

CS 411 - Homework 1

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1. Explain why the “Part-Picking robot” environment (Fig 2.6, page 45, AIMA) is characterized with following properties - partially observable, single-agent, stochastic, episodic, dynamic and continuous.
 - a. Partially Observable - It is a partially observable environment because the part picker cannot see the other squares of the area that it is not hovering over or it cannot see any parts that are outside its field of view
 - b. Single-agent - The only agent in this environment is the part picker itself. Its performance behaviour does not depend on the actions of any other entity in its environment, its performance only depends on its own sensors and actuators
 - c. Stochastic - It is stochastic because we can say with certain probabilities that the robot will pick the parts it sees and similarly assign probabilities to where it will move next based on what it senses
 - d. Episodic - It is episodic as the agent performs a series of atomic actions to pick parts and the percepts of the current sequence are independent of the previous episodes and the future episode is not dependent on the current episode of the robot, as part picking tasks are independent of the sequence in which they are picked, the sequence in which they are picked does not impact its performance
 - e. Dynamic - The environment of the part-picking robot continuously changes, if new parts are added to the environment or removed
 - f. Continuous - It is characterised as a continuous environment because the movement of the robot in the given space and the addition and removal of parts is smooth over time
2. Give PEAS description for the robotic-soccer environment.
 - a. Performance - Depending on the position of the robot in the team, individual performance can be measured based on several parameters, goals scored, ball steals, player tackles, shots blocked, shots on target, percentage of successful passes, and many more.
But to evaluate the performance of the team of robots, we can simply measure goals scored, percentage possession of the ball and percentage of successful passes or more if necessary

- b. Environment - It is a Fully observable, Multi agent, Stochastic, Sequential, Static, Continuous
 - i. The robot can fully observe the field, the ball and the players
 - ii. There are many agents in the game of soccer, and the actions of other players impacts the performance of our robot
 - iii. The robot performs certain actions like kicking, passing and tackling with certain probabilities based on the state of the game
 - iv. Sequential because, the actions taken by the robot have long term consequences for the rest of the game
 - v. It is static because the environment does not change or modify itself, the ground remains the same size the ball always follows the same laws of physics, the only things that modify the environment are the agents and the environment never inherently changes on its own
 - vi. It is continuous because the robot needs to constantly sense its environment through time to know ball position, player positions et cetera and the latency it takes to make a decision during the game is the same as it not making a decision in that latency period
 - c. Actuators - The actuators of the robot can be its robotic limbs, arms and legs and its core
 - d. Sensors - The sensors of the robot can be its vision and feel of the ball on its robotic foot
- 3. Define rational agent and autonomous agent in your own words
 - a. Rational agents are a class of agents that acts in a way that maximises the performance at any given instant given the set of its percept history
 - b. Autonomous agents are a set of agents that act independently without human intervention towards their goals
- 4.
 - a.
 - i. The addition of the action "NoOp" would still make the cleaner keep moving back and forth.
 - ii. In order for the agent to stop moving after the whole floor is clean, we need the agent to have a history of the percept at the previous square to truly know if both the squares are clean.
 - iii. The addition of NoOp would keep the location of the agent unchanged, so on the next percept, the agent would still make the decision to move Left/Right to check whether the adjacent square is Clean or Dirty (as it has no history and does not know), and thus, the cycle would repeat and the agent would move indefinitely, or it would simply stop moving

after cleaning the square it currently perceives, as it continuously executes a NoOp and does not move to clean the adjacent square.

- iv. And if we incorporate the percept history into the agent, it would no longer be an SRA, it would be a Reflex agent with state or a model based reflex agent

b.

1. A Reflex agent with state, also known as model based reflex agent would be better suited for this task.
2. It can use the history of whether the square it was on previously was clean to avoid moving back and forth between the squares continuously.
3. It would stop moving after both squares were cleaned due to its knowledge of the history of whether the square it was at before was clean or not and it can be programmed to stop moving when it knows that the previous and current square both are clean.