CS331 (Spring 2019): Introduction to Artificial Intelligence
Written Assignment #1

Date handed out: April 3, 2019
Date due: April 10, 2019, 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. You will be answering parts (a)-(c) for a smart home assistant like Google Home or Amazon’s Alexa. These agents listen for keywords (e.g. “Okay, Google”), and when addressed, respond to questions and perform tasks (e.g. adding an item to a list, answering a question through the speaker). If they are unable to understand or respond to a query, the systems announce this to the user [11 pts].

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. (Exercise 2.3f-i in the book) For each statement, say whether it is true or false. Provide a one-sentence example, counterexample, or justification.

f) Suppose an agent selects its action uniformly at random from the set of possible actions. There exists a deterministic task environment in which this agent is rational. [2 points]

g) It is possible for a given agent to be perfectly rational in two distinct task environments. [2 points]

h) Every agent is rational in an unobservable environment. [2 points]

i) A perfectly rational poker-playing agent never loses. [2 points]

3. (From Exercise 2.11 in the book) 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.), dirt distribution, and initial location are unknown. Clean squares stay clean.
   • Actuators: Suck cleans dirt, Left moves left, Right moves right.
   • Sensors: Location and dirt sensors.

a) Can a simple reflex agent be perfectly rational for this environment? [2 points]

b) Can a simple reflex agent with a randomized agent function outperform a simple reflex agent with a deterministic agent function? Explain why or why not. [2 points]

c) Can a reflex agent with state outperform a simple reflex agent? Explain why or why not. [2 points]