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| **COMP1694 (2017/18)** | **Artificial Intelligence** | **Faculty Header ID: 300183** | **Contribution:**  **100% of course** |
| **Course Leader: Dr Jixin Ma** | **Artificial Intelligence Coursework** |  | **Deadline Date: Friday 15/12/2017** |
| **This coursework will be marked anonymously YOU MUST NOT PUT ANY INDICATION OF YOUR IDENTITY IN YOUR SUBMISSION** | | | |
| This coursework should take an average student who is up-to-date with tutorial work approximately 50 hours   Feedback and grades are normally made available within 15 working days of the coursework deadline | | | |
| **Learning Outcomes:**  A. Use logic as a representation and reasoning strategy for AI; B. Critically describe and discuss representation schemas such as Procedural Representations, Network Representations and Structured Representations and apply these to case studies. C. Be proficient in the use of the PROLOG programming language; D. Critically select and apply a variety of techniques underpinning AI applications such as Games, Temporal/Spatial Reasoning, etc. | | | |

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| Plagiarism is presenting somebody else's work as your own. It includes: copying information directly from the Web or books without referencing the material; submitting joint coursework as an individual effort; copying another student's coursework; stealing coursework from another student and submitting it as your own work. Suspected plagiarism will be investigated and if found to have occurred will be dealt with according to the procedures set down by the University. Please see your student handbook for further details of what is / isn't plagiarism.   **All material copied or amended from any source (e.g. internet, books) must be referenced correctly according to the reference style you are using.   Your work will be submitted for plagiarism checking. Any attempt to bypass our plagiarism detection systems will be treated as a severe Assessment Offence.** |

**Coursework Submission Requirements**

* An electronic copy of your work for this coursework must be fully uploaded on the Deadline Date of **Friday 15/12/2017** using the link on the coursework Moodle page for COMP1694.
* For this coursework you must submit a single PDF document. In general, any text in the document must not be an image (i.e. must not be scanned) and would normally be generated from other documents (e.g. MS Office using "Save As .. PDF"). An exception to this is hand written mathematical notation, but when scanning do ensure the file size is not excessive.
* There are limits on the file size (see the relevant course Moodle page).
* Make sure that any files you upload are virus-free and not protected by a password or corrupted otherwise they will be treated as null submissions.
* Your work will not be printed in colour. Please ensure that any pages with colour are acceptable when printed in Black and White.
* You must NOT submit a paper copy of this coursework.
* All courseworks must be submitted as above. Under no circumstances can they be accepted by academic staff

The University website has details of the current Coursework Regulations, including details of penalties for late submission, procedures for Extenuating Circumstances, and penalties for Assessment Offences. See <http://www2.gre.ac.uk/current-students/regs>

* **Detailed Specification**

This assignment assesses your understanding of the disciplines of Artificial Intelligence, in particular, knowledge representation and reasoning; and competence in the use of the logic-based programming language, PROLOG.

* **Deliverables**

A report in terms of answers to the corresponding questions in the form of PDF should be uploaded to the coursework system by the submission deadline.

* **Grading/Assessment Criteria**

You will be assessed on the Correctness and Completeness of the coursework.

**Grade % Answers**

I 86-100

76-85

70-75

The coursework is exemplary and provides clear evidence of a complete grasp of the knowledge, understanding and skills appropriate to the level of this course. There is also ample excellent evidence showing that all the learning outcomes and responsibilities appropriate to that level are fully satisfied.

The coursework is outstanding and demonstrates comprehensive knowledge, understanding and skills appropriate to the level of this course. There is also excellent evidence showing that all the learning outcomes and responsibilities appropriate to that level are fully satisfied.

The coursework is excellent and is evidence of comprehensive knowledge, understanding and skills appropriate to the level of this course. There is also excellent evidence showing that all the learning outcomes and responsibilities appropriate to that

level are satisfied.

II(i) 65-69

The coursework is very good and is evidence of the knowledge, understanding and skills appropriate to the level of this course. There is also very good evidence showing that all the learning outcomes and responsibilities appropriate to that level are

satisfied.

60-64

The coursework is good and is evidence of the knowledge, understanding and skills appropriate to the level of this course. There is also good evidence showing that all the learning outcomes and responsibilities appropriate to that level are satisfied.

II(ii) 55-59

50-54

The coursework is sound and is evidence of the knowledge, understanding and skills appropriate to the level of this course. There is also sound evidence showing that all the learning outcomes and responsibilities appropriate to that level are satisfied.

The coursework is sound but provides limited evidence of the knowledge, understanding and skills appropriate to the level of this course. There is also sound but limited evidence showing that all the learning outcomes and responsibilities to that level are satisfied.

III 45-49

40-44

The coursework is acceptable but provides significantly restricted evidence of the knowledge, understanding and skills appropriate to the level of this course. There is also acceptable but significantly restricted evidence showing that all the learning outcomes and responsibilities appropriate to that level are satisfied.

The coursework is acceptable but provides barely sufficient evidence of the knowledge, understanding and skills appropriate to the level of this course. There is also acceptable but barely sufficient evidence showing that all the learning outcomes and responsibilities appropriate to that level are satisfied.

COMPENSATABLE FAIL

35-39

30-34

FAIL 20-29

10-19

0-9

The coursework narrowly fails to provide sufficient evidence of the knowledge, understanding and skills appropriate to the level of this course. There is acceptable evidence showing that the great majority of the learning outcomes and responsibilities appropriate to that level are satisfied.

The coursework provides insufficient evidence of the knowledge, understanding and skills appropriate to the level of this course. The evidence provided shows that the majority of the learning outcomes and responsibilities appropriate to that level are satisfied.

The coursework is unacceptable and provides little evidence of the knowledge, understanding and skills appropriate to the level of this course. The evidence shows that only some of the learning outcomes and responsibilities appropriate to that level are satisfied.

The coursework is unacceptable and provides negligible evidence of the knowledge, understanding and skills appropriate to the level of this course. The evidence shows that

few of the learning outcomes and responsibilities appropriate to that level are satisfied.

The coursework is unacceptable and provides no evidence of

the knowledge, understanding and skills appropriate to the level of this course. The evidence fails to show that any of the learning outcomes and responsibilities appropriate to that level are satisfied.

**Artificial Intelligence Coursework**

**Part A:**

1. Assume that the universe of discourse is the set of people studying or working at the University of Greenwich. Rewrite the following statements in the form of predicate logic.
2. Each person is either a student or a staff.
3. Each lecturer teaches some courses.

#### Some hard-working people are not boring.

1. Hard-working people are respectable.
2. Everyone knows some hard-working people.

**[10 marks]**

2. (a) Use truth table to verify the following equivalence:

A → B ≅ ~A ∨ B

and use your own example to explain your understanding of the actual meaning of “A materially implies B” in propositional logic.

**[8 marks]**

(b) Distinguish between *deductive*, *inductive* and *abductive* reasoning; give an example of the appropriate use of each.

**[9 marks]**

(c) List the four main representation schemas learnt from this course and give a typical example(s) for each of them.

**[8 marks]**

3. (a) Express the following knowledge as a Prolog rule(s):

*X is Z’s grandparent if X is Y’s father or mother, and Y is Z’s father or mother.*

**[5 marks]**

(b) Consider the following Prolog program/database:

a(X):- b(X), c(X), d(X).

a(X):- c(X), d(X).

a(X):- d(X) .  
b(1).

b(a).

b(2).

b(3).

d(10).

d(11).

c(3).

c(4).

Given the query ?- a(X). What are the successive variable bindings that the variable X gets when the above query is run. Separate bindings by a comma (i.e., 1, a, 5, ...).

**[8 marks]**

(c) Explain what the following program does:

element(Element, [Element|Tail]) :- !.

element(Element, [Head|Tail]) :- element(Element, Tail).

**[6 marks]**

(d) What is the actual meaning of “no”s in Prolog? Explain the so-called “*negation as failure*” strategy used in Prolog.

**[6 marks]**

**Part B:**

**4.**

Write a research report on temporal logics and/or their application in the domain of Artificial Intelligence. It can be about any relevant theoretical and / or practical issues, such as:

* Time Theories and/or Models

 Temporal Knowledge Representation and Management

 Temporal Data Mining or Case-Based Reasoning

 Time Series and/or State Sequences

 Temporal Database Management

 Reasoning about action, event and change

 Prediction/Planning

 Diagnosis/Explanation

 Industrial Process Control

 Natural Language Understanding

Again, you may make use of materials which you find in the lectures notes, textbooks and the Internet, but you should adapt them to your essay and give full citations and references to sources each time copied material is used. The contents of the report must be related to the key words “Time” and/or “temporal”, in terms of a well-presented literature review/survey (10 marks), together with your own understanding, observations, critical analysis and evaluation of temporal logics and/or their applications in the domain of Artificial Intelligence (10 marks). The report should be around 5 pages using Times New Roman Font, 12 point, with 1.5 spacing, including references and Web/Book citations. Longer submissions will not be penalized, but will not necessarily draw extra credit.

**[20 marks]**

**5.**

AI research and games are a mutually beneficial combination. On the one hand, AI technology can provide solutions to an increasing demand to add realistic, intelligent behaviour to the virtual creatures that populate a game world. On the other hand, as game environments become more complex and realistic, they offer a range of excellent test beds for fundamental AI research.

Write a literature review report on the topic of applying Artificial Intelligence techniques, such as learning, search and planning, to games. It may focus on past and recent applications, open problems and promising avenues for future research, and/or on resources available to people who would like to work in this space (10 marks). The report should provide your understanding and evaluation of various Artificial Intelligence techniques that can be applied to games, and/or concrete game examples that, as benchmarks that accurately reflect real-life problems, AI researchers can benefit from (10 marks). You may make use of materials which you find in the lectures notes, textbooks and the Internet, but you should adapt them to your report and give full citations and references to sources each time copied material is used. The report should be around 3 pages using Times New Roman Font, 12 point, with 1.5 spacing, including references and Web/Book citations. Longer submissions will not be penalized, but will not necessarily draw extra credit.

**[20 marks]**