

CS331 (Spring 2022): Introduction to Artificial Intelligence

Written Assignment #1

Date handed out: March 30, 2022

Date due: April 6, 2022, 10am, on Canvas

Total: 25 points

The written portion of this assignment is to be done individually. Please hand in a pdf on Canvas. Assignments done on a word processor are preferred but not mandatory. For hand-written assignments, if we cannot read your writing, we cannot mark your assignment.

1. The Starship robots (such as the one shown below) deliver food on OSU's campus. Parts (a)-(c) ask you to develop a description of a Starship robot's environment and design using your knowledge of AI agents. **[11 pts]**



<https://today.oregonstate.edu/news/robots-provide-food-delivery-corvallis-campus>

a) Develop a description of the task environment using the PEAS description i.e.:

- Performance
- Environment
- Actuators
- Sensors

b) Then describe the environment according to the following properties:

- fully vs partially observable
- deterministic vs stochastic
- episodic vs sequential
- static vs dynamic
- discrete vs continuous
- single vs multi-agent

Note that in some cases, both answers might be correct. Justify each answer to the task environment properties with a one sentence explanation.

c) Suggest the most appropriate agent design by choosing the most appropriate of the following agent types:

- simple reflex agent
- model-based reflex agent
- goal-based agents
- utility-based agent

Justify your answer with a one sentence explanation.

2. For each statement, say whether it is true or false. Provide a one-sentence example, counterexample, or justification.

a) An agent must have an accurate model (i.e., encoding of how the world works) in order to be rational. **[2 points]**

b) A rational agent will always win a game of rock-paper-scissors. **[2 points]**

c) Suppose that an agent selects randomly between two actions. There is a stochastic environment where the agent is rational. **[2 points]**

d) An agent that is not rational in one task environment may be rational in another. **[2 points]**

3. Consider a modified version of the vacuum environment:

- Performance measure: one point awarded for each clean square at each time step.
- Environment: geography of the environment (its extent, boundaries, obstacles, etc.), and initial location are *known*. Dirt distribution is *unknown*. Clean squares may become dirty again *with a low probability each time step*.
- Actuators: Suck cleans dirt, Left moves left, Right moves right, Up moves up, Down moves down.
- Sensors: Location and dirt sensors.

a) What is the optimal behavior for an agent in this environment? **[2 points]**

b) Can a simple reflex agent with a *randomized* agent function be rational for this environment? Why or why not? **[2 points]**

c) Consider the probability that a clean square will become dirty again. Is there a probability for which a simple reflex agent with a *deterministic* agent function can be rational? Explain why not or provide the probability and agent function. **[2 points]**