UNIVERSITY
OF SKÖVDE

School of Informatics

WRITTEN EXAMINATION

Course IT776A Artificial Intelligence A1N

Examination

Course code IT776A

Credits for written examination 4.5

Date 2024-10-29

Examination time 8:15-11:30

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

Exam, autumn term, 2024

October 29th, 2024

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

1.1. The most common definitions of AI are grounded in Marvin Minsky's definition. How does Marvin Minsky define AI? (2 points)

1.2. Explain how intelligent behavior, in accordance with Russel and Norvig's description, can be defined as rational behavior and what requirements need to be fulfilled for an agent to be able to behave rationally? (3 points)

1.3. Name the two areas of AI that intersect the most with the area of data science (1 point)

1.4. Briefly define, in the way we have discussed in the lectures, each of these areas that you named under 1.3 (2 points)

1.5. Briefly state for what purposes a data scientist will use the methods from these two areas that you named under 1.3 (2 points)

2. Agents

2.1. The agent definition provided by Russel & Norvig and discussed during the lectures distinguishes between 4 types of agents ranging from low intelligence to higher intelligence.

- Name the 4 types of agents and
- provide the two main characteristics that distinguishes these agents and
- list which of these agents fulfill which characteristics.

(4points)

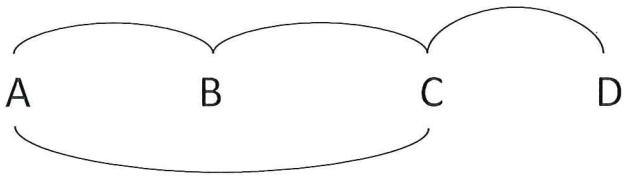
2.2. What type of agent would you choose for the following tasks described below under a) and b). For each task explain

- the type of agent that you choose and
- motivate and explain why you chose this type of agent for the task.
- Keep in mind that while the agent must be able to successfully fulfill those tasks you still want it to be as simple as possible. Explain why your choice of agent is the simplest possible design that still will lead to a successful task completion.

a) An autonomous vacuum cleaner which is able to clean the whole floor.
b) An autonomous taxi driver that drives a passenger to a chosen destination where the passenger can before the drive input their priorities regarding a combination of route criteria (e.g. fast, safe, scenic, etc.).

(6 points)

3. Search



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

3.2. State how deep the complete search tree would be and explain why the tree has this depth (1 point)

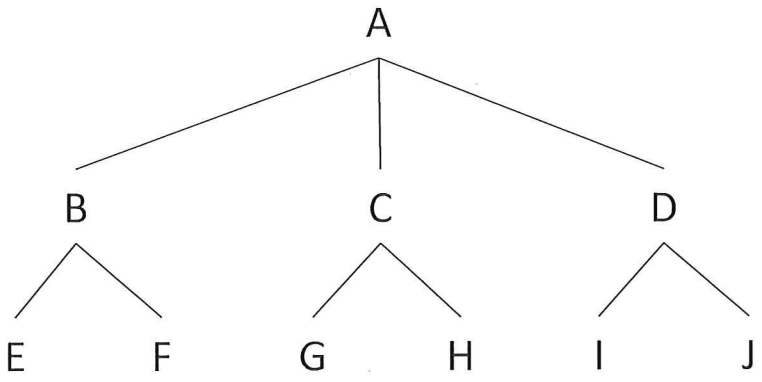
3.3. Explain what it means when a search strategy is optimal (1 point)

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

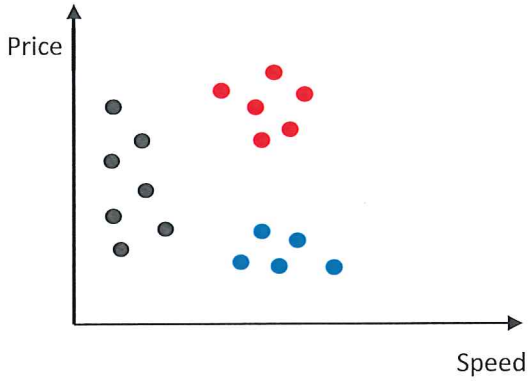
3.5. For the four different uninformed search strategies that we discussed during the lectures

- Provide their name and a short description of how they work
- List the nodes as they are visited by the respective search strategy
- 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



Consider the diagram above which shows cars with regard to their speed and price. We want to distinguish three different groups of cars considering these two features. The three different groups of cars are indicated by the respective colors.

4.1. Using a single layer perceptron to build a classifier between these three groups of cars, which two different approaches did we discuss during the lectures that could be used here? (2 point)

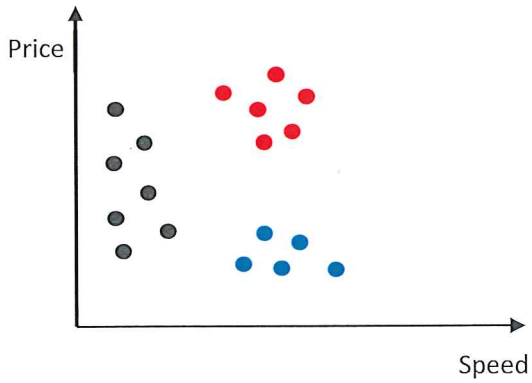
4.2. Build a single layer perceptron for each of the two approaches that can distinguish between these three classes based on the data provided in the diagram.

- Draw each single layer perceptron and
- describe how the respective approach works, using this problem as an example.
- Describe with words and illustrations what happens within the nodes (formulas are not needed)

(6 points)

4.3. Draw into the pictures below, how the resulting separation between the groups would look like for each of the approaches. (2 points)

Approach 1 (provide the name):



Approach 2 (provide the name):