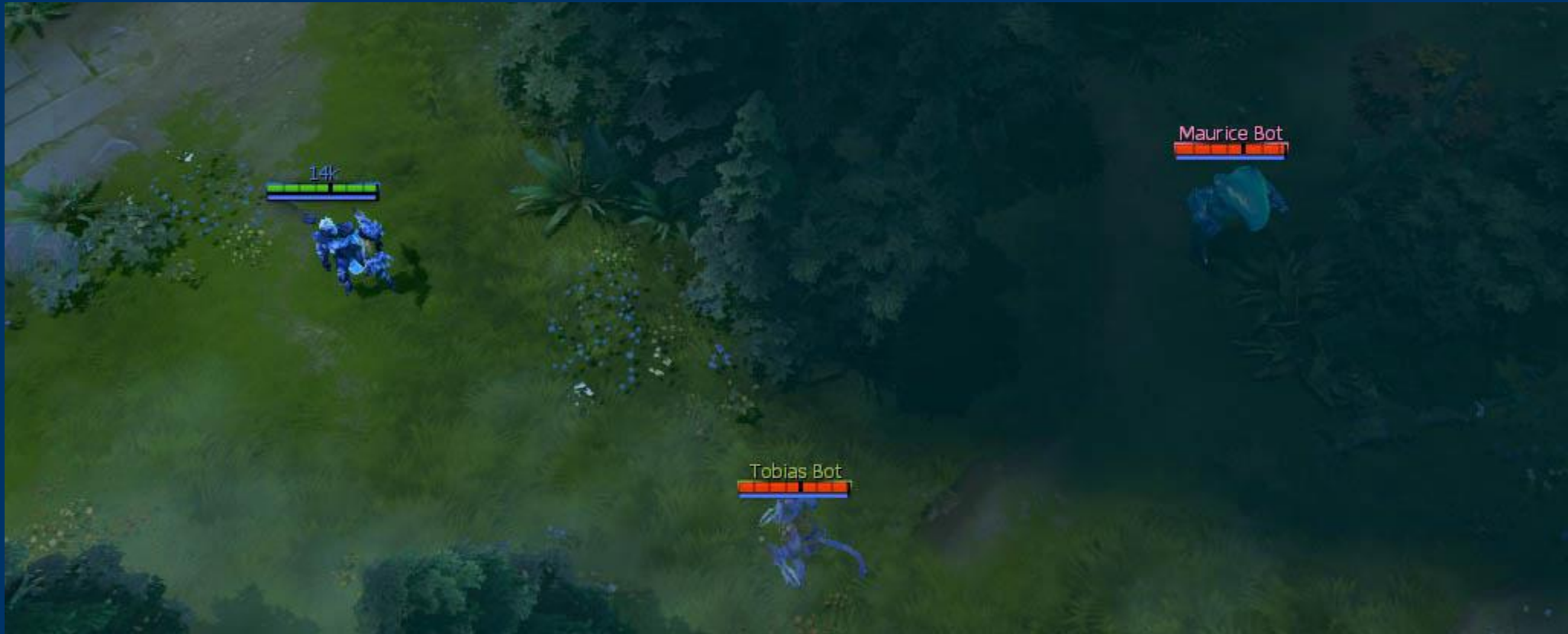
The agent needs memory of previously detected states.



Examples



Examples

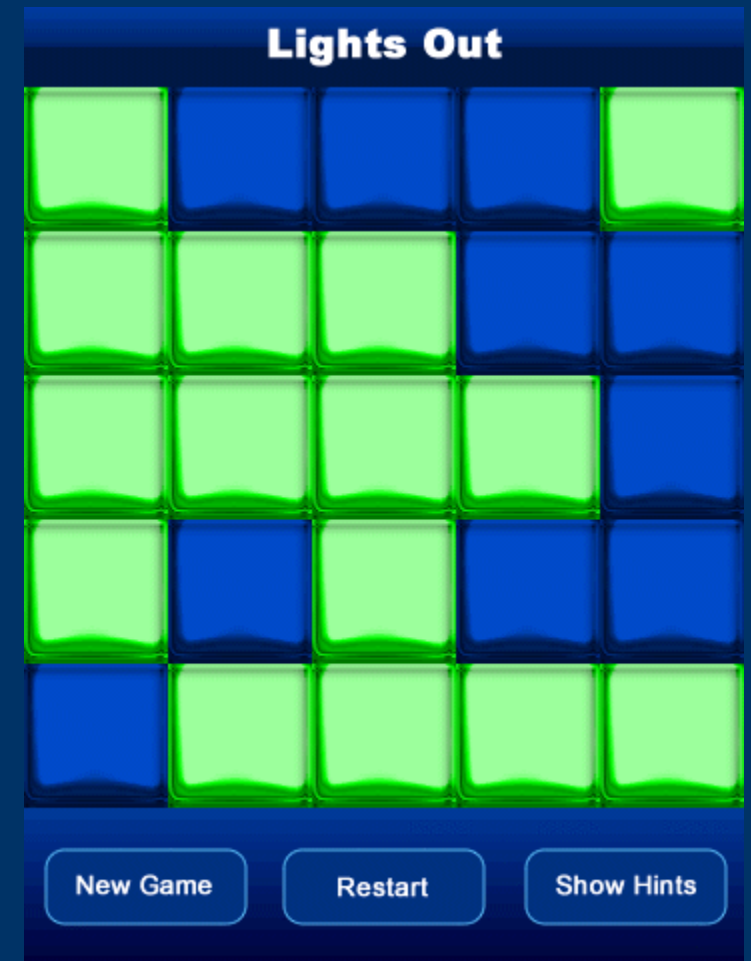
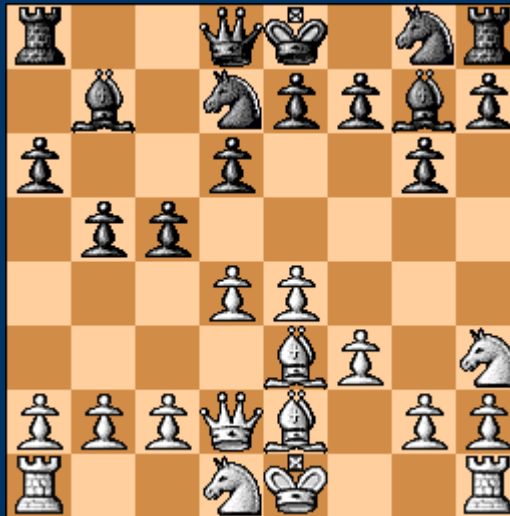
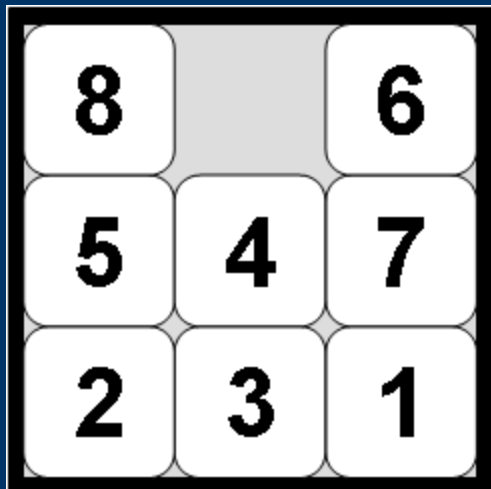


Examples



A problem is *deterministic* if the agent's actions uniquely determine the outcome.

Examples



A problem is *stochastic* if there is an element of randomness to it.

Examples

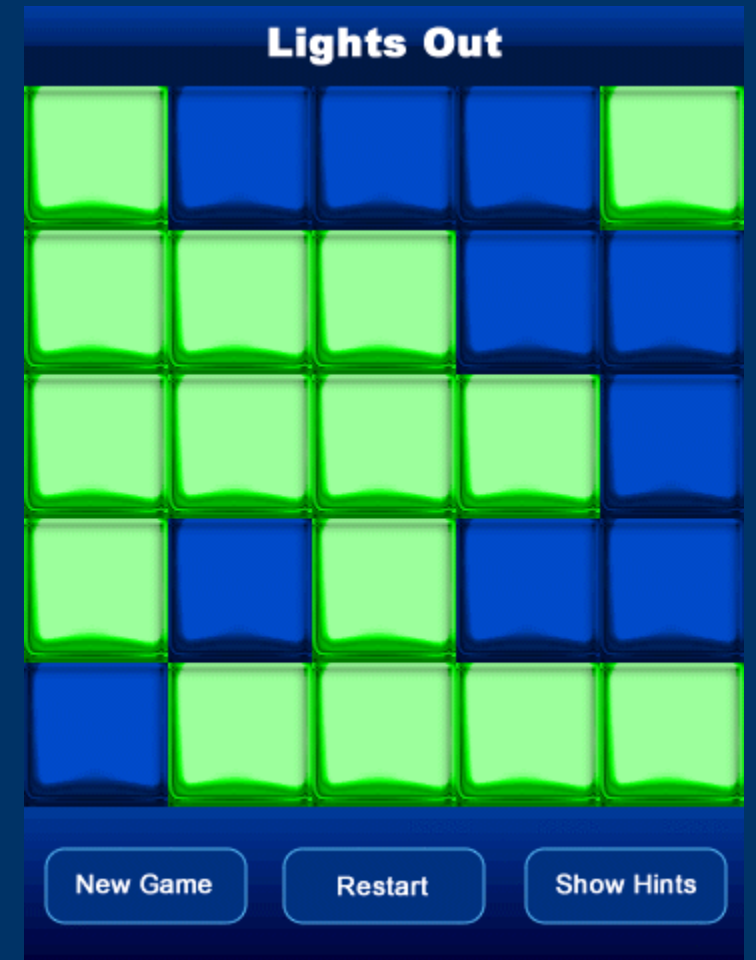
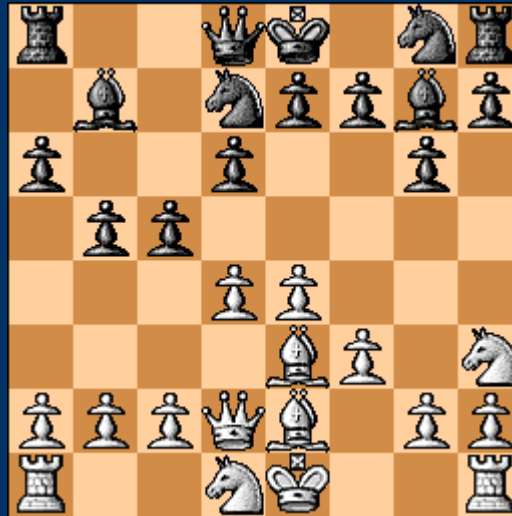
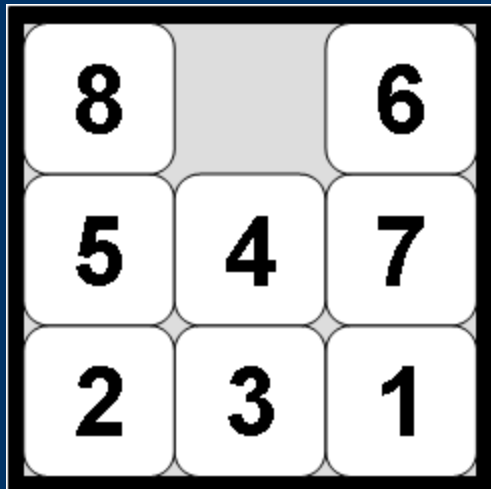


Examples



A problem has a *discrete* environment if there is a **finite** number of **action choices** and a **finite** number of **things to be sensed**.

Examples



Examples



Examples

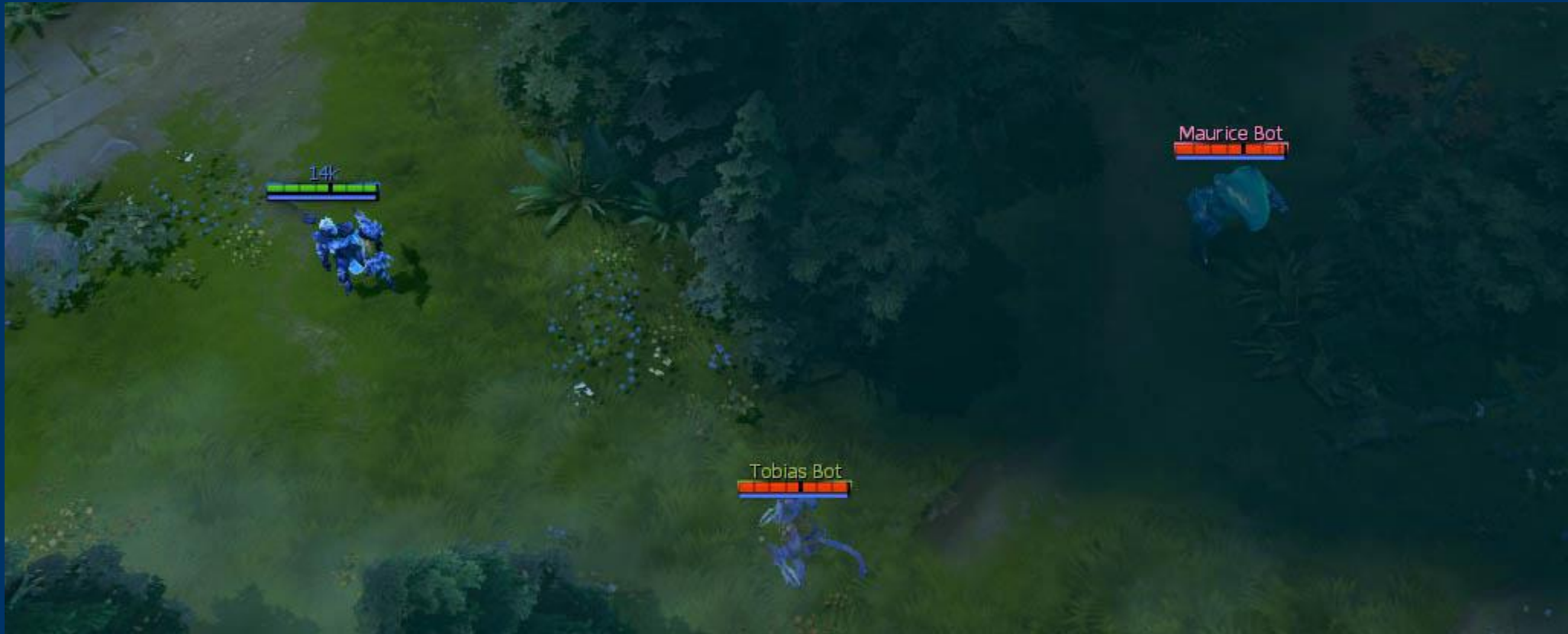


A problem has a *continuous* environment if the space of possible actions or things to sense is infinite.

Examples



Examples



Examples



A problem's environment is *benign* if it, or other agents, do not contradict the agent's objectives.

Examples

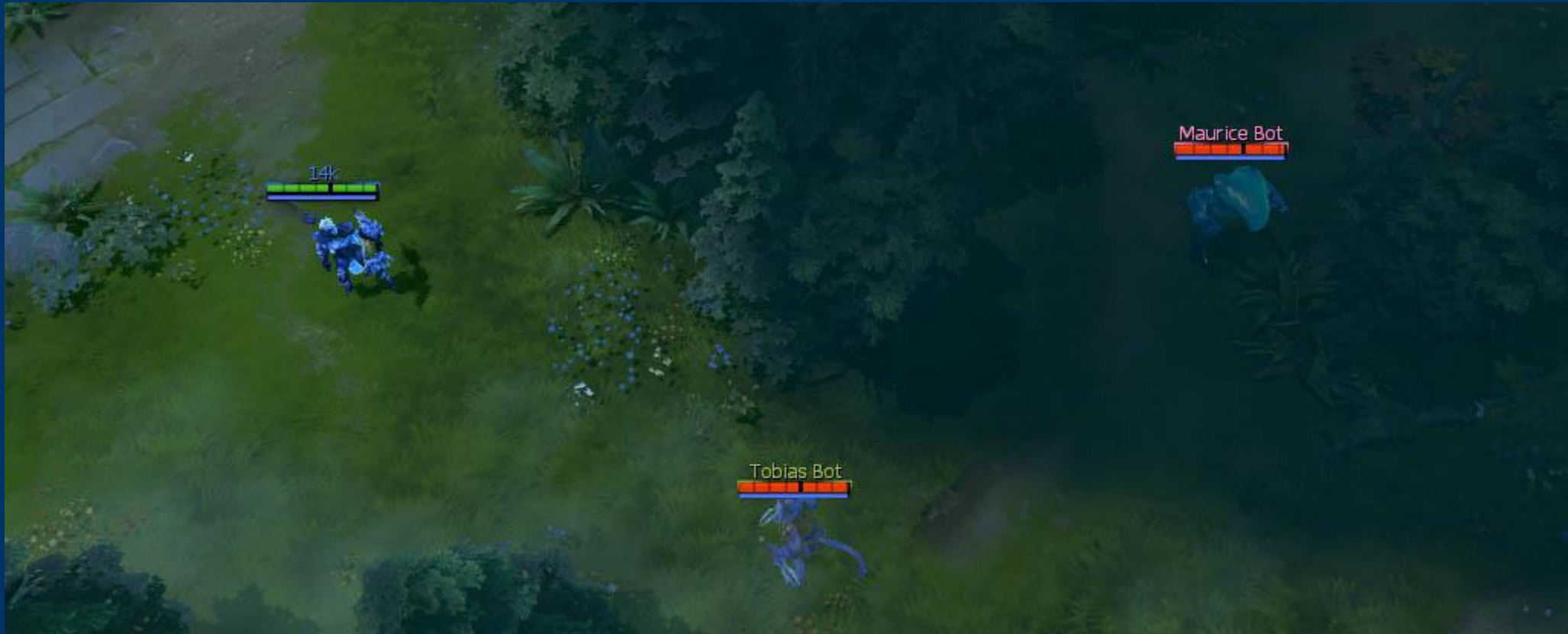


Examples



A problem's environment is *adversarial* if it, or any other agents oppose the agent's objectives or threaten its safety.

Examples



Examples



Artificial Intelligence in Uncertainty Management

Artificial intelligence is commonly used
when we humans can not figure out
what to do. :-D

Why don't we know what to do?

Why don't we know what to do?

Because of *uncertainty*.

How do we become uncertain?

Sensor Limits

Laziness

Adversaries

Ignorance

Stochasticity