ASSIGNMENT-1
ASU ID : 1218506822

Exercise: 1.1

We know that the goal of the agent is to maximize the performance measure. It is mentioned that the performance measure is directly proportional with only the first T time steps. Hence, when the environment is timed and the agent has access to time, the agent's actions depend on the time T and the actions may vary accordingly. For example, let's assume a boxing contest, where a player gets +3 points for hard shots and +1 for easy shots. During the first T time steps. The agent tries to be offensive and score as much as possible carefully but when he is left with little time at the end he tries to be defensive and score +1 rather than +3 . After the contest is done, the boxer doesn't bother about his performance. Therefore in this case, the agent will also operate similarly, depending not only on the state of the environment but also time.

Exercise: 1.2

a.An agent that senses only partial information about the state cannot be perfectly rational (**False**) The agent's goals may still be achievable, For instance, assume a simple vacuum-cleaner agent that cleans a square if it is dirty and moves to the other square if not dirty, performance measure is to clean the room, Though the agent does not observe the adjacent square state, still it can move left and right and clean the room maximizing the performance measure being rational.

b. There exist task environments in which no pure reflex agent can behave rationally. (**True**) We know the simple reflex agent ignores the previous percepts and chooses action based on the current percept. If we assume the environment , where the vacuum cleaner is assigned **(+1 point for clean square upto time T)** and deducted **(-1 per move)**. In this case, the agent may move left or right every time since it does not have information about the previous state, revisiting the clean squares again may lead to penalty of losing points. In this case agent can't be rational

c.There exists a task environment in which every agent is rational. (**True**). If in the environment, the agent is rewarded for any actuator movement it takes irrespective of the state. For Example, If the vacuum cleaner gains points for left, right or no-op , Then is said to be rational because irrespective of the action chosen it maximises the performance measure.

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. (**True**). If we consider an environment, where all the actions are rewarded the same. The performance measure of agent is also rational because any action randomly taken by the

agent gives the same reward. For example, assume that the vacuum cleaner has following actions left or right or no-op, any operation it chose randomly is maximises performance measure.

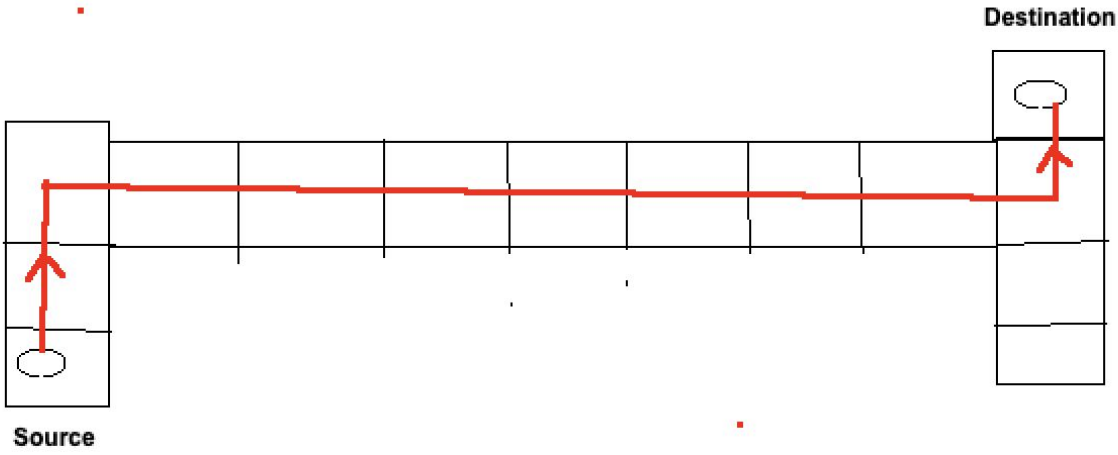
e. Every agent is rational in an unobservable environment.
(**False**). Let's consider an agent without any sensors to create an unobservable environment. For example, in general a vacuum cleaner has to sense the state,clean when it dirt and move If there are no sensors, the vacuum does not sense and move at all .Even if it moves, it cannot sense and clean accordingly. So, In this case the agent may sit idle and does not maximise the performance measure by cleaning the room, therefore it is not rational.

Exercise 1.3

a. Can a simple reflex agent be perfectly rational for this environment? Explain.
(**No.)** It is given that the agent does not know about the extent, boundaries, and obstacles and it just knows its current location and dirt in the environment. For instance, let's assume that the reflex agent is in Block A , it senses the dirt and sucks it. If the agent chooses the action left as it is aware of boundaries, it moves out of the environment and can be stuck there , In another instance, the agent can also be stuck with an unexpected obstacle.Therefore,it cannot be rational because the agent does not increase the performance measure of cleaning the room.

b. Can a simple reflex agent with randomized function outperform a simple reflex agent?
(Yes). A simple reflex agent with a randomized agent function can outperform the simple reflex agent because if we take that the agent is blocked by an obstacle in the environment. Instead of moving in the direction that is blocked it can randomly choose any other direction that is not blocked. Suppose If it chooses right and is stuck, then it randomly chooses up and there might be no obstacle, this way the agent might still remain in the environment and maximise its performance matrix.Therefore the agent can be rational in this case. In some environments, randomized behavior is rational and avoids infinite loops or blockages.

c.



This is an instance of the environment where the randomized agent function will perform poorly. Suppose if the agent starts from the bottom left corner of the environment and has to reach the top right corner and the agent can randomly opt up, down, left, right directions. If the agent chooses right from the source and it can go outside the environment and has to choose multiple directions until it chooses randomly left. The agent is penalized for those random options towards its journey to destination, which affects its performance badly.

Exercise 1.4

a. What is this type of agent? Can you specify the agent function?

This is a **simple reflex agent**, which senses the current location, Everytime when it encounters an obstacle in the path, it does tactile sensing of adjacent obstacles. it will choose the possibility towards the goal by following the contour of the obstacle.

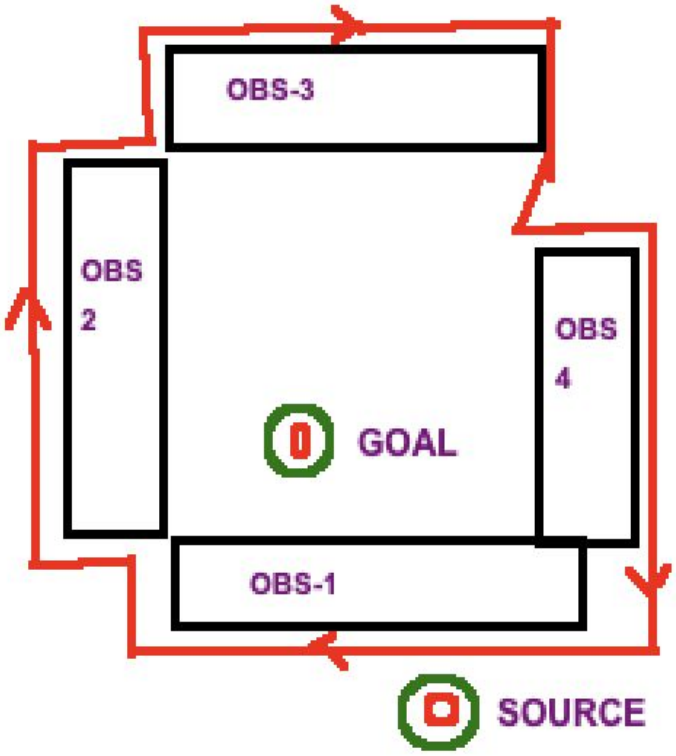
The agent function will the following condition-action clauses:
1. If there is a possibility to move towards the goal from the current location then head towards the goal.
2.If encountered with an obstacle from the current location, follow the contour of the obstacle.

Agent Function:

Percept Sequence	Action
[CurrentLocation, No Obstacle]	MOVE (towards the goal)
[CurrentLocation, Obstacle]	FOLLOW the contour
…….. ……...	…… ……..
[CurrentLocation, Goal]	STOP

b. Can this agent always reach the goal location? If your answer is yes, explain your answer. Otherwise, justify

(**No**) the agent can't always reach the goal, The agent may get stuck in a cycle in this kind of environment.



Let's consider the above diagram. The agent starts from the source, finds an obstacle -1 , obstacle-2, obstacle-3 and tries to follow the contour of the obstacle, from obstacle -3 , when moving towards the goal, it finds an obstacle-4 , instead of proceeding towards the goal, it follows the contour of the obstacle-4 and keeps on moving and gets stuck in cycle.