

Questions

1. Define intelligence.
2. What are the different approaches in defining artificial intelligence?
3. Suppose you design a machine to pass the Turing test. What are the capabilities such a machine must have?
4. Design ten questions to pose to a man/machine that is taking the Turing test.
5. Do you think that building an artificially intelligent computer automatically shed light on the nature of natural intelligence?
6. List 5 tasks that you will like a computer to be able to do within the next 5 years.
7. List 5 tasks that computers are unlikely to be able to do in the next 10 years.
8. Define an agent.
9. What is a rational agent ?
10. What is bounded rationality ?
11. What is an autonomous agent ?
12. Describe the salient features of an agent.
13. Find out about the Mars rover.
 1. What are the percepts for this agent ?
 2. Characterize the operating environment.
 3. What are the actions the agent can take ?
 4. How can one evaluate the performance of the agent ?
 5. What sort of agent architecture do you think is most suitable for this agent ?
14. Answer the same questions as above for an Internet shopping agent.

Answers

1. Intelligence is a rather hard to define term.

Intelligence is often defined in terms of what we understand as intelligence in humans.

Allen Newell defines *intelligence* as the *ability to bring all the knowledge a system has at its disposal to bear in the solution of a problem*.

A more practical definition that has been used in the context of building artificial systems with intelligence is *to perform better on tasks that humans currently do better*.

2.

- Thinking rationally
- Acting rationally
- Thinking like a human
- Acting like a human

3.
 - Natural language processing
 - Knowledge representation
 - Automated reasoning
 - Machine Learning
 - Computer vision
 - Robotics

4-7 : Use your own imagination

8. An agent is anything that can be viewed as perceiving its environment through sensors and executing actions using actuators.
9. A rational agent always selects an action based on the percept sequence it has received so as to maximize its (expected) performance measure given the percepts it has received and the knowledge possessed by it.
10. A rational agent that can use only bounded resources cannot exhibit the optimal behaviour. A bounded rational agent does the best possible job of selecting good actions given its goal, and given its bounded resources.
11. Autonomous agents are software entities that are capable of independent action in dynamic, unpredictable environments. An autonomous agent can learn and adapt to a new environment.
12.
 - An agent perceives its environment using sensors
 - An agent takes actions in the environment using actuators
 - A rational agent acts so as to reach its goal, or to maximize its utility
 - Reactive agents decide their action on the basis of their current state and the percepts. Deliberative agents reason about their goals to decide their action.
13. Mars Rover
 - a. Spirit's sensor include
 - i. panoramic and microscopic cameras,
 - ii. a radio receiver,
 - iii. spectrometers for studying rock samples including an alpha particle x-ray spectrometer, Mossbauer spectrometer, and miniature thermal emission spectrometer
 - b. The environment (the Martian surface)
 - i. partially observable,
 - ii. non-deterministic,
 - iii. sequential,
 - iv. dynamic,
 - v. continuous, and
 - vi. may be single-agent. If a rover must cooperate with its mother ship or other rovers, or if mischievous Martians tamper with its progress, then the environment gains additional agents
 - c. The **rover** Spirit has
 - i. motor-driven wheels for locomotion
 - ii. along with a robotic arm to bring sensors close to interesting rocks and a
 - iii. rock abrasion tool (RAT) capable of efficiently drilling 45mm holes in hard volcanic rock.
 - iv. Spirit also has a radio transmitter for communication.
 - d. Performance measure: A **Mars rover** may be tasked with

- i. maximizing the distance or variety of terrain it traverses,
- ii. or with collecting as many samples as possible,
- iii. or with finding life (for which it receives 1 point if it succeeds, and 0 points if it fails).

Criteria such as maximizing lifetime or minimizing power consumption are (at best) derived from more fundamental goals; e.g., if it crashes or runs out of power in the field, then it can't explore.

- e. A model-based reflex agent is suitable for low level navigation.

For route planning, experimentation etc, some combination of goal-based, and utility-based would be needed.

14. **Internet book shopping agent**

- f. Sensors: Ability to parse Web pages, interface for user requests
- g. Environment: Internet. Partially observable, partly deterministic, sequential, partly static, discrete, single-agent (exception: auctions)
- h. Actuators: Ability to follow links, fill in forms, display info to user
- i. Performance Measure: Obtains requested books, minimizes cost/time
- j. Agent architecture: goal based agent with utilities for open-ended situations