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Artificial Intelligence: HW1

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

1.1: An agent that senses only partial information about the state cannot be perfectly rational.

False. Perfect rationality constrains an agent's actions to provide the maximum expectation of success given the information available. Therefore, for a simple vacuum machine with limited sensors, it can still be perfectly rational with good performance measure.

1.2: There exist task environments in which no pure reflex agent can behave rationally.

True. Since the pure reflex agent cannot store information from previous percepts, like a simple vacuum machine cannot know where was cleaned so it will do the cleaning randomly.

1.3: There exists a task environment in which every agent is rational.

True. For those environments that have limited states, the actions will lead to the same result. For example, the cooling thermostat will always be rational, no matter the action, if the environment temperature is low.

1.4: The input to an agent program is the same as the input to the agent function.

False. The agent function is a conceptual mapping from entire percepts without state or side-effects, while the agent program only takes the implication of current percept.

1.5: Every agent function is implementable by some program/machine combination.

False. With the difference between agent function and program, the agent function may be implemented poorly due to the physical restriction like run out of memory.

1.6: 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.

It is True if the environment has only one state. If the reward is the same, the random choice of action will not change it and the agent will be rational. We can use the example of thermostat before to support the rational agent in one state environment.

1.7: It is possible for a given agent to be perfectly rational in two distinct task environments.

True. For example, even though the two environments may be distinct, the different part may not be achieved by the agent in both environment due to the based information.

1.8: Every agent is rational in an unobservable environment.

False, an agent can be rational if it has a build-in knowledge could be able to access the state. For example, a simple vacuum cleaner is not rational if it never cleans.

1.9: A perfectly rational poker-playing agent never loses.

False. There is always a possibility that the perfectly rational poker-playing agent could lose. For instance, thinking about if a perfectly rational poker-playing agent plays card game with another one, there is one must lose.

2: For each of the following activities, give a PEAS description an agent could use.

2.1: Playing soccer:

• Performance measure: Win or Lose

• Environment: Soccer Field or stadium

• Actuators: Legs, Head, Body, Even hands for goalie

• Sensors: Eyes, Ears

It can be partially observable, stochastic (strategic), sequential, dynamic, discrete (if in a match it is 90mins), multiagent, unknown.

2.2: Shopping for used AI books on the Internet.

• Performance measure: Cost, Quality of the book

• Environment: Internet

• Actuators: Search engine, Input query, Purchasing Processor

• Sensors: Website or other types of interface

It can be partially observable, stochastic, sequential, dynamic, continuous, multiagent, unknown.

2.3: Practicing tennis against a wall.

• Performance measure: Win or Lose

• Environment: Tennis Field, Wall

• Actuators: Racket, Hands, Legs

• Sensors: Eyes, Ears

It can be partially observable, stochastic, sequential, dynamic, continuous, single-agent, unknown.

3: Consider a simple thermostat that turns on the A/C when the temperature is at least 3 degrees above the setting and turns the A/C off when the temperature is at least 3 degrees below the setting. Is a thermostat an instance of a simple reflex agent, a model-based reflex agent, or a goal-based agent? Explain why.

This thermostat could be an instance of a simple reflex agent. There are two states: On and Off. It has a percept which is the temperature. Therefore, the thermostat could simply react based on the current percept and do not need to track it. It is not a goal-based agent because its action is simple, and it does not need search algorithms to find action sequences unless we make this thermostat more complicated.