

Assignment 1

Subject

Topics of this session :

1. What is intelligence ?
2. Understand what is an environment, an agent, their relation.
3. Goals and utilities.

This assignment is graded and must be submitted (individually or in groups of 2-3) on Moodle before next week's class.

For each exercise, detail your reflexion steps :

- We are mostly interested in your actual thinking process.
- Even if you are unable to solve an exercise, write out what were you reflexion steps.
- For each attempted exercise, a written feedback will be provided.

Reference material : [Artificial Intelligence, A Modern Approach, Chapters 1 and 2.](#)

Exercise 1

For each of the following problems :

1. Autonomous vacuum cleaner,
2. Smart home assistant (Alexa, Google Home),
3. Chatbot (chatGPT),
4. Self-driving car,
5. [Battleship AI](#).

Identify :

- The state space,
- The observation space,
- The belief space,
- The action space,
- The environment / agent boundary.

Example : Maze solving robot :

- State space : maze layout, robot's position, start and goal positions.
- Observation space : wall sensors (front and side)/ camera.
- Belief space : explored areas, robot's position.
- Action space : turn, go forward.
- Environment / agent boundary :
 - Environment : Maze walls.
 - Agent : Robot's body, sensors, actuators.

Exercise 2

For each problem given in exercise 2, answer the following questions :

- Can you define a clear goal, achievable by the agent ? If yes, which one ?
- Can you define a utility function for the problem ? If yes, give an example.

Note : A utility function is what determines the preferences of the intelligent agent. It dictates how an agent's action should be penalized/rewarded.

Based on your previous answers, are utility functions more convenient than goals to design intelligent agents ? Why ?

Example : Maze solving robot :

- **Goal** : Exit the maze.
- **Utility function** : Yes, give a +1 reward when moving closer to the exit, a penalty of -1 otherwise.

Exercise 3

In general, based on which information agents make intelligent decisions ? Provide a concrete example.

Exercise 4

From your understanding, what is the general difference between the state space, observation space, and belief space ?

Exercise 5

Describe a situation (a type of problem) where :

1. An intelligent agent can be distinguished from a non-intelligent one,
2. An intelligent agent cannot be distinguished from a non-intelligent one,
3. An intelligent agent is impossible to have.