# TDT4136 - Assignment 1 - Martin Skatvedt

*Q: What is Artificial Intelligence (AI)? Include at least 3 definitions of AI that are not covered in the lecture.*

A:

1. Artifical intelligence is defined in terms of findelity to human performance, such as learning and problem solving.
2. Artifical intelligence is defined in terms of rationallity and acting rational.
3. Artifical intelligence is the ability to perform tasks associated with inteligent beeings.

*Q: What is the Turing test? What is its purpose and how is it conducted?*

A: The turing test is a thought experiment, to check if *Can a machine think?*. The test is conducted by a human which asks written questions to a human and a machine. To succed the test, the human cant tell the which of the answers came from the machine and from the human.

*Q: What is rationality?*

A: Rationality is the combination of rathional thinking and acting rational. It is the process of given any information, determining what is right, and then doing the action that gives the most performance measure.

*Q: What is the difference between thinking rationally and acting rationally? Is rational thinking an absolute condition for acting rationally?*

A: Thinking rationally is only the process of determining what is right and wrong. While acting rationally is the part of doing the action which gives the most performance measure. However rational thinking is not an abosulute condition for action rationally. For example when you touch a hot stove, you remove your hand by reflex. This means that if you had held your hand there while thinking out the most rational thing to do, it would be less rational than just removing your hand.

*Q: What is the connection between knowledge and action according to Aristotle? How can his argument be used to implement his idea in AI?*

A: Artistotle meant that if we have a problem, we need to formulate an action to fix that problem.

*Q: 1. Who was (or were) the first AI researcher(s) to implement these ideas?*

A: Newell and Simon implemented Aristoteles ideas 2300 later.

*Q: 2. What is the name of the program or system they developed? Write a short description about it.*

A: They developed the *General Problem Solver* program. They used an idea called

problemreduction. Which meant that they broke a porblem into many small problems, and solved each one individually.

*Q: Consider a robot with the task of crossing the road, and an action portfolio,*
*A = {lookBack, lookForward, lookLeft, lookRight, goForward, goBack, goLeft, goRight}*
*Q: 1. While crossing the road, an elk crashes on the robot and smashes it. Is the robot rational?*
A: No, its performance is less than what is expected. An agent which has the ability to look left and right, should have seen the Elk coming, and decided not to cross the road.
*Q: 1. While crossing the road on a green light, a passing car drives into the robot and crashes, preventing the robot from crossing to the other side. Is the robot rational?*
A: Yes, the robot acted rational. The robot chose to cross the road at a green light, which is rational. The robot can not predict the future and know that the car was going to run a red light.

*Q: Consider the vacuum cleaner world described in Figure 2.2 (Chapter 2.1 of AIMA 4th Ed.). Let us modify this vacuum environment such that the agent is penalized 1 point for each movement:*
*Q: Could a simple reflex agent be rational for this environment? Why?*
A: No, because if both the squares are empty, the robot would move back and forth and be penalized for each movement.
*Q: Could a reflex agent with state be rational in this environment? Why?*
A: No, because even though it could store the state of both squares, it would still need to check the other square if it is clean or not, and would still move far to often.
*Q: Assume now that the simple reflex agent (i.e. no internal state) can perceive the clean status of both locations at the same time. Could this agent be rational? Why? In case it could be rational, write the agent function using mathematical notation.*
A: Yes, because the robot would not need to move before it knows that a square is dirty.

*Q: Consider the original vacuum cleaner environment shown in Figure 2.2. Describe the environment using the properties from Chapter 2.3.2 (e.g. episodic/sequential, deterministic/stochastic, etc.) Explain why you chose such values and properties.*

A: Enviroment properties:

- **Fully observable:** The robot always knows the state of both squares.
- **Single Agent:** There is only one robot operating on the squares.
- **Deterministic:** The squares has a state, and can only be changed by the robot, which makes it deterministic.
- **Sequential:** The robot percives the enivorment, and then decides wheter to move, vaccum or do nothing. This means that if the robot decides to vaccum, the action will have a consequence on the next action.
- **Static:** The enviroment is static. The robot only has to look once to percive wheter a square is dirty or clean, the state of the squares does not change dynamicly.
- **Discrete:** The enviroment is discrete because it has a limited and finite amount of states (dirty/clean).

- **Known:** The enviroment consists of two squares, and the robot knows that it can move to the right and left. This means that the enviroment is known, and the robot does not have to figure out its laws.

*Q: Write both advantages and limitations of the following types of agents:*

- **Simple reflex agents:**
  - Advantages: The advantage of simple reflex agents is its size. They are often small and fast, because of their *if this then that* nature.
  - Limitations: Simple reflex agents are simple and not very perceptive. They also dont consider percept history, which makes them likley to end up in infinite loops.
- **Model-based reflex agents:**
  - Advantages: Model based reflex agents, uses sensors and has an internal state. This also means that the model-based reflex agent considers its history when making choices. Furthermore it means that it can work in a partially oberservable enviroment.
  - Limitations: Model-based reflex agents has its own perception of the enviroment. Even if the enviroment is partially observable, it still has to make a *best guess*. Also since it is still a reflex agent, it still uses rules, to determine its actions.
- **Goal-based agents:**
  - Advantages: A goal-based agent uses a goal, instead of rules to make a decision. The goal-based agent has a goal, which determines its rules. It is also more flexible, as you can just give it a new goal, instead of explicit rules.
  - Limitations: The goal-based agent is less efficient, as they have to make their of decisions, instead of using a lookup on rules.
- **Utility-based agents:**
  - Advantages: Utility-based agents gives a score for each action, to check its utility. This removes the *happy or unhappy* aspect as in goal-based agents. This means that a utility-based agent will always choose the action which makes it the most useful or has the most utility. Utility-based agents has the advantage when there are mutiple possible actions, and it has to select of them.
  - Limitations: Due to the sheer compexity of utility-based agents, they are limited by computation complexity.