

# Assignment 1: Vacuum-Cleaning Agents

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Our goal was to study the performance of different types of agents; Memory-less Deterministic Reflex Agent, Random Reflex Agent and Memory-Based Deterministic Reflex Agent. We will measure the performance based on number of cleaned cells vs the number of actions taken. The environment is a  $n \times m$  empty rectangular room with  $p\%$  chance of containing dirt. The agents have 5 actions; go forward, turn right by 90 degrees, turn left by 90 degrees, suck up dirt, and turn off. The agents also have 3 sensors to interact with the room; a wall sensor, a dirt sensor, and a home sensor. The memory-less Deterministic Reflex Agent

## 1 Introduction

AI background Generic vacuum problem Environment, partially observable, deterministic, single agent, sequential, discrete, known. Agents-overview. Memory restrictions

## 2 Problem Formulation

Environment specifics

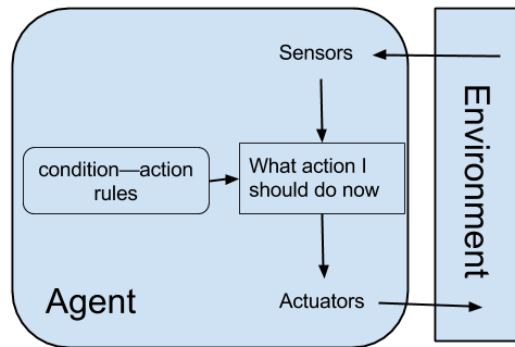
## 3 Agents

Describe the idea behind the design of each of your agents. Use diagrams and english as appropriate.

### 3.1 Memory-less Deterministic Reflex Agent

What is the best possible performance achievable by any memory-less reflex agent in this domain? What prevents a memory-less reflex agent from doing very well in this task?

### 3.1.1 Design



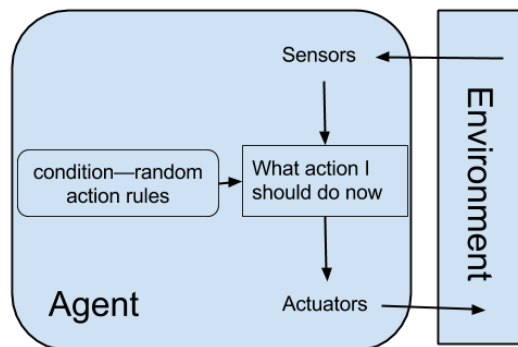
### 3.1.2 If-then Rules

if dirt then suck else if wall then turn right else forward

## 3.2 Random Reflex Agent

How well does the random agent perform? Do you think that this is the best possible performance achievable by any random agent? Why or why not? Give a table showing the number of actions it took to clean 90% of the room for each trial. What is the average of these numbers for the best 45 trials? What are the costs and benefits of randomness in agent design?

### 3.2.1 Design



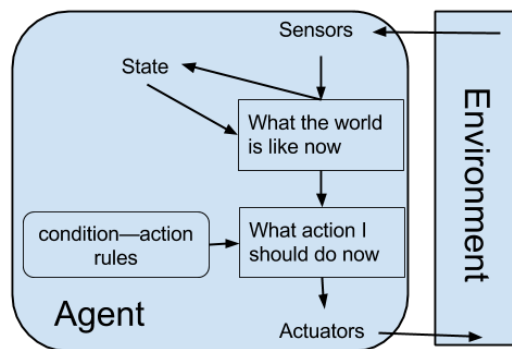
### 3.2.2 If-then Rules

if dirt then suck else if wall then turn-right 0.5 turn-left 0.5 else forward 0.5  
turn-right 0.25 turn-left 0.25

### 3.3 Memory-Based Deterministic Reflex Agent

How does the memory-based deterministic agent perform compared to the random agent? Was it able to completely clean the room? Was it able to shut itself off after it is done? If it did, how many actions did it take to do this? Can the agent be improved any further with more memory than you used? Why or why not?

#### 3.3.1 Design



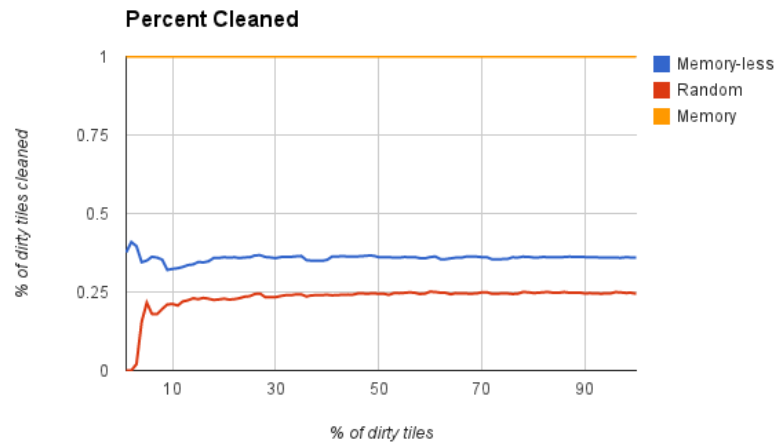
#### 3.3.2 If-then Rules

if dirt then suck else if state0 and wall then turn-right set-state1 else if state1 and wall then turn-right set-state6 else if state1 and not all then forward set-state2 else if state2 then turn-right set-state 3 else if state3 and wall then turn-left set-state4 else if state4 and wall then turn-right set-state6 else if state4 and not wall then forward set-state5 else if state5 then turn-left state-state0 else if state6 and wall then turn-right set-state7 else if state7 and home then off

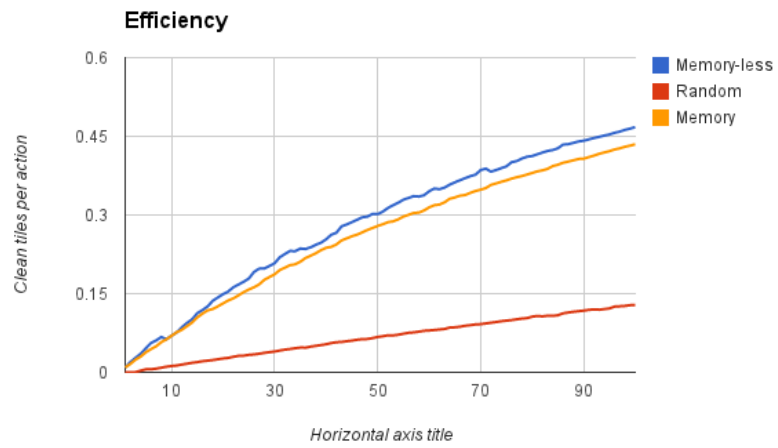
## 4 Results

Plots, discuss plots.

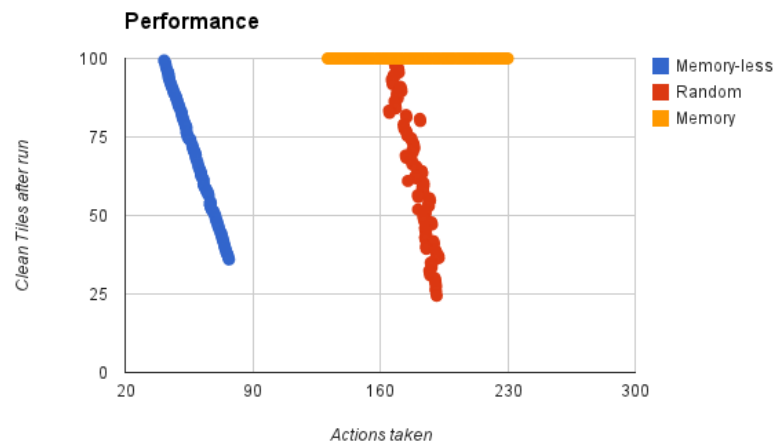
Plot 1- %final dirt vs % starting dirt



Plot 2- dirt per action vs % starting dirt



Plot 3- # clean cells vs # actions taken



## 5 Conclusion

What did you learn from this experiment? Were you surprised by anything?