CS 5100: Foundations of Artificial Intelligence (Spring 2020)   Chris Amato
Student name: (Due) January 16, 2020

Introduction, Agents, Search

1 Introduction

AIMA 1.3. Are reflex actions (such as flinching from a hot stove) rational? Are they intelligent?

2 Intelligent Agents

AIMA 2.3. For each of the following assertions, say whether it is true or false and support your answer with examples or counterexamples where appropriate.

(a) An agent that senses only partial information about the state cannot be perfectly rational.

(b) There exist task environments in which no pure reflex agent can behave rationally.

(c) There exists a task environment in which every agent is rational.

(d) Suppose an agent selects its action uniformly at random from the set of possible actions. There exists a deterministic task environment in which this agent is rational.

(e) It is possible for a given agent to be perfectly rational in two distinct task environments.

(f) Every agent is rational in an unobservable environment.

(g) A perfectly rational poker-playing agent never loses.

Properties of task environments

- Fully observable vs. partially observable
- Single agent vs. multiagent
- Deterministic vs. stochastic
- Static vs. dynamic
- Discrete vs. continuous

AIMA 2.4. For each of the following activities, characterize the task environment it in terms of the properties listed above.

(a) Playing soccer.

(b) Exploring the subsurface oceans of Titan.

(c) Playing a tennis match.

(d) Practicing tennis against a wall.

(e) Performing a high jump.

(f) Knitting a sweater.

3 Search

AIMA 3.2 Your goal is to navigate a robot out of a maze. The robot starts in the center of the maze facing north. You can turn the robot to face north, east, south, or west. You can direct the robot to move forward a certain distance, although it will stop before hitting a wall.

(a) Formulate this problem. How large is the state space?

(b) In navigating a maze, the only place we need to turn is at the intersection of two or more corridors. Reformulate this problem using this observation. How large is the state space now?

(c) From each point in the maze, we can move in any of the four directions until we reach a turning point, and this is the only action we need to do. Reformulate the problem using these actions. Do we need to keep track of the robot's orientation now?

(d) In our initial description of the problem we already abstracted from the real world, restricting actions and removing details. List three such simplifications we made.