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

1. An agent that senses only partial information about the state cannot be perfectly rational.
2. There exist task environments in which no pure reflex agent can behave rationally.
3. There exists a task environment in which every agent is rational.
4. The input to an agent program is the same as the input to the agent function.
5. Every agent function is implementable by some program/machine combination.
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.
7. It is possible for a given agent to be perfectly rational in two distinct task environments.
8. Every agent is rational in an unobservable environment.
9. A perfectly rational poker-playing agent never loses.

Answers

1.What is rational depends on 4 things: the performance measure, the agent's prior knowledge about the environment, actions the agent can perform, agent's percept sequence.

Therefore, for each possible percept sequence, a rational agent should select an action that maximizes its expected performance measure, **given the evidence provided by the percept sequence** and whatever built-in knowledge it has.

If the agent has partial information about the state, its rationality is argued keeping in mind it has limited capability of sense. So essentially, the question now becomes: what does it mean for the agent to be rational when it has limited sensing? It's possible for such agents to be rational.

2.Pure reflex agents simply act on the current percept ignoring percept history and in the case of environments where the same percepts require different actions to be deemed rational, the pure reflex agents cannot be rational as they have fixed action for any given percept.

3.Examples of such task environments are trivial environments where the performance measure is a fixed signal that ignores the action and the percept sequence. However such task environments are not of much importance.

4.Agent program is a concrete implementation of some agent function that is abstract. The input to the agent program is the current percept whereas the input to the agent function could be the entire percept sequence.

5.Consider the agent functions which if tabulated are infinitely long. It is possible to design an agent function whose output depends on the entire percept sequence for every percept sequence. The agent programs, which are concrete physical implementations, may either run out of time or/and memory making the exact implementation impossible.

6.Yes, consider an environment where the performance measure isn't dependent on the action taken.

7.This can be seen by extending the example discussed in 3. Given two such environments agents can be rational.

8.It is possible certain actions are better than others even if the environment is unobservable so not every agent is necessarily rational in a given unobservable environment.

9.Such an agent can still lose, however rational. Poker is a game of chance in the short run and a game of skill in the long run. Rational agents minimize losing but still are susceptible to lose due to "luck".