Fundamentals of Artificial Intelligence
Exercise 1: Intelligent Agents – Problems Winter Semester 2022/23
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1 Presented Problems

Problem 1.1: Rational Agents

Problem 1.1.1: Which actions does a rational agent select?

Problem 1.1.2: Which of these games would a rational agent always win or draw at and why? Is it physically possible to build such an agent?

a. Poker
b. Tic-Tac-Toe (Noughts and Crosses)
c. Chess

Problem 1.2: Intelligent Agents

Consider the following intelligent agents:

a. GPS route guidance
b. Kettle (*Wasserkocher*)
c. Bi-directional escalator on Munich Underground

Problem 1.2.1: Suggest performance measures for each of the above agents, and which type of agent should be used out of the following:

- Simple reflex agent
- Model-based reflex agent (reflex agent with state)
- Goal-based agent
- Utility-based agent
- Learning agent (in combination with any of the above)

Problem 1.2.2: (adapted from *Russell & Norvig 3rd ed.*, q. 2.10) Consider the Vacuum Cleaner environment from the lecture notes (slide 11, lecture 2), in which the agent's performance measure awards three points for each clean floor at the end of the time of operation and penalises one point for each movement during operation. It can only perceive the room it is in.

a. Can a simple reflex agent be rational for this environment?
b. What about a reflex agent with state?

Problem 1.3: Environments

Problem 1.3.1: Andrea says: "a game of billiards is deterministic: a player's action is determined by the state of the table and where the ball is."

Bernhard says: "A game of billiards is stochastic, as one player doesn't know what the other player will do."

Catherine says: "A game of billiards is stochastic because it is impossible to know exactly where the ball is and what the shape of the ball and the table are. When the player hits the ball, it might go somewhere else than intended."

Who do you agree with?

2 Additional Problems

Problem 1.4: Intelligent Agents

Consider the following intelligent agents:

a. Bomb disposal agent
b. Weather forecast
c. Chess/strategy game on clock

Problem 1.4.1: Suggest performance measures for each of the above agents, and which type of agent should be used.

Problem 1.4.2: Think of further agents. For each, propose a performance measure and decide which type of agent can be used.

Problem 1.4.3: (from *Russell & Norvig* 2^{nd} *ed.*, q. 2.2) Both the *Performance Measure* and the *Utility Function* measure how well an agent is doing. What is the difference between the two?

Problem 1.5: Environments

Problem 1.5.1: (from *Russell & Norvig* 3^{rd} *ed.*, q. 2.4) For each of the following activities, give a PEAS description of the task environment and characterise it in terms of the properties listed in slides 19-25 from Lecture 2.

1. Playing football,
2. Subsea cable repair,
3. Price query for a product on the internet,
4. Bidding on an item at an auction.