Written Assignment 1

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I. Smart Home Assistant Analysis

A. PEAS Description

- **Performance** - speed of response, accuracy of response, personalized responses
- **Environment** - home owners (users), room, potential noise, internet, databases
- **Actuators** - speakers, LED lighting
- **Sensors** - microphone, ethernet, potential integrations/extensions (Nest thermostat)

B. Environment Description

- **Partially Observable:** Not only are the sensors only activated by keywords ("Alexa" or "Okay, Google"), but the sensors are subject to noise contamination in loud environments.
- **Multi-agent:** I lean towards multi-agent because the person using the home assistant can be thought of as a cooperating agent who can structure their language (query) to maximize the speed and accuracy of the returned result.
- **Stochastic:** Two contributing factors: uncertainty of an answer, perhaps like a subjective question - "Who is the most exciting athlete of all time?" as well as the uncertainty of the question; for example, what if a dog barks at the time a question is being asked. Should that be considered part of the query?
- **Sequential:** You could argue each question is isolated from the next, but in this case I purport that each question cumulatively contributes to a profile of the individual in order to return responses best suited to the individual.
- **Static:** Based on my understanding of these systems, once a request has been received, the device no longer accepts input until it has returned a result.
- **Discrete:** I go back and forth on this, but ultimately because the environment is static with respect to the actual task of mapping the query to a response. Meaning once the query is received, there is nothing changing the query or results with respect the time delta from the reception of the keyword to end of the response.

C. Agent Suggestion

Utility-based agent: It is not as simple as was the response correct, but how timely was it and to what degree does it fit the user who requested it.

II. True/False

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.

True: Because the task environment includes the performance metric, it can be manipulated such that random action is indeed rational.

g; It is possible for a given agent to be perfectly rational in two distinct task environments.

True: Assuming by distinct the prompt means at least one distinguishing feature between the two environments, then predicting the sum of the outcome of a dice roll where in one environment the die are weighted to come up 3 4 and the other environment has the die weighted 5 2.

h: Every agent is rational in an unobservable environment.

False: If the environment is unobservable, the agent is only rational if the built-in knowledge base is rational in the environment.

i: A perfectly rational poker-playing agent never loses.

False: The agent can make the best possible move based on the combination of cards it receives, but the cards are distributed at random and thus the best (perfectly rational) move can still result in a loss.

III. Modified Vacuum Environment

a: Can a simple reflex agent be perfectly rational for this environment?

No. Because the simple reflex agent is only aware of the current precept, it has no knowledge of squares it has already visited and thus will revisit clean squares.

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.

Yes. Without the ability to perceive the environment / boundaries, a deterministic agent function can enter an infinite loop against an obstacle whereas probability tells us the random agent will eventually break out from an obstacle.

c: Can a reflex agent with state outperform a simple reflex agent? Explain why or why not.

Yes. Because it now has state, it can not only remember the locations it has visited, but also map the environment such that it can move between any two points in the most efficient manner (somewhat irrelevant in this single dimensional case of left and right).