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CMPE 540: Principles Of Artificial Intelligence

Assignment I: Vacuum Cleaner

On this assignment, the task was to build an intelligent vacuum cleaner. In order to implement this, I created a simple environment that consists of 4 adjacent zones. These zones can be either clean or dirty. Our agent, a vacuum cleaner that has location and dirtiness sensors travels in these zones and cleans them if it gets a “dirty” signal.

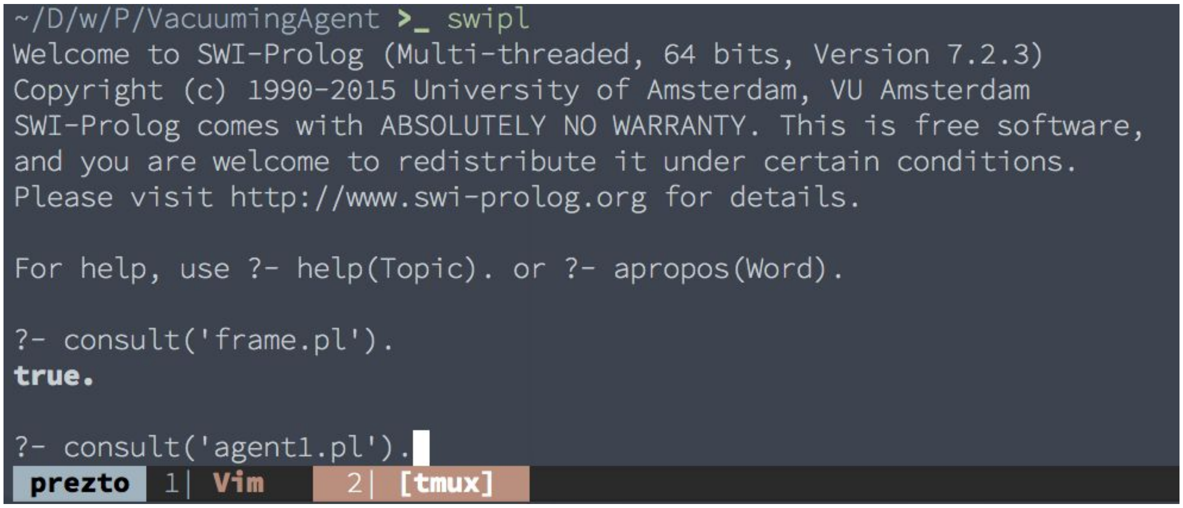
In the project directory, there are four *.pl* files (frame.pl, agent1.pl, agent2.pl, initialstate.pl). agent1.pl and agent2.pl are the agent codes which has different specs from each other. frame.pl defines the dynamic predicates needed and defines the iterations. initialstate.pl defines the dirtiness of the environment and sets the agent’s initial position.

Agent1 is a simple reflex agent which has no memory and has no idea about the history. It can take three different actions; go left, go right and clean. Its movement is random; a random function runs and picks a number between 0 and 1. If the number is in the lower half portion, it moves right and if it’s in the upper portion, it moves left. If it senses dirt in the room, it cleans it. This agent never stops and always searches for a dirty zone moving randomly.

Agent2 is more intelligent compared to 1. It can take an additional action which is ‘do nothing’. In order to implement ‘do nothing’ correctly, it should have memory. The agent must realize that all the zones in the environment are clean. A ‘knowClean(...)’ predicate is asserted when a zone is cleaned or a clean zone is discovered for the first time. If all the zones have knowClean predicate, that means the environment is entirely clean so it can stay idle and take the action “do nothing” until the end of the iterations.

You can find the comments inside the codes which explains which part does what job. Below, the test cases and different agent behaviours are shown in the pictures. In order to run the program, you should follow this prosedure:

- Run SWI Prolog application / run “swipl” in terminal
- Run the following commands on the console:
  - consult(‘frame.pl’).
  - consult(‘agent1.pl’). (or consult(‘agent2.pl’).)
  - simulateMore.

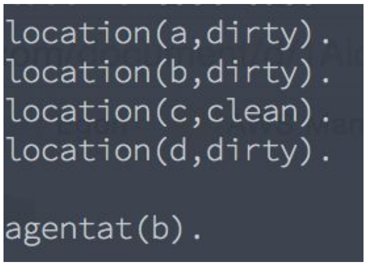


```
~/D/w/P/VacuumingAgent >_ swipl
Welcome to SWI-Prolog (Multi-threaded, 64 bits, Version 7.2.3)
Copyright (c) 1990-2015 University of Amsterdam, VU Amsterdam
SWI-Prolog comes with ABSOLUTELY NO WARRANTY. This is free software,
and you are welcome to redistribute it under certain conditions.
Please visit http://www.swi-prolog.org for details.

For help, use ?- help(Topic). or ?- apropos(Word).

?- consult('frame.pl').
true.

?- consult('agent1.pl').
```

Figure 1: Commands to run the program

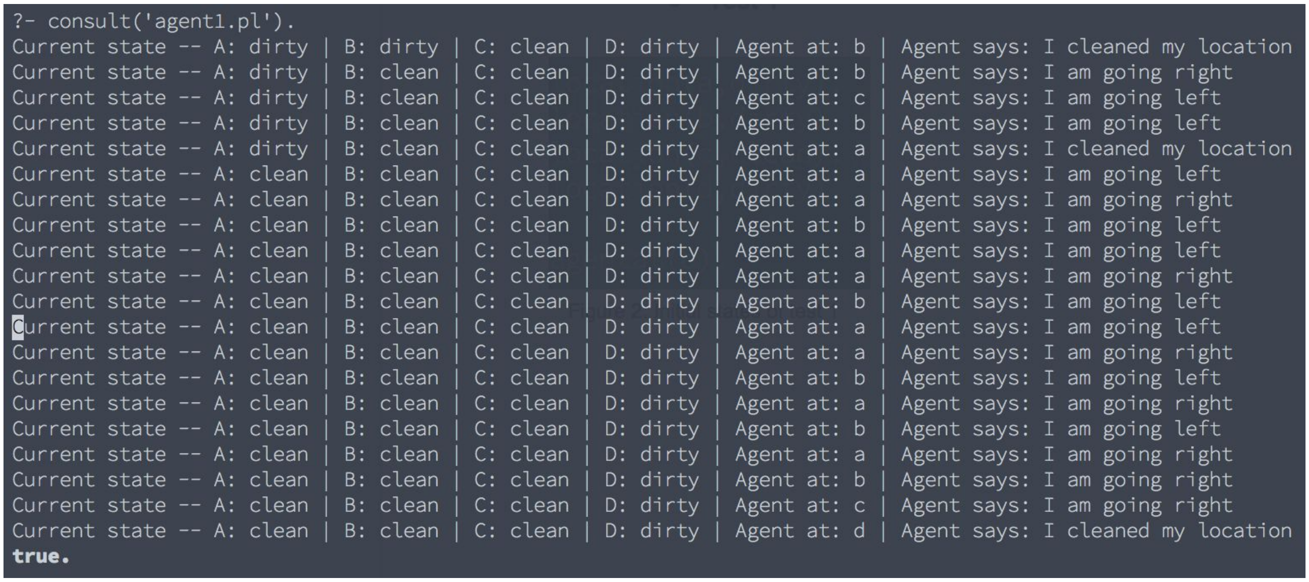
Test cases

- **Test 1**



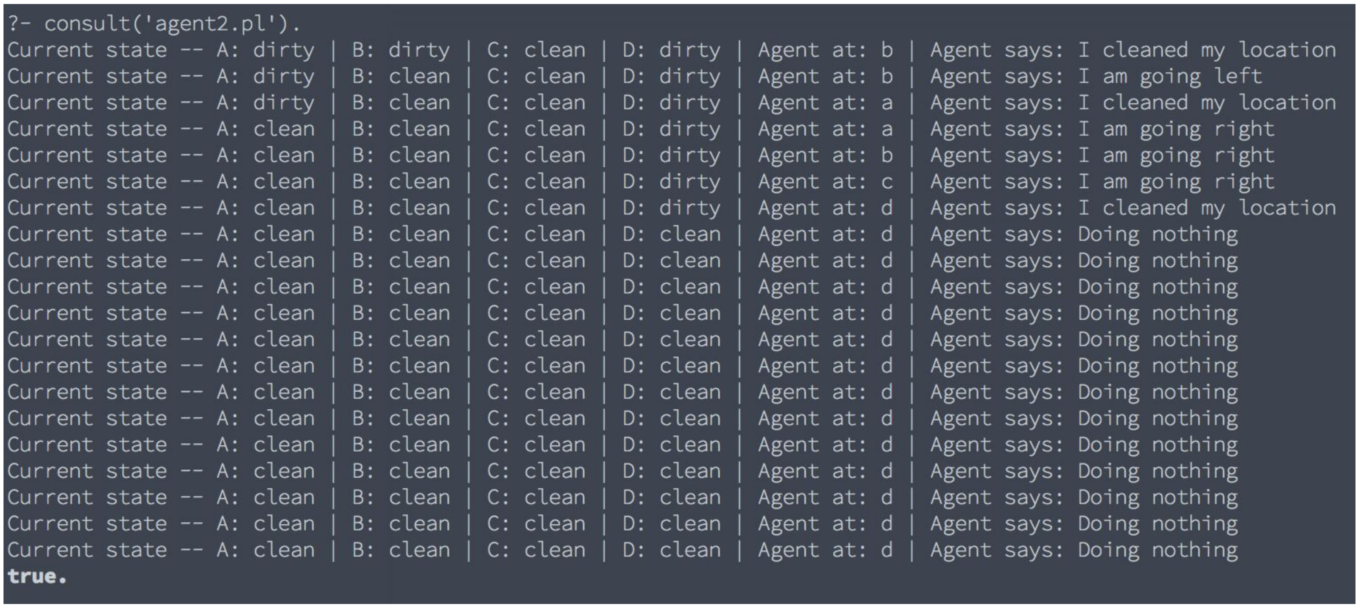
```
location(a,dirty).
location(b,dirty).
location(c,clean).
location(d,dirty).

agentat(b).
```

Figure 2: Initial state of test1



```
?- consult('agent1.pl').
Current state -- A: dirty | B: dirty | C: clean | D: dirty | Agent at: b | Agent says: I cleaned my location
Current state -- A: dirty | B: clean | C: clean | D: dirty | Agent at: b | Agent says: I am going right
Current state -- A: dirty | B: clean | C: clean | D: dirty | Agent at: c | Agent says: I am going left
Current state -- A: dirty | B: clean | C: clean | D: dirty | Agent at: b | Agent says: I am going left
Current state -- A: dirty | B: clean | C: clean | D: dirty | Agent at: a | Agent says: I cleaned my location
Current state -- A: clean | B: clean | C: clean | D: dirty | Agent at: a | Agent says: I am going left
Current state -- A: clean | B: clean | C: clean | D: dirty | Agent at: a | Agent says: I am going right
Current state -- A: clean | B: clean | C: clean | D: dirty | Agent at: b | Agent says: I am going left
Current state -- A: clean | B: clean | C: clean | D: dirty | Agent at: a | Agent says: I am going left
Current state -- A: clean | B: clean | C: clean | D: dirty | Agent at: a | Agent says: I am going right
Current state -- A: clean | B: clean | C: clean | D: dirty | Agent at: b | Agent says: I am going left
Current state -- A: clean | B: clean | C: clean | D: dirty | Agent at: a | Agent says: I am going left
Current state -- A: clean | B: clean | C: clean | D: dirty | Agent at: a | Agent says: I am going right
Current state -- A: clean | B: clean | C: clean | D: dirty | Agent at: b | Agent says: I am going left
Current state -- A: clean | B: clean | C: clean | D: dirty | Agent at: a | Agent says: I am going right
Current state -- A: clean | B: clean | C: clean | D: dirty | Agent at: b | Agent says: I am going left
Current state -- A: clean | B: clean | C: clean | D: dirty | Agent at: a | Agent says: I am going right
Current state -- A: clean | B: clean | C: clean | D: dirty | Agent at: b | Agent says: I am going right
Current state -- A: clean | B: clean | C: clean | D: dirty | Agent at: c | Agent says: I am going right
Current state -- A: clean | B: clean | C: clean | D: dirty | Agent at: d | Agent says: I cleaned my location
true.
```

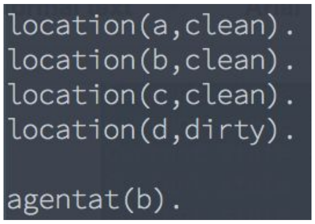
Figure 3: Behaviour of agent1 at test1



```
?- consult('agent2.pl').
Current state -- A: dirty | B: dirty | C: clean | D: dirty | Agent at: b | Agent says: I cleaned my location
Current state -- A: dirty | B: clean | C: clean | D: dirty | Agent at: b | Agent says: I am going left
Current state -- A: dirty | B: clean | C: clean | D: dirty | Agent at: a | Agent says: I cleaned my location
Current state -- A: clean | B: clean | C: clean | D: dirty | Agent at: a | Agent says: I am going right
Current state -- A: clean | B: clean | C: clean | D: dirty | Agent at: b | Agent says: I am going right
Current state -- A: clean | B: clean | C: clean | D: dirty | Agent at: c | Agent says: I am going right
Current state -- A: clean | B: clean | C: clean | D: dirty | Agent at: d | Agent says: I cleaned my location
Current state -- A: clean | B: clean | C: clean | D: clean | Agent at: d | Agent says: Doing nothing
Current state -- A: clean | B: clean | C: clean | D: clean | Agent at: d | Agent says: Doing nothing
Current state -- A: clean | B: clean | C: clean | D: clean | Agent at: d | Agent says: Doing nothing
Current state -- A: clean | B: clean | C: clean | D: clean | Agent at: d | Agent says: Doing nothing
Current state -- A: clean | B: clean | C: clean | D: clean | Agent at: d | Agent says: Doing nothing
Current state -- A: clean | B: clean | C: clean | D: clean | Agent at: d | Agent says: Doing nothing
Current state -- A: clean | B: clean | C: clean | D: clean | Agent at: d | Agent says: Doing nothing
Current state -- A: clean | B: clean | C: clean | D: clean | Agent at: d | Agent says: Doing nothing
Current state -- A: clean | B: clean | C: clean | D: clean | Agent at: d | Agent says: Doing nothing
Current state -- A: clean | B: clean | C: clean | D: clean | Agent at: d | Agent says: Doing nothing
Current state -- A: clean | B: clean | C: clean | D: clean | Agent at: d | Agent says: Doing nothing
Current state -- A: clean | B: clean | C: clean | D: clean | Agent at: d | Agent says: Doing nothing
Current state -- A: clean | B: clean | C: clean | D: clean | Agent at: d | Agent says: Doing nothing
true.
```

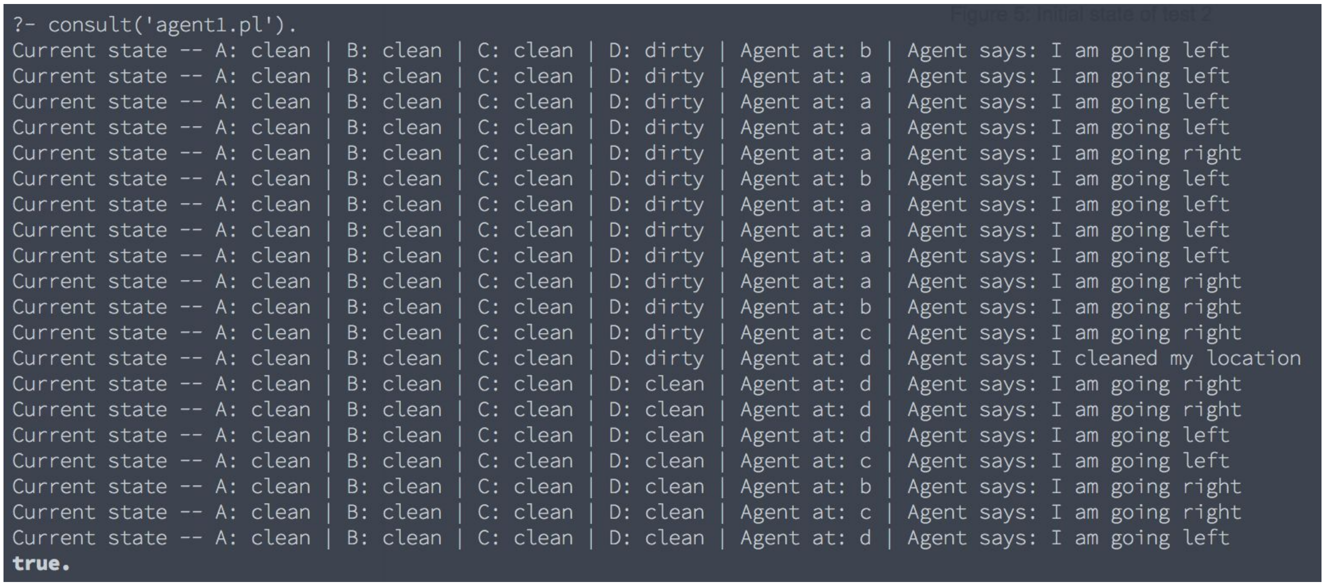
Figure 4: Behaviour of agent2 at test1

- **Test 2**



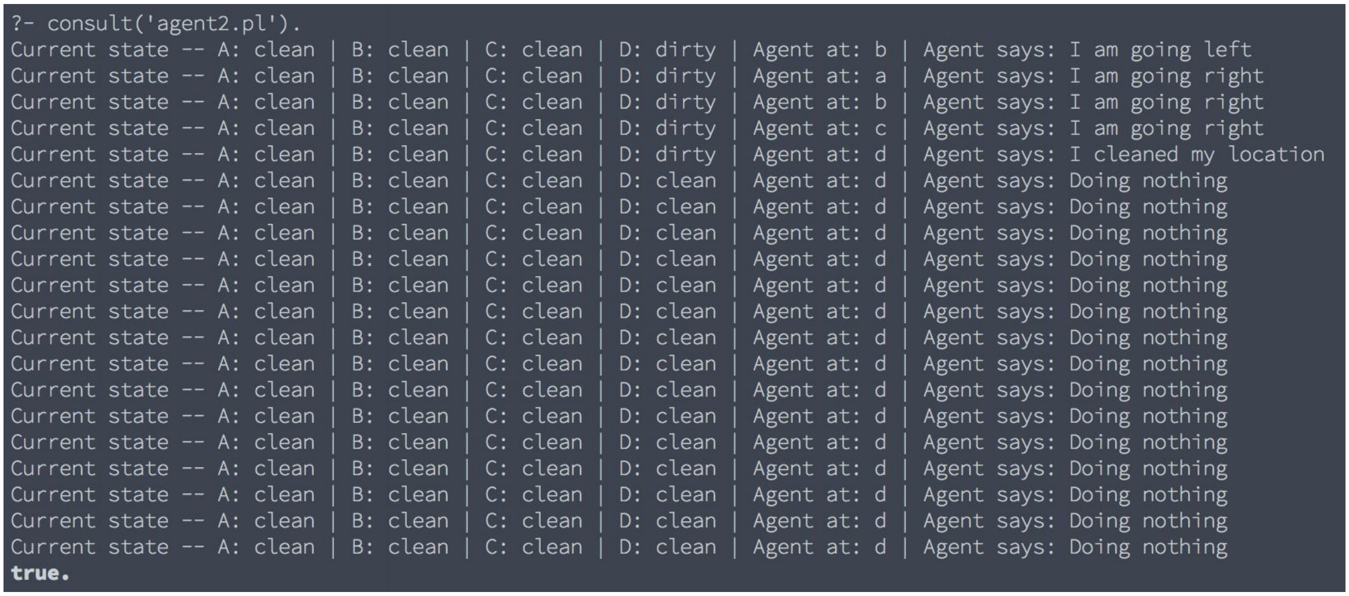
```
location(a,clean).
location(b,clean).
location(c,clean).
location(d,dirty).

agentat(b).
```

Figure 5: Initial state of test 2



```
?- consult('agent1.pl').
Current state -- A: clean | B: clean | C: clean | D: dirty | Agent at: b | Agent says: I am going left
Current state -- A: clean | B: clean | C: clean | D: dirty | Agent at: a | Agent says: I am going left
Current state -- A: clean | B: clean | C: clean | D: dirty | Agent at: a | Agent says: I am going left
Current state -- A: clean | B: clean | C: clean | D: dirty | Agent at: a | Agent says: I am going left
Current state -- A: clean | B: clean | C: clean | D: dirty | Agent at: a | Agent says: I am going right
Current state -- A: clean | B: clean | C: clean | D: dirty | Agent at: b | Agent says: I am going left
Current state -- A: clean | B: clean | C: clean | D: dirty | Agent at: a | Agent says: I am going left
Current state -- A: clean | B: clean | C: clean | D: dirty | Agent at: a | Agent says: I am going left
Current state -- A: clean | B: clean | C: clean | D: dirty | Agent at: a | Agent says: I am going left
Current state -- A: clean | B: clean | C: clean | D: dirty | Agent at: a | Agent says: I am going right
Current state -- A: clean | B: clean | C: clean | D: dirty | Agent at: b | Agent says: I am going right
Current state -- A: clean | B: clean | C: clean | D: dirty | Agent at: c | Agent says: I am going right
Current state -- A: clean | B: clean | C: clean | D: dirty | Agent at: d | Agent says: I cleaned my location
Current state -- A: clean | B: clean | C: clean | D: clean | Agent at: d | Agent says: I am going right
Current state -- A: clean | B: clean | C: clean | D: clean | Agent at: d | Agent says: I am going right
Current state -- A: clean | B: clean | C: clean | D: clean | Agent at: d | Agent says: I am going left
Current state -- A: clean | B: clean | C: clean | D: clean | Agent at: c | Agent says: I am going left
Current state -- A: clean | B: clean | C: clean | D: clean | Agent at: b | Agent says: I am going right
Current state -- A: clean | B: clean | C: clean | D: clean | Agent at: c | Agent says: I am going right
Current state -- A: clean | B: clean | C: clean | D: clean | Agent at: d | Agent says: I am going left
true.
```

Figure 6: Behaviour of agent1 at test2



```
?- consult('agent2.pl').
Current state -- A: clean | B: clean | C: clean | D: dirty | Agent at: b | Agent says: I am going left
Current state -- A: clean | B: clean | C: clean | D: dirty | Agent at: a | Agent says: I am going right
Current state -- A: clean | B: clean | C: clean | D: dirty | Agent at: b | Agent says: I am going right
Current state -- A: clean | B: clean | C: clean | D: dirty | Agent at: c | Agent says: I am going right
Current state -- A: clean | B: clean | C: clean | D: dirty | Agent at: d | Agent says: I cleaned my location
Current state -- A: clean | B: clean | C: clean | D: clean | Agent at: d | Agent says: Doing nothing
Current state -- A: clean | B: clean | C: clean | D: clean | Agent at: d | Agent says: Doing nothing
Current state -- A: clean | B: clean | C: clean | D: clean | Agent at: d | Agent says: Doing nothing
Current state -- A: clean | B: clean | C: clean | D: clean | Agent at: d | Agent says: Doing nothing
Current state -- A: clean | B: clean | C: clean | D: clean | Agent at: d | Agent says: Doing nothing
Current state -- A: clean | B: clean | C: clean | D: clean | Agent at: d | Agent says: Doing nothing
Current state -- A: clean | B: clean | C: clean | D: clean | Agent at: d | Agent says: Doing nothing
Current state -- A: clean | B: clean | C: clean | D: clean | Agent at: d | Agent says: Doing nothing
Current state -- A: clean | B: clean | C: clean | D: clean | Agent at: d | Agent says: Doing nothing
Current state -- A: clean | B: clean | C: clean | D: clean | Agent at: d | Agent says: Doing nothing
Current state -- A: clean | B: clean | C: clean | D: clean | Agent at: d | Agent says: Doing nothing
Current state -- A: clean | B: clean | C: clean | D: clean | Agent at: d | Agent says: Doing nothing
Current state -- A: clean | B: clean | C: clean | D: clean | Agent at: d | Agent says: Doing nothing
Current state -- A: clean | B: clean | C: clean | D: clean | Agent at: d | Agent says: Doing nothing
Current state -- A: clean | B: clean | C: clean | D: clean | Agent at: d | Agent says: Doing nothing
true.
```

Figure 7: Behaviour of agent2 at test2