IMT3591 – Artificial Intelligence – Spring 2014 – Assingment1

DEVELOPING A SIMULATION ENVIRONMENT FOR A VACUUM CLEANER AGENT.

In this assignment, you will be developing a vacuum cleaner agent. As explained in the lecture, agents enter a perceive-think-act cycle while they are living in their environments in order to achieve their goals and be able to cope with the changing environmental conditions. The thinking of an agent can be algorithmic, logic-based or reactive. This assignment is about a reactive vacuum cleaner agent. If, after a reactive agent perceives its environment, finds a rule in its memory whose precondition matches the perception which the agent received from its environment, then the reactive agent will apply this rule and execute the action part of the rule. It will not further do any other logic based or algorithmic thinking. Then, the question mark in Figure 1 below corresponds to a set of rules that the reactive agent keeps in its memory. After each new percept, the agent matches its current situation with the precondition of the existing rules. If there is a match with any of the existing rules, then the agent applies the action part of the matching rule. In Figure 2, a vacuum cleaner agent is shown in its environment of just two locations.

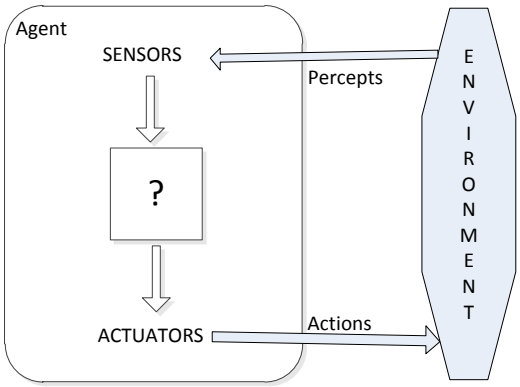

Figure 1. Agents interract with environments through sensors and actuators

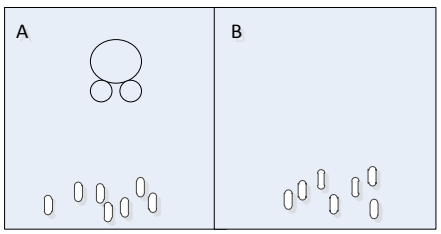

Figure 2. A vacuum cleaner environment/world with just two locations

In the below table, the list of corresponding actions is given for an example percept sequence for the environment given in Figure 2:

Percept Sequence	Action
[A, Dirty]	Suck
[A, Clean]	Right
[B, Dirty]	Suck
[B, Clean]	Left

The agent behavior is defined as follows:

- The agent uses a performance measure where the measure awards one point for each clean square at each time step, over a lifetime of 1000 steps.
- The geography of the agent is know a priori, as shown in Figure 2 above but the dirt distribution and the initial location of the agent are not. Clean squares stays clean and sucking cleans the current square. The left and right actions move the agent left and right except when this would take the agent outside the environment, in which case the agent remains where it is.
- The only available actions are Left, Right, Suck and NoOp (do nothing).
- The agent perfectly perceives *its location* and *whether that location contains dirt*.

In this assignment, you are asked to:

a) Implement an environment for the vacuum cleaner agent. Your implementation of the environment should be modular so that the environment characteristics (size, shape, dirt placement, etc.) can be changed easily.

b) Implement a simple reflex agent for the vacuum environment. Run the environment simulator with this agent for all possible initial dirt configurations and agent locations for the environment shown in Figure 2. Record the agent's performance score for each configuration and its overall average score.

c) Describe a rational agent function for the modified performance measure that deducts one point for each movement. Does the corresponding agent program require internal state?

d) Discuss possible agent designs for the cases in which clean squares can become dirty and the geography of the environment is unknown. Does it make sense for the agent to learn from its experience in these cases? If so, what should it learn?

e) Implement an environment where the squares can become dirty and the geography of the environment is unknown using a design from part d. Clearly define your new agent behavior.

The delivery:

The code for the agent and its environment should be submitted to the fronter for your group on **4th February, by midnight**. Also, you will be delivering a report to fronter where you indicate the recorded performance of the agent, and where you describe your agent and environment design and answer part c), d) above.

On 5th February, each group will make a demonstration of 20 minutes of their implementation at a predefined time. Your agent and environment design should be clearly understandable from your report.