Lincoln School of Computer Science

Assessment Component Briefing Document

Title: CMP2020M Artificial Intelligence – Component One	Indicative Weighting: 25%

Learning Outcomes:

On successful completion of this component a student will have demonstrated competence in the following areas:

- [LO1] explain the theoretical capabilities of Artificial Intelligence;
- [LO2] apply Artificial Intelligence techniques to solve practical problems;
- [LO3] locate and reference relevant information.

Requirements

This is the first of two assessed Workshop Tasks, which will then be assessed in following week following the hand-in date. You have two answer the following questions and write Prolog code were asked for. All Prolog code has to be submitted as one zip file. The reference implementation for your code is SWI-Prolog. Your code has to work in this Prolog implementation. So, you are expected to submit two documents for this assessment:

1. The zip file containing all your **own Prolog code** with appropriate **documentation**. Please indicate in your source code comments which question your code is an answer for.
2. An **individual report explaining your source code and answering the questions**. You may quote (parts of) your code in this document. Explain in your own works why and how your solution works. Please refer to source files where appropriate. Reference any sources you have used in your report following Harvard citation standards.

The actual task (questions 1 to 5) can be found at the end of this document!

Useful Information

This assessment is an <u>individually assessed</u> component. Your work must be presented according to the Lincoln School of Computer Science guidelines for the presentation of assessed written work. Please make sure you have a clear understanding of the grading principles for this component as detailed in the accompanying Criterion Reference Grid.
If you are unsure about any aspect of this assessment component, please seek the advice of a member of the delivery team.

Submission Instructions

The deadline for submission of **individual reports** and **program code** is spread throughout the semester. Please check the official documentation for hand-in dates. Every student is required to demonstrate his or her solution to the delivery team at the beginning of the following workshop and explain the working of the submitted solution.

You must make an electronic submission of your work in PDF format together with a zip file containing all developed code files by using the assessment link on Blackboard for this component. *DO NOT include this briefing document with your submission.*

Task

Q1. Draw the family tree representing the following facts in Prolog.   [20 marks]

```prolog
% Fact section. Do not modify, add or delete facts.
female(lora).              % This predicate represents the fact that
                           % lora is female.
female(amanda).
female(sheela).
female(diana).
female(aileen).
female(emily).

male(oscar).
male(owen).
male(tom).
male(adam).
male(shaun).

parent(lora, amanda).      % This predicate represents the fact that
                           % lora is a parent to amanda
parent(lora, tom).
parent(lora, sheela).
parent(oscar, amanda).
parent(oscar, tom).
parent(owen, sheela).
parent(amanda, diana).
parent(amanda, adam).
parent(tom, shaun).
parent(tom, aileen).
parent(sheela, emily).
```

Q2. Fill in the bodies of the following eleven predicates so that they correctly encode the relationships between the people described in the fact section. For the purposes of this assignment, sister, brother and sibling should be defined to include persons related to each through either one or both parents (i.e. "sister" includes half-sister, "brother" includes half-brother, and "sibling" includes both sister and brother).   [20 marks]

```prolog
% Predicate section. Please complete the following code.
mother(X, Y) :-            % This rule should represent that X is a
                           % mother to Y. Likewise for the following
                           % rules.
father(X, Y) :-
child(X, Y) :-
daughter(X, Y) :-
son(X, Y) :-
sister(X, Y) :-
```

```
brother(X, Y) :-
sibling(X, Y) :-
uncle(X, Y) :-
aunt(X, Y) :-
cousin(X, Y) :-
```

Q3. Show that using your rules; you can infer that shaun, aileen and emily are diana's cousins, and that diana and adam are brother and sister. Create some queries that test every predicate, and include these in your report.   [20 marks]

Q4. Write a predicate relative(X, Y) that is able to determine correctly whether two people are related, and do it in such a way that you can use the predicate to query the database for all of a person's relatives (the query must terminate, rather than return an infinite sequence of answers). Your predicate should be defined to include only blood relations (people who are related to one another by birth but not by marriage). For example, adam and sheela are relatives (because lora is the mother of both amanda and sheela, and amanda is the mother of adam) but adam and owen are not relatives.   [20 marks]

Q5. Write a recursive predicate `modolo(X, D, R)` that takes as input a positive integer X, a divisor D<=X and returns the remainder R of the integer quotient X/D. For instance, if X=6 and D=4, then R=2. You have to assume that only positive integers are allowed in the inputs and outputs of your function.
                                                                [20 marks]