Topics Covered: This assignment covers: (a) Introduction to A.I. and (b) Intelligent Agents.

Must be done independently.

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.
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?
c. If you answered yes to part b, explain why. Likewise, if you answered no to part b, explain why not.

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.
b. There exist task environments in which no pure reflex agent can behave rationally.
c. There exists a task environment in which every agent is rational.
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.
e. A perfectly rational poker-playing agent never loses.

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).