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CS534-S23-S01 Group Project Assignment #1

Question 1:

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

False. The agent can still behave rationally according to the available sensory information it has perceived.

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

True. A simple reflex agent will not behave rationally in a partially observable environment as it does not pay attention to how its world evolves.

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

True. A simplistic task environment that is fully observable with no action being considered less optimal than the next.

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

False. The agent program runs on the physical architecture to produce the agent function while the agent function maps from percept histories to actions.

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

False. The agent function could be to solve an extremely complex or unsolvable problem.

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.

True. The agent's task could be to act randomly.

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

True. If the initial environment is modified in such a way that it does not affect the actions of the agent then it will remain perfectly rational.

8. Every agent is rational in an unobservable environment.

False. Some actions are likely to be considered less optimal than others; however, the agent would not know this without knowledge of the environment.

9. A perfectly rational poker-playing agent never loses.

False. There is an element of luck associated with poker and the agent may never draw cards better than opposing players.

Question 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.

1. Formulate this problem based upon the above observation.

Set of Possible States – We do not know the size of the maze, but it is fair to assume an unknown finite space.

Initial State – The robot starts in the middle of the maze facing north.

Goal State – The robot must get anywhere outside the maze (facing any direction).

Possible Actions – The robot can change the direction it's facing (north, east, south, or west) and move forward.

Transition Model – The robot can change the direction it's facing at any time. It will progress forward until it encounters a wall at which point it will stop. Once stopped, it will need to change its direction to progress further.

Action Cost Function – Time and distance traveled, but this is not necessarily defined in the problem statement.

2. 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 additional observation.

Set of Possible States – Since the robot only needs to turn at intersections, the number of states within the maze has been reduced. Possible states would include intersections and dead ends. The robot would be moving forward at any other time until it has encountered one of these states (stopped and turned).

Initial State – **No Change**

Goal State – **No Change**

Possible Actions – **No Change**

Transition Model – ~~The robot can change the direction it's facing at any time.~~ The robot will progress forward until it encounters an intersection of two or more corridors (or a wall) at which point it will stop. Once stopped, it will need to change its direction to progress further.

Action Cost Function – **No Change**

3. 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 additional actions.

Set of Possible States – The number of states within the maze has been reduced again since the robot no longer needs to turn at intersections. Instead, it only needs to move in a different direction. Possible states would still include intersections and dead ends. The robot would be moving at any other time until it has encountered one of these states (and stopped).

Initial State – **No Change**

Goal State – **No Change**

Possible Actions – The robot can change the direction it's facing (north, east, south, or west) [not necessary now] and move in any direction.

Transition Model – ~~The robot can change the direction it's facing at any time.~~ The robot will progress ~~forward~~ until it encounters an intersection of two or more corridors (or a wall) at which point it will stop. Once stopped, it will need to move in another direction to progress further.

Action Cost Function – **No Change**