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

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

False.
Perfect rationality refers to the ability to make good decisions given the sensor information received.

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

True
A pure reflex agent ignores previous percepts, so cannot obtain an optimal state estimate in a partially observable environment

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

True
For example, in an environment with a single state, such that all actions have the same reward, it doesn't matter which action is taken.

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

False.
The agent function, notionally speaking, takes as input the entire percept sequence up to that point, whereas the agent program takes the current percept only.

e. Every agent function is implementable by some program/machine combination, suppose an agent selects its action uniformly at random from the set of possible actions.

False.
For example, the environment may contain Turing machines and input tapes and the agent's job is to solve the halting problem; there is an agent function that specifies the right answers, but no agent program can implement it. Another example would be an agent function that requires solving intractable problem instances of arbitrary size in constant time.

f. There exists a deterministic task environment in which this agent is rational.

True.
This is a special case of (c); if it doesn't matter which action you take, selecting randomly is rational.

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

True

For example, we can arbitrarily modify the parts of the environment that are unreachable by any optimal policy as long as they stay unreachable.

h. Every agent is rational in an unobservable environment.

(We had some sort of discussion on this one: KEYWORD here is the words Every Agent)

Fully observable: sensors give complete state of the environment at each point in time, i.e. if the sensors detect all aspects that are relevant to the choice of action.

Unobservable environments occur as a result of lack of sensors or mechanism to get any percepts from the environment.

Given the above knowledge the answer would be:

False

Explanation:
Suppose the agent has a model of the environment and therefore can form certain beliefs about the environment. In this case:

- Some actions taken could be stupid (agents that pick such actions are obviously irrational)
- Other actions will be the correct actions to take and therefore rational.

From the conversation in class, it seemed that we are confusing an expected utility or measure of success based on whether or not we can see the environment. This should not be the case:

For instance, if you go ailing to a medical doctor, they might give you a general antibiotic rather than having you go to the lab to draw your blood (in this case sensing), then you having to wait for couple of days for the results before prescribing a more specific antibiotic and possibly having you hospitalized.

PS: We shall be discussing later about belief states etc. and searching/ problem solving with uncertainty (think probabilities etc).

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

False.
Unless it draws the perfect hand, the agent can always lose if an opponent has better cards. This can happen for game after game. The correct statement is that the agent's expected winnings are nonnegative.

For each of the following activities, give a PEAS description of the task environment as discussed in the previous class.

NB: **The answers to this depend on the level of detail and abstraction. I think someone in the class pointed this out! I fully agree:**

a. Playing soccer.

b. Exploring the subsurface oceans of Titan.

c. Shopping for used AI books on the Internet.

d. Playing a tennis match.

e. Practicing tennis against a wall

f. Performing a high jump.

g. Knitting a sweater.

h. Bidding on an item at an auction.