School of Informatics

WRITTEN EXAMINATION

Course IT776A Artificial Intelligence A1N

Examination

Course code IT776A   Credits for written examination 4.5

Date 2025-10-28   Examination time 14:15-18:30

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, 2025

October 28th, 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 working 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. Russel and Norvig define intelligent behavior to be rational behavior, please provide the definition for rational behavior (as provided by Russel & Norvig). (4 points)

B. Provide the definition of AI that has been commonly adopted by, for example dictionaries, and was originally formulated by Marvin Minsky. (3 points)

C. Provide the definition of Data Mining by Hand et al. (3 points)

2. Agents

A. Fill in the table below with the following:

1. Name the four different types of agents that we discussed in the lectures (2 points).

2. Name the two agent features, that we discussed in the lectures and that are most important to distinguish these agents from each other (2 points).

3. Indicate which of the agent types do or do not have those features (2 points).

4. Indicate in the table which of the agent types can use search strategies to calculate their output (2 points).

Algorithm Name	Feature 1:	Feature 2:	Search capability
1:			
2:			
3:			
4:			

B. What type of agent (out of the four types that we have discussed in the lectures) would you use for playing tic-tac-toe? Motivate your answer. (2 points)

3. Search

A. Name the four uninformed search strategies that we have discussed in the lectures (2 points)

B. For each of the four uninformed search strategies write down the order in which the strategy would explore the nodes in the following tree. (4 points)
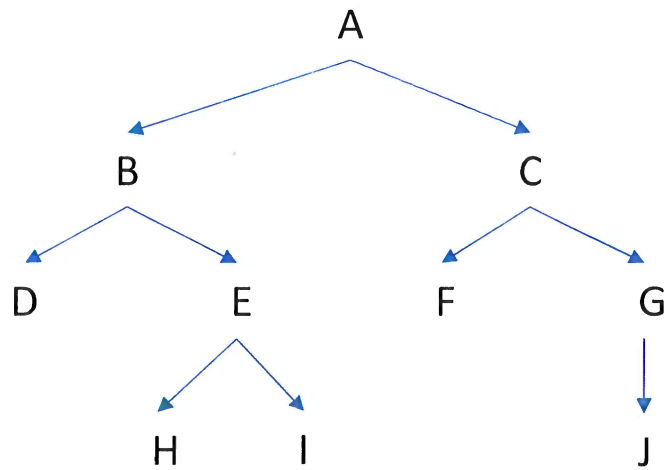
C. You are playing the game below against an opponent. It is your move and you need to decide if you want to choose move a_1 or move a_2. After that, your opponent will choose a move and after that it is your turn again for the last move. The aim of the game is for you to get the highest number of points. The points are listed here as the leaf nodes of the tree. Your opponent is playing against you and wants you to get the lowest possible number of points. The highest number in this game is 10.

1. What algorithm do you use? (1 point)

2. Which move do you choose, a_1 or a_2? (1 point)

3. Write the utility values for each of the nodes in the tree (2 points)
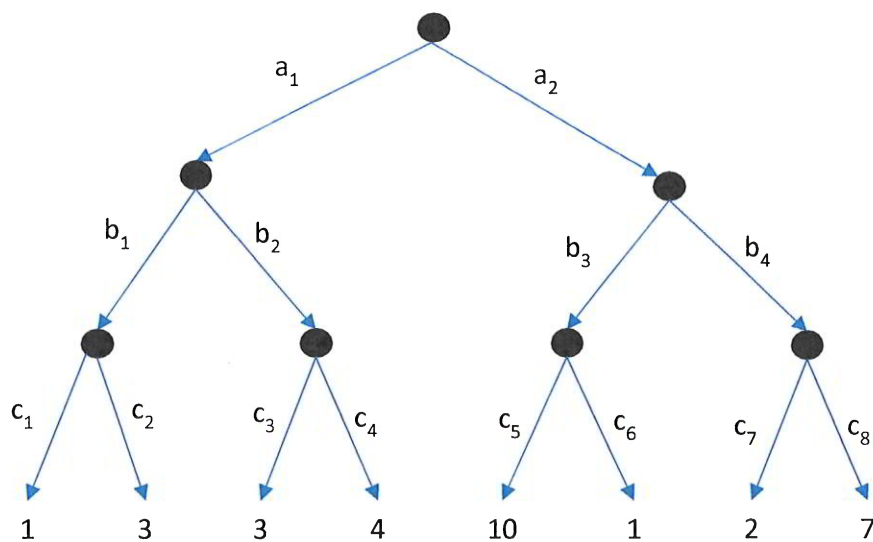
4. Machine Learning
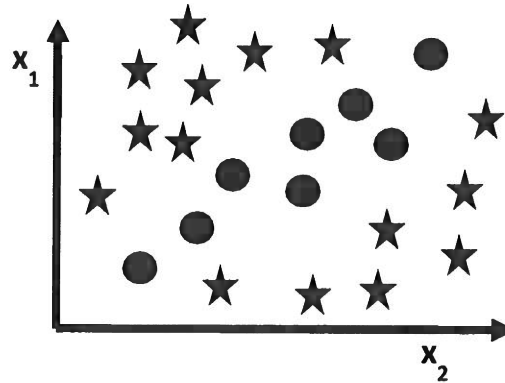
Consider the diagram above, where datapoints that are represented through their x_1 and x_2 values are grouped into two groups, stars and circles.

A. Build a single layer perceptron that can distinguish between these two classes based on the data provided in the diagram.

   1. Draw the single layer perceptron. (1 point)

   2. Which of the two approaches that we discussed during the lectures do you use? Describe the approach. (1 point)

   3. Describe with words and illustrations what happens within the nodes of your single layer perceptron (formulas and weights are not needed). (2 points)

   4. What is the output from your single layer perceptron and how can we, based on that, know if the datapoint provided will be classified as a star or as a circle? (1 point)

B. Extend your single layer perceptron into a multi-layer perceptron.
   The multi-layer perceptron shall have one output node that provides output "1" if the object is a star and output "0" if the object is a circle.

   1. Draw the multi-layer perceptron. (1 point)

   2. Provide the values for the second set of weights in your multi-layer perceptron. (2 points)

   3. Provide the formula for the activation function for the output node. (2 points)