## Examination Paper

## School of Science and Technology

**MIDDLESEX UNIVERSITY**

**EXAMINATION PAPER**

**Academic Year 2018/2019 July**

**CSD 3939**

###### Developing Artificial Intelligence

**Prof Chris Huyck**

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| --- | --- |
| Time allowed:  | 3 hours |
| Total number of questions:  | 4 |
| Instructions to candidates:  | Answer all 4 questions.*Each question is worth a maximum 25 marks.*  |
| Materials provided: | None |
| Equipment permitted:  | None |
| Total number of pages:  | 4 (including front cover)  |

**EXAM PAPER CAN BE REMOVED FROM THE EXAM ROOM**

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| **No books, paper or electronic devices are permitted to be brought into the examination room.****Candidates are warned that credit cannot be given for work that is illegible.** |

1. State Spaces

(a) The second coursework represented a character by a 64 dimensional vector of values between 0 and 16 (inclusive). How many possible inputs are there?

(7 marks)

(b) You can define a maze with a graph where the nodes represent choice points, and the arcs represent the connections between the choice points. Describe the depth first search algorithm of mazes. Give an example maze with at least 5 choice points and an example search of that maze.

(10 marks)

(c) Describe Iterative Deepening. When is it useful? Give an example of when it is useful.

(8 marks)

2. Knowledge Representation

a) Is XML Turing complete? (A simpler version of this question is: does XML do any processing?) Explain why it is or is not.

(6 marks)

(b) Write a semantic net for the topics in CSD3939. This should include at least 12 nodes, and 5 types of arcs, including the most important types of arcs.

(10 marks)

(c) There is a project at a social media firm to automatically determine whether a statement is true or false. What would be the benefits and drawbacks of using a logic based reasoning system? Specify the type of logic you would recommend.

(9 marks)

3. Machine Learning

a) What is the distinction between a parametric and a non-parametric algorithm. Give an example of each.

(10 marks)

(b) I’ve made a table of mushrooms. The three binary features (colour, spotted, height) determine whether a mushroom is poisonous. Build the decision tree to categorise mushrooms that asks the fewest questions.

|  |  |  |  |
| --- | --- | --- | --- |
| Red | Spots | Tall | Poisonous |
| Red  | Spots | Short | Poisonous |
| Red | No Spots | Tall | Not Poisonous |
| Red | No Spots | Short | Not Poisonous |
| Blue | Spots | Tall | Poisonous |
| Blue | Spots | Short | Poisonous |
| Blue | No Spots | Tall | Poisonous |
| Blue | No Spots | Short | Not Poisonous |

(8 marks)

(c) Would a deep net be a good solution for the second coursework? (The second coursework was a 2-fold categorisation of digits with inputs being 64 dimensions, and there being 5620 data items.) Explain why or why not.

(7 marks)

4. Applications

a) Give an example of a mobile robot, and briefly explain how it works.

(9 marks)

(b) Describe a McCullouch Pitts neuron. (It is also called an integrate and fire neuron).

(8 marks)

(c) How would you use a bag of words technique to represent semantics of a word in a corpus of 1000 documents?

(8 marks)