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.

Agent: Any entity can be called an agent, as long as it can perform both the sensing and the action functions.

Agent function: A function that can process and respond to each perceived data of the agent.

Agent program: The agent function is included in the Agent program. Every time we call the agent program, it will make an action based on changes in the environment.

Rationality: Through the perceived data, the agent will act to achieve the optimal goal.

Autonomy: The agent's actions are not determined by the initial process, but rather accumulate experience as the action progresses.

Reflex agent: The reflex agent simply completes the action through a simple program based on the current perceptual input.

Model-based agent: The model-based agent will act according to a built-in model that will be updated in real time as the environment changes.

Goal-based agent: The goal-based agent will act in an optimal manner in order to achieve a given goal.

Utility-based agent: The utility-based agent will act to maximize the expected output.

Learning agent: The learning agent will act on the basis of experience gained from previous processes.

2. Both the performance measure and the utility function measure how well an agent is doing.

Explain the difference between the two.

The performance measure is an assessment by an observer outside the agent based on the agent's actions. The utility function measure is an assessment by the agent himself based on his actions, processing efficiency, and the results of the actions.

3. In this question we explore further the differences between agent functions and agent programs.

(a) Can there be more than one agent program that implements a given agent function?

Yes. Adding any agent function including null statements to the agent program does not affect the result of the run.

(b) Are there agent functions that cannot be implemented by any agent program?

Yes. If the function of an agent function is to print some other things after the agent program prints the correct result, this agent function cannot be used by any program.

(c) Given a fixed machine architecture, does each agent program implement exactly one agent

function?

Yes. The architecture and program decide how the agent behavior.

(d) Given an architecture with n bits of storage, how many possible agent programs are there?

Is this enough, that is, might there be environments for which there are no good agent

programs?

There are 2^n agent programs, because the architecture fix the number of the agent programs, even though some of them will not run.

4. Let us examine the rationality of various vacuum-cleaner agent functions in various environments.

(a) Describe a rational agent function for the modified performance measure that deducts one point for each movement. Does the corresponding agent program require internal state?

Yes. The cleaner check the state of the room. If the room is clean, the cleaner move to the next room. If the room is dirty, the cleaner suck the dust in the room. If we have internal state, and we record that room A is clean, the cleaner will no longer go back to room A, and it will help save energy.

(b) 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?

The cleaner can record the dirty square of the room when they suck dust in these squares. Then sort the squares by the times these squares become dirty. Cleaner first clears the top square.