

# Foundations of Artificial Intelligence

M. Helmert  
S. Eriksson  
Spring Term 2022

University of Basel  
Computer Science

## Exercise Sheet 1 Due: February 27, 2022

**Important:** for submission, consult the rules at the end of the exercise. Non-adherence to the rules will lead to your submission not being corrected.

### Exercise 1.1 (1+1+1+1 marks)

Characterize the following AI systems with respect to the four categories (acting humanly, thinking humanly, thinking rationally, acting rationally) that have been introduced in the lecture. Justify your answers in one to two sentences.

- (a) digital assistants (Siri, Alexa, Cortana, ...)
- (b) an AI designed to compete against humans in StarCraft II
- (c) self-driving cars
- (d) R1/XCON (slide set A2, slide 12)

*Note: In many cases several categories can be argued for, meaning there is not only one correct answer. Choose one category and present your argument for it.*

### Exercise 1.2 (1+1+1 marks)

Check the literature and the internet to investigate to which extent the following tasks can nowadays be performed automatically by computers and/or robots. Describe your findings in one to two sentences and provide a source.

- (a) playing the game of Checkers
- (b) biometrical authentication of a face
- (c) recognizing the semantics of natural language

### Exercise 1.3 (1+1+1 marks)

Consider the following vacuum cleaner domain. There exist two cells (*right* and *left*) that can either be in a dirty state or in a clean state. The vacuum cleaning agent can drive from left to right and from right to left. Furthermore, the agent has a sensor to detect the current state of the cell. Consider the following stochastic extension of this domain.

- (a) When trying to clean a cell that is already clean, in some cases the cell gets dirty.
- (b) The agent's sensor is faulty: With a probability of  $p \in (0, 1]$ , a cell which is possibly dirty is recognized as clean.

Consider the three scenarios where only (a) holds, where only (b) holds, and where both (a) and (b) hold. Investigate for each of these scenarios if there is an agent that guarantees that the cells are clean after finitely many steps. Specify how such an agent looks like in case it exists, or justify why such an agent does not exist.

**Submission rules:**

- Exercise sheets must be submitted in groups of two students. Please submit a single copy of the exercises per group (only one member of the group does the submission).
- Create a single PDF file (ending .pdf) for all non-programming exercises. Use a file name that does not contain any spaces or special characters other than the underscore “\_”. If you want to submit handwritten solutions, include their scans in the single PDF. Make sure it is in a reasonable resolution so that it is readable, but ensure at the same time that the PDF size is not astronomically large. Put the names of all group members on top of the first page. Either use page numbers on all pages or put your names on each page. Make sure your PDF has size A4 (fits the page size if printed on A4).
- For programming exercises, only create those code textfiles required by the exercise. Put your names in a comment on top of each file. Make sure your code compiles and test it. Code that does not compile or which we cannot successfully execute will not be graded.
- For the submission: if the exercise sheet does not include programming exercises, simply upload the single PDF. If the exercise sheet includes programming exercises, upload a ZIP file (ending .zip, .tar.gz or .tgz; *not* .rar or anything else) containing the single PDF and the code textfile(s) and nothing else. Do not use directories within the ZIP, i.e., zip the files directly.
- Do not upload several versions to ADAM, i.e., if you need to resubmit, use the same file name again so that the previous submission is overwritten.