WRITTEN EXAMINATION

Course IT776A Artificial Intelligence A1N

Examination

Course code IT776A

Credits for written examination 4.5

Date 2025-12-17

Examination time 08:15-12:30

Examination responsible Joe Steinhauer

Teachers concerned Joe Steinhauer

Aid at the exam/appendices

Other

Instructions
- ☐ Take a new sheet of paper for each teacher.
- ☒ Take a new sheet of paper when starting a new question.
- ☒ Write only on one side of the paper.
- ☒ Write your name and personal ID No. on all pages you hand in.
- ☒ Use page numbering.
- ☒ Don´t use a red pen.
- ☒ Mark answered questions with a cross on the cover sheet.

Grade points 40

Examination results should be made public within 18 working days

Good luck!

Total number of pages

Artificial Intelligence, IT776A

Re-exam, autumn term, 2025

December 17th, 2025

Rules

- All questions are to be answered within the context of artificial intelligence and the contents of lectures, slides and assignments.

- You are expected to answer in a thorough, yet concise manner. That is, elaborate on your answers without dwelling on aspects which are not strongly related to the question at hand.

- Write in an intelligible manner. If your writing needs to be decoded, no points will be awarded.

- Use a clear handwriting, if your text is not readable, no points will be awarded.

- The exam has 4 parts à 10 points. To pass this exam you have to pass each of the 4 parts by reaching no less than 5 points. If you successfully pass all parts your final grade will be determined by the sum of all points and the following grading scheme:

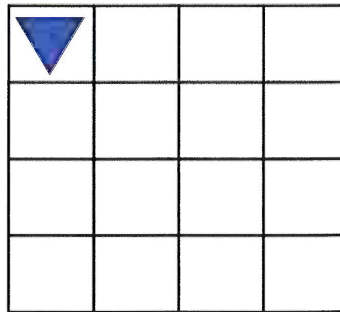| Sum of Points	Final Grade
36 – 40	A
32 – 35	B
28 – 31	C
24 – 27	D
20 – 23	E
< 20	F

Table 1: Exam grading scheme.

Good luck!

1. AI in general

In this part you are asked to provide definitions. You do not need to provide the exact same wording as the original definitions but the content of the definitions must be the same as intended by their authors. That means you must include all content of the original definition but you must not add content that was not part of the original definition.
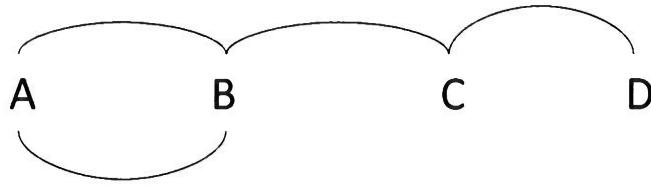
A. Provide the definition of AI as formulated by Marvin Minsky. (3 points)

B. Russel & Norvig define intelligent behavior as rational behavior, provide their definition of rational behavior. (4 points)

C. Provide the definition of machine learning (by Mitchell), that we discussed during the course. Describe and explain what three elements, that are named in the definition are. (3 points)
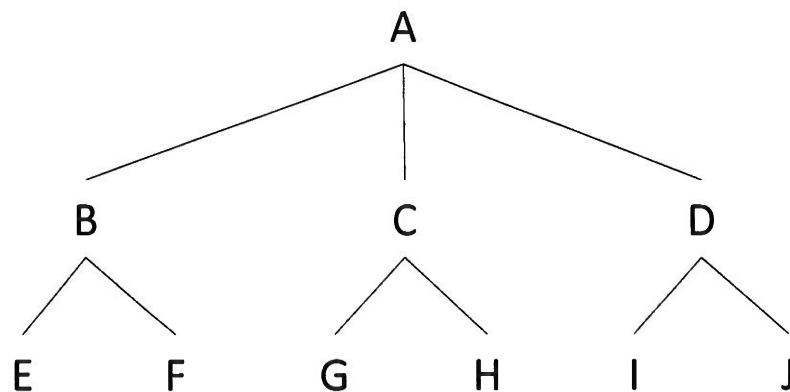
2. Agents

A. List the four different agent types that we have discussed in the lectures and describe their differences using the two most important characteristics of these agent types.
(4 point)

B. The picture below shows a room represented as a grid with an autonomous vacuum cleaner represented as a triangle. The agent (vacuum cleaner), can move left, right, up or down. What type of agent is the simplest type of agent that is capable of cleaning the whole floor in the picture below? Motivate your answer. (2 points)

C. Write the pseudo code for vacuum cleaner that will allow it to clean the whole floor. Keep the program as simple as possible. Include what input the agent needs and what output it produces. The code you provide here needs to be designed for the agent type that you chose under question B. (4 Points)
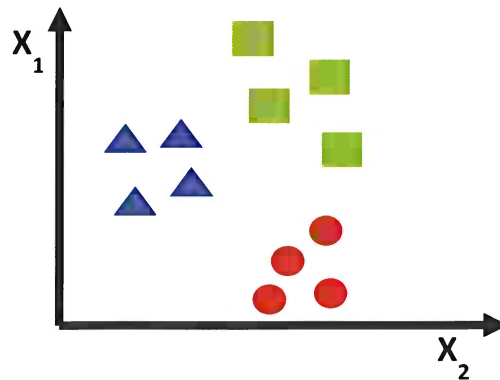
3. Search

A. Consider the abstracted road map above and draw a search tree for it using A as the root node. Draw the tree up to <u>and including depth 3</u> (1 point).

B. State how deep the complete search tree would be <u>and explain</u> why the tree has this depth (1 point)

C. Explain what it means when a search strategy is optimal (1 point)

D. Explain what it means when a search strategy is complete (1 point)

E. For the <u>four different uninformed</u> search strategies that we discussed during the lectures
- Provide their name and a short description of how they work
- For the tree **provided below**, list the nodes <u>as they are visited</u> by the respective search strategy in the correct order.
- State whether or not the search strategy is optimal, complete, both or neither and
- explain why or why not it is optimal or complete, both or neither

(6 points)

4. Machine Learning

A. Single Layer Perceptron

1. Design and draw a Single Layer Perceptron that can distinguish between the three classes in the picture below. (3 points)

2. Describe what each of the neurons does with regard to the classification problem (3 points)

3. What is the name of the classification approach that you are using (1 point)

4. The **?** in the picture below represents a new data point that has not yet been classified, using the single layer perceptron classifier that you build above, as what type of element will the data point be classified? Explain why this is the case (3 points)