Jeremy Keys
2/1/17

Artificial Intelligence I – 2017 - Homework 1 (100 points)

1. Let us continue with the quiz from the class (you do not need to answer in the same way that you answered in the class). Assume that you want to develop a restaurant agent that works as a hostess. Specify the following:
   - Performance measure
   - Environment
   - Actuators
   - Sensors

   Answer:
   -Performance measure: For the quiz, I answered that my performance measure would be the speed (measured in minutes and seconds) by which the agent is able to accomplish all of its tasks, i.e., to serve all customers. This doesn't really make sense in the context of intelligence agents. The best performance measure would be one that rewards the agent for **serving customers uniquely and quickly**. For instance, if the agent delivers an order to the correct table, it should be awarded a point (and vice versa for a wrong delivery), with a deduction for unnecessary electricity consumption, and another deduction once a table has been seated for a specified amount of time without being served. It should also be awarded a point for returning to its "service station" after each delivery, in order to maximize the speed performance measure. Another measure might be efficiency with which it delivers the orders; perhaps if the agent has two small orders, it will deliver them "simultaneously" instead of in two trips. This performance measure would encourage the agent to choose a strategy that serves tables quickly and with minimal unnecessary "walking around". To boil it down to what the book might say, **the performance measures might be accuracy, speed and efficiency, safety, and the maximization profits and customer satisfaction**.

   -Environment: The environment would simply be a typical restaurant, with counters, tables, chairs, other agents, and customers acting as hazards (impassable areas). Presumably, the agent would be allowed to traverse all non-impassable territory, in any order it chooses. The environment would also contain some sort of server station, at which the agent could load

   -Actuators: The agent would need legs, wheels, or treads in order to move to and from its destinations. It would also need some sort of arm mechanism on which trays with food and drinks could be placed. The agent would need the ability to turn itself and change its height in order to complete the task of delivering the tray.

   -Sensors: The agent needs at least one camera, in order to determine whether the location it wants to move to is hazardous or not. Perhaps in addition to a camera, some sort of proximity sensor could be added, such as a low-powered radar. If the agent is meant to be

responsive to customers, it will also need a microphone, as audible natural language input is the most natural input type for this application.

2. What would be the environment type that your agent needs to operate on. Justify your answer.

Answer:

This agent will need to operate in a **task environment**. In (1), I laid out the **PEAS** of the agent. It will be operating in a **partially observable** environment, although I would suggest there should be a category between partially and fully, such as *mostly observable*; there are very few non-observable elements of the environment; if the restaurant has multiple rooms or is curved or shaped, its camera cannot detect all of the territory at once. Similarly, the agent will not know if previous orders are currently ready, unless there is an automated system the agent has access to wirelessly that is used by the kitchen staff to notify the agent. The environment will also be a **stochastic (non-deterministic)** environment, as customers come in and leave, orders are cancelled or sent back, *et cetera*. The multiagent will be operating in an **episodic** environment, in that orders and customer requests are discrete of each other; as long as the multiagent can track percepts it receives from the actions of other agents, and handle those accordingly, then the environment is episodic. How the agent handles its first customer of the day is wholly unrelated to how it handles its last customer of the day. The agent will also be operating in a **continuous** and **dynamic** environment, as customers enter and exit, or go to the restroom, and so on. The agent will be reasonably able to predict the outcome of each of its actions, so it is a **known** environment.

A good name for this type of agent would be an **Interactive Server**. The agent is also a **cooperative multiagent**; it must cooperate with other agents, such as the cooks assisting the agent with loading the food, or other Server agents, or customers who are walking around. In order to maximize the performance measure of all agents (namely, to not get run over by another agent, the safety measure), the Interactive Server multiagent must **fully cooperate** with all other agents.

3. Which type of program agent would you use in the implementation of your agent? Justify your answer.

Answer:

A program agent which would work would be a **model-based, utility-based** program agent. A model-based agent works because the Server's environment, goals and "desires" (its desire to maximize utility) are relatively static; its job description is not particularly subject to change. Rather than having a goal-based agent, a utility-based agent is more appropriate; the agent should want to maximize utility in a way to keep customers happy. In order to maximize utility, it can learn from the environment; initially, it might be programmed with the complete layout of the environment, and apply basic search algorithms to get initial routes, and it can apply learning elements to determine the actual fastest routes (when factoring in efficiency).