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Artificial Intelligence

**Homework 1**

Complete the following problems/answer the following questions.

Problem 1: Consider Vacuum Cleaner World, and in particular, consider the very simple

example environment on page 38 of the textbook, in figure 2.2, which contains only 2 cells.

Consider the following PEAS description of the task. Assume that the performance measure (P)

gives your agent 1 point for each clean cell at each time step, over a lifetime of 1000 time

steps. The environment (E) is as shown in figure 2.2 on page 38 (i.e., 2 cells, A and B). Your

actuators (A) are: Left, Right, and Suck. Left moves you left if there is a cell to the left and does

nothing if there aren't any cells to the left. Right moves you right if there is a cell to the right and

does nothing if there aren't any cells to the right. Suck picks up all dirt in your current cell. Each

of these requires one time step. Your sensors (S) tell your agent the cell it is currently in, and

whether the cell is clean or dirty. Answer the following questions:

a. (True or False) It is possible for a Simple Reflex Agent to be perfectly rational in this

task environment.

**-ANSWER True**

b. Figure 2.3 on page 38 of the textbook describes the agent-function for this task

environment as a table listing the percept sequence in the first column and the action the

agent should take given that percept sequence in the second column. Is the agent

described there rational for this task environment?

**-ANSWER Yes the agent is rational for the current task environment.**

c. If you answered yes to part b, explain why. Likewise, if you answered no to part b,

explain why not.

**-ANSWER This is because the functions that are associated with the Agent give the agent the capability to complete objective as efficiently as possible.**

Problem 2: For each of the following statements, indicate if the statement is True or False. If

True, provide an example demonstrating that it is True. If False, provide a counterexample.

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

**-ANSWER False, in order for an agent to be perfectly rational it is supposed to make the most optimizable decision based on the information the senses receive.**

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

**-ANSWER True, a pure reflex agent does not pat attention to previous precepts.**

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

**-ANSWER True, if you have an environment with only one state any action taken will achieve the goal. It also doesn’t matter what action is taken because every action will lead to the same goal.**

d. 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.

**-ANSWER True, if you are in an environment where any action that is completed receives the same reward. In this instance selecting a random action is rational.**

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

**-ANSWER False, the agent can only win if it has the perfect hand. The agent can easily lose if an opponent obtains a better hand.**

Problem 3: Indicate the characteristics of each of the following task environments. Please

organize your answer in the form of a table such as Figure 2.6 from page 47 of the textbook.

Specifically, indicate for each task environment if it is fully or partially observable, single agent

or multiagent, deterministic or stochastic, sequential or episodic, static or dynamic or

semidynamic, and discrete or continuous.

a. Playing soccer.

b. Shopping for used AI books on the Internet.

c. Playing a tennis match.

d. Practicing tennis against a wall.

e. Performing a high jump.

f. Knitting a sweater.

g. Bidding on an item at an auction (an ascending price auction where bidders know the

current high bid, and can choose to place a new bid a fixed increment above the current

high bid, the auction ends when nobody wants to place any additional bids, and the high

bidder gets the item for the price of their bid).

h. Bidding on an item at an auction (a sealed price auction where each bidder submits their

bid privately, a single bid from each bidder, the sealed bids are only opened when the

auction ends, and the highest bidder gets the item for the price of the second highest bid).

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| Task Environment | Observable | Agents | Deterministic | Episodic | Static | Discrete |
| A | Partially | Multi | Stochastic | Sequential | Dynamic | Continuous |
| B | Partially | Single | Deterministic | Episodic | Static | Discrete |
| C | Partially | Multi | Stochastic | Sequential | Dynamic | Continuous |
| D | Fully | Single | Stochastic | Sequential | Dynamic | Discrete |
| E | Fully | Single | Stochastic | Sequential | Static | Discrete |
| F | Fully | Single | Deterministic | Sequential | Static | Continuous |
| G | Fully | Multi | Deterministic | Sequential | Dynamic | Discrete |
| H | Partially | Multi | Stochastic | Episodic | Static | Discrete |