

## Upload your answers document in BlackBoard (Paperless Homework)

### Question 1 (Chapter 1, 25 points)

Define in your own words: (a) intelligence, (b) artificial intelligence, (c) agent, (d) rationality, (e) logical reasoning.

- a. **Intelligence** – I think intelligence is making sense of the world around you. It is also being able to think creatively and come up with novel ideas. Self-reflection also plays a big role in intelligence. Having the knowledge and skills to plan and think ahead is a good sign of an intelligent being.
- b. **Artificial Intelligence** – An bring that is created, by humans, that is capable of showing signs of being intelligent. This agent may not necessarily interact in the real world, but is capable of interacting and learning from its environment.
- c. **Agent** – An agent is the entity that acts in the environment. This agent collects data from its world via sensors and interacts via some sort of actuator. An agent is an abstract term for the piece of software or hardware, that does the interacting. The hardware example is easier to visualize. A robot would be the agent walking around our world. It has sensors in its eyes to detect light and objects. It has actuators in its feet and arms that enable it to move around in the world. Software is similar but only part of the code takes in sensor data and sends output to actuator code to be run.
- d. **Rationality** – Rationality describes a process or action that has the greatest chance for success or reward or minimization of error. Rationality means choosing the best option from your current state. A rational agent will make the best choice given its current understanding of its surrounding, i.e. it will “do the right thing”. Now how to define the “right” thing is a continued area of research, but mainly it concerns minimizing the error between its modeled world and the real world.
- e. **Logical Reasoning** – Logical reasoning is following steps in a predefined order (could be random) in order to achieve a goal. It uses previous premises to come to valid conclusions. It is a way to follow consistent rules when you evaluate questions.

### Question 2 (Chapter 1, 25 points)

To what extent are the following computer systems instances of artificial intelligence:

#### **a. Supermarket bar code scanners.**

The bar code scanner is able to perceive its environment by using the laser to scan in the bar code. Data is then sent through a series of functions to a database where the price is returned. This price is then sent (actuated) to the register for the employee to charge the customer. Overall, not a very intelligent system, but a convenient tool. It is following a programmed set of instructions (algorithms) in order to make this happen.

#### **b. Web search engines.**

A search engine is significantly smarter than a bar code scanner. Where the scanner is essentially a smart database lookup tool, a search engine returns many more values. It may also give suggestions for your favorite sights (or unfortunately, ads) which shows there is a recommender engine somewhere under the hood. The search engine needs to know something of your preferences so it can use that to learn what you like, what videos do you watch on Youtube, etc. This system shows more intelligence.

### Question 3 (Chapter 2, 25 points)

For each of the following activities, give a PEAS description of the task environment and characterize it in terms of the properties listed in Section 2.3.2.

**a. Playing soccer.**

Performance Measure – Scoring goals

Environment – The soccer field, ball location, players

Actuators – Legs to move/run/kick

Sensors – Eyes to detect the ball, legs to feel the slipperiness of the grass.

Full observable, Multi agents, Stochastic, sequential, dynamic, continuous

**b. Exploring the subsurface oceans of Titan.**

Performance Measure – Survival rate, battery life, elemental protections

Environment – outdoors, rocky

Actuators – wheels, robotic grabber

Sensors – Temperature control, cameras, audio sensors

Partially observable, Single agent (unless aliens!), deterministic, episodic, static, continuous

**c. Shopping for used AI books on the Internet.**

Performance Measure – Cheapest price, good book condition, safe browsing sites

Environment – Virtual, set of customers on website

Actuators – Price of books sent to screen, recommendations shown to users,

Sensors – book title and author, price range or other filters (book condition, edition, etc), keyboard/mouse entry

Partially observable, multi agent, stochastic, sequential, dynamic, continuous

### Question 4 (Chapter 2, 25 points)

Define in your own words the following terms:

**Agent** - An agent is the entity that acts in the environment. This agent collects data from its world via sensors and interacts via some sort of actuator. An agent is an abstract term for the piece of software or hardware, that does the interacting. The hardware example is easier to visualize. A robot would be the agent walking around our world. It has sensors in its eyes to

detect light and objects. It has actuators in its feet and arms that enable it to move around in the world. Software is similar but only part of the code takes in sensor data and sends output to actuator code to be run.

**Agent Function** – An agent function is a function that maps input sequences to corresponding actions for the agent to take. An equation to determine how the agent should act given certain input (and its corresponding history).

**Agent Program** – This is the implementation of the agent function. The actual program that will run the agent function.

**Rationality** - Rationality describes a process or action that has the greatest chance for success or reward or minimization of error. Rationality means choosing the best option from your current state. A rational agent will make the best choice given its current understanding of its surrounding, i.e. it will “do the right thing”. Now how to define the “right” thing is a continued area of research, but mainly it concerns minimizing the error between its modeled world and the real world

**Autonomy** – Moving in the world with no assistance. An agent is autonomous if its behavior is determined by its own experience and interactions in the world, i.e. not being told how to behave, but making those choices by itself.

**Reflex agent** – A type of intelligent agent that will perform its actions based only on the current situation. It is strictly reacting to its current state. It performs actions based on pre-determined rules for these environmental conditions, i.e. if-then statements. If X happens do Y, if Z happens do W.

**Model-based Agent** – An intelligent agent that uses its precept history to create an internal “model” of its environment. The closer this model is to its actual environment, the better it will be able to interact in the world.

**Goal-based Agent** – An agent which chooses its actions in order to achieve its goals. These agents consider their actions and how they would impact future actions. They are generally better performing than other agents because they are able to consider future possibilities, not just react.

**Utility-based Agent** – A goal-based agent which, in addition to considering future ways to achieve its goal, tries to find the best way to do so. The usefulness or utility of the agent is which differentiates it from other agents. It utilizes techniques to optimize achieving its goals.

**Learning Agent** – An agent that is able to learn from experiences. Usually given basic knowledge, like how a game of chess is played, then given autonomy will interact and learn while doing so. Reinforcement learning is a good example because an agent may know how to play chess, but it will continually play against itself until it learns how to play chess really good, continually improving.