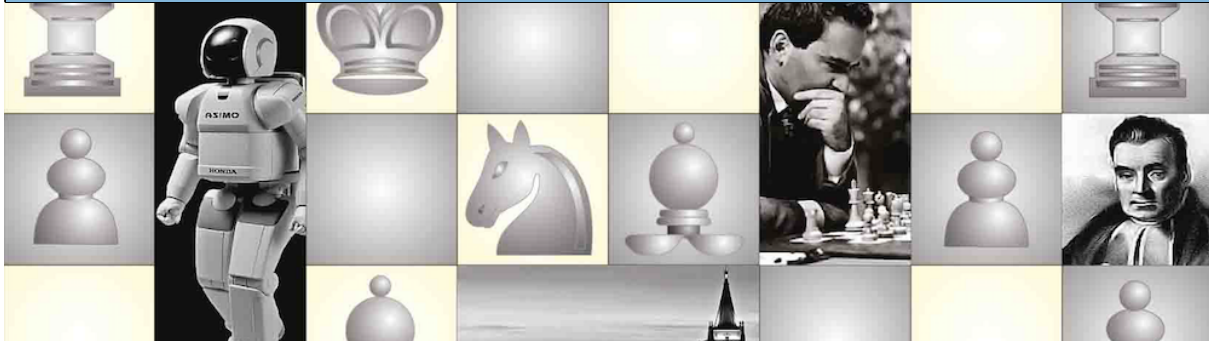


Fall 2024 - CSC545/645 Artificial Intelligence - Assignment 1



Due date: Thursday, September 5, 2024, 2 pm. Hint: For the online code repository, you might want to consult the AIMA web pages: <http://aima.cs.berkeley.edu/>. Please create a folder called `assignment1` in your local working copy of our SVN repository and place all files and folders necessary for the assignment in this folder. Once done with the assignment, add the files and folders to the repo with `svn add files, folders` and then commit with `svn ci -m "SOME USEFUL MESSAGE" files, folders`.

Exercise 1.1 (10 points)

Read the textbook's chapters 1 (Introduction) and 2 (Intelligent Agents).

1. Define in your own words the following terms: agent, agent function, agent program, rationality, autonomy, reflex agent, model-based agent, goal-based agent, utility-based agent, learning agent.
[5 points]
2. Both the performance measure and the utility function measure how well an agent is doing. Explain the difference between the two.
[1 point]
3. In this question we explore further the differences between agent functions and agent programs.
[2 points]
 - (a) Can there be more than one agent program that implements a given agent function?
 - (b) Are there agent functions that cannot be implemented by any agent program?
 - (c) Given a fixed machine architecture, does each agent program implement exactly one agent function?
 - (d) Let us examine the rationality of various vacuum-cleaner agent functions in various environments.
[2 points]
 - i. Describe a rational agent function for the modified performance measure that deducts one point for each movement. Does the corresponding agent program require an internal state?
 - ii. 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?

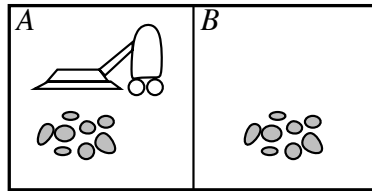


Figure 1: Simple vacuum-cleaner world

Exercise 1.2 (10 points)

The following exercises all concern the implementation of environments and agents for the vacuum-cleaner world. Programs need to be written in C/C++, Java, or Python.

1. **Simulator:** Implement a performance-measuring environment simulator for the vacuum-cleaner world depicted in figure 1 (Figure 2.2 on page 36/38 of our textbook (3rd/4th edition)). Your implementation should be modular so that the sensors, actuators, and environment characteristics (size, shape, dirt placement, etc.) can be changed easily. (Note: Exclusive to CSC545 students: Depending on the selected programming languages and operating systems, this step might be unnecessary as there are existing implementations in the online code repository.)
[5 points if programmed yourself, none if code from AIMA is used. CSC645 students have to write the program themselves.]
2. **Agent:** Implement a simple reflex agent for the vacuum environment in Exercise 1.2.1. Run the environment simulator with this agent for all possible initial dirt configurations and agent locations. Record the agent's performance score for each configuration and its overall average score.
[5 points]