Q1. Define in your own words:

**a. Intelligence**

The ability to acquire and apply knowledge and skills and the collection of information of military or political values.

**b. Artificial Intelligence**

The study and design of intelligent agents, where an intelligent agent is a system that perceives its environment and takes actions which maximizes its chances of success.

**c. Agent**

An agent is something that acts.

**d. Rationality**

The rationality of human thought is a key problem in the psychology of reasoning. For Example, doing what is expected of you or what is acceptable to do. When a problem arises there are specific ways that one would solve it; these are filed under *Rationality*.

**e. Logical Reasoning**

The reasoning is the mental process of deriving logical conclusion and making predictions from available knowledge, facts, and beliefs. Or we can say, "**Reasoning is a way to infer facts from existing data**." It is a general process of thinking rationally, to find valid conclusions.

Q2. Are reflex actions (such as flinching from hot stove) rational? Are they intelligent?

Reflex actions are rational. Reflexes were acquired over time to help preserve the well-being of an organism.  If a person didn't have the reflex to recoil from the hot stove, that person would suffer painful burns. Reflexes are not the result of an intelligent decision process, however, because there is no thought or decision making process involved in performing them.  If someone took the time to think about removing their hand from the hot stove then by the time they came to the conclusion that the burner is hot, and the result of not moving their hand would be getting burned, they would have already suffered burns.

Q3. To what extent are the following computer system instances of artificial intelligence?

● **Supermarket bar code scanners**

A scanner reads the bar code from item and gets its price and all details from database. Scanner recognizes bar code and scans it and display the information to the cashier and the customer.

**●Web search engines**

Web Search Engines are connected to the every piece of information stored on the internet. Think of it like an all knowing entity. You can type anything in and if it exists on the web, it will find it for you. There are options when using search engines, but those only refine the search; such as excluding items from a certain date, only retrieving peer reviewed articles, or only finding images that contain pictures of Iron Man.

**● Voice-activated telephone menus**

The phone is programmed to hear a voice, listen for key words, and perform an action based on those words. For example, I take out my phone and say “Galaxy, call home.” My phone picks up that I’m addressing it by saying Galaxy, it knows to open the phone app when I say call, and it knows which contact to call when I saw home. If I had multiple numbers for home it would ask me to clarify which number I want to call.

Q4. Let us examine the rationality of various vacuum-cleaner agent functions.

A. Show that the simple vacuum-cleaner agent function described in Figure 2.3 is indeed rational under the assumptions listed on page 38.

B. Describe a rational agent function for the case in which each movement costs one point. Does the corresponding agent program require internal state?

C. 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? If not, why not?

**Answers:**

A) The simple vacuum cleaner agent is indeed rational under these assumptions because it accounts for all variables. The map is known, there is a sensor for clean or dirty, what to do in that space and the agent will never go out of bounds.

B) If each move costs one point then an internal state is required to keep track of starting points (if any) and the subtraction of those points. Unless of course the score starts at 0 and goes negative for each move. But if cleaning a space awards one point, then an optimal goal would be to try and get a score of 0 or higher.

C) If clean spaces can become dirty again then obviously a vacuum should clean it again. But the vacuum should not be constantly running this would waste electricity. The vacuum should map its surroundings and objects so it knows that the environment looks like for each additional time. By learning how large the area is it can determine how many times a day it must run to keep every space clean. Upon starting up it should assume every space is dirty and start a path around to clean them all, making sure to get every space. The more the vacuum does this the more it will know its surroundings and how often to clean.

Q5. For each of the following assertions, say whether it is true or false and support your answer with examples or counterexamples where appropriate.

a. An agent that senses only partial information about the state cannot be perfectly rational. (**False**)

**Support: The Vacuum cleaning agent is rational because it has no information about the other part.**

b. There exist task environments in which no pure reflex agent can behave rationally. (**True**)

**Support: A reflex agent reacts to the current people, but if memory is needed then a pure reflex agent can behave rationally.**

c. There exists a task environment in which every agent is rational. (**True**)

**Support: If every action has same results.**

d. The input to an agent program is the same as the input to the agent function. (**False**)

**Support: The agent program and agent function are different because program contains history and function contains current percept.**

e. Every agent function is implementable by some program/machine combination. (**False**)

**Support: The reflex agent will only act to certain variables.**

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**)

**Support: Eventually one of the random selections will be correct.**

g. It is possible for a given agent to be perfectly rational in two distinct task environments. (**True**)

**Support: If Environments are similar.**

h. Every agent is rational in an unobservable environment. (**False**)

**Support: A GPS mapping system that does not record its finding.**

i. A perfectly rational poker-playing agent never loses. (**False**)

**Support: There always a chance that opponent will be dealt better cards.**