THE UNIVERSITY OF AUCKLAND

FIRST SEMESTER, 2009
Campus: City

COMPSCI.367
The Practice of Artificial Intelligence

(Time allowed: 45 minutes)

This test is out of **100** marks.
Attempt **ALL** questions.
Write your answers in the space provided in this booklet. There is space at the back for answers that overflow the allotted space.
The use of calculators is **NOT** permitted.

Surname (Family Name):	
First Name(s):	
UoA ID Number:	
Login Name (UPI):	

Section	Mark	Marks Available
A		60
B		40
Total		100

Print Name:

PART A: Knowledge Engineering

Question 1

Extend the following logical statement using *universal insantiation* and *modus ponens.*
[6 marks]

```
{ ∀P(bird(P)  ⇒ flies(P)),  bird(tweety) }
```

The answer is

```
flies(tweety)
```

Question 2

How does *Case-Based Reasoning* reduce the problems associated with the *knowledge elicitation bottleneck*?

[6 marks]

The knowledge elicitation bottleneck is caused by the difficulty of eliciting knowledge from domain experts. This process is the hardest and most time consuming part of developing an expert system. Once rules have been obtained and anlaysed implementing them is usually much easier. Case-based reasoners use cases that are episodes or records of real events stored as problem description/solution pairs. Since these records often already exist and since they don't need to be analysed knowledge elicitation is not needed and so the bottleneck is reduced or even removed.

Continued…

Print Name:

Question 3

What is *meta-knowledge*? Give an example.

[5 marks]

Meta-knowledge is knowledge about knowledge. In the context of expert systems meta-knowledge is used to represent control knowledge that may decided upon which inferencing technique to use or even which set of rules to apply.

For example:

If patient is CHILD then breadth first search
If patient is ADULT then depth first search

Question 4

Not all knowledge is suitable for inclusion in a knowledge based system. Is *aesthetic knowledge* suitable or not? Please explain your answer.

[5 marks].

No aesthetic knowledge is NOT suitable. Aesthetic knowedge is very subjective and opinion based. Two or more people will not agree on aesthetic judgements and so it is not possible to form a concensus therefore reliable rules cannot be written.

Continued…

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Question 5

List three reasons for using an *ontology*.

[6 marks].

1) an ontology provides a common and shared language to describe the concepts of a domain and their relations

2) building an ontology leads to a greater understanding of a problem domain

3) an ontology allows different computer systems or agents share information or knowledge

[other reasonable reasons were accepted]

Question 6

Create a semantic network to describe a University course. Your network should include the concepts: *course*, *title*, *department*, *faculty*, *student*, *lecturer and pre-requisite*.

[14 marks]

There is no single correct semantic network but any reasonable diagram with the concepts as vertices (or nodes) and sensibly labeled directed edges (arcs) would get full marks. Indications or one-to-one, many-to-many...etc edges were also welcome.

[1 mark for each correct concept and 1 mark for each correct relations to a maximum of 14]

Continued…

Print Name:

Question 7

Define a CLIPS template to describe a car. Your car template should be able to handle the following information:
[10 marks].

```
ID:             registration number
Name:           car name
Type:           sedan, sports, station_wagon . . .
Manufacturer:   Ford, Holden, Toyota, Honda . . .
Owner:          name of owner
Transmission:   manual, automatic
Engine:         petrol, diesel, hybrid
Engine Size:    size in litres
Age:            age in years
Under-warranty: no, yes
```

```
(deftemplate car "a template for a car"
   (slot id)
   (slot name)
   (slot type)
   (slot manufacturer)
   (slot owner)
   (slot transmission)
   (slot engine)
   (slot engine_size (type number))
   (slot age (type number))
   (slot warranty (allowed-symbols T F)))
```

marks were no deducted for minor syntax errros and typing and allowed symbols or values were not necessary.

Continued…

Print Name:

Question 8

Define a CLIPS rule for the following pseudocode:

```
IF the test is computer_science
THEN the difficulty is hard
```

[4 marks]

```
(defrule hardTest
   (test computer_science)
   =>
   assert (difficulty hard)
 )
```

varients on this were allowed and minor syntax errors were not penalised

Question 9

What happens if you define two rules in CLIPS both called *computer_science* ?

[4 marks]

The second rule overwrites the first. This was not a question about salience.

Continued…

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PART B: Machine Learning

Question 10

What is another name for an *unbiased learning* algorithm?
[4 marks]

Question 11

What is the main difference between *concept learning*, *classification* and *regression*?
[6 marks]

Question 12

How are machine learning algorithms like search algorithms? Give an example of one hypothesis space.
[6 marks]

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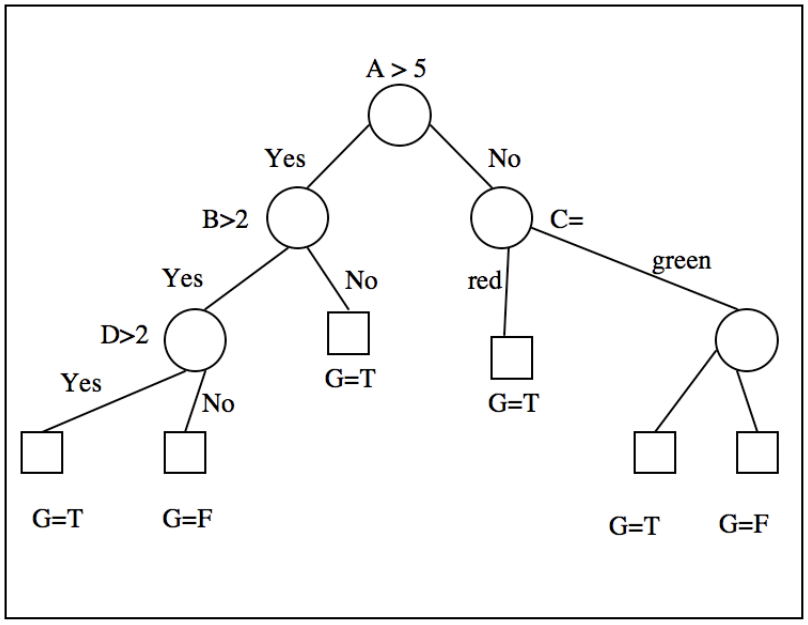
Question 13

How many rules does the decision tree below have? Write out 2 of the rules in propositional logic.
[6 marks]



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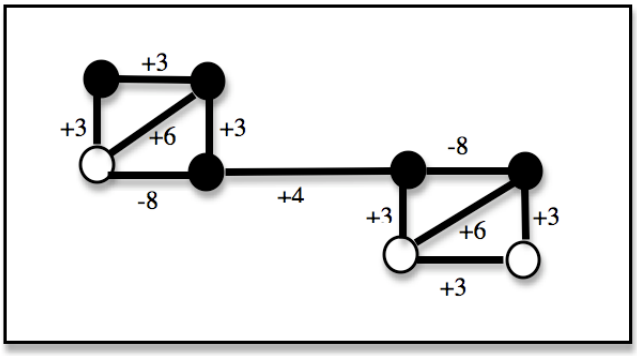
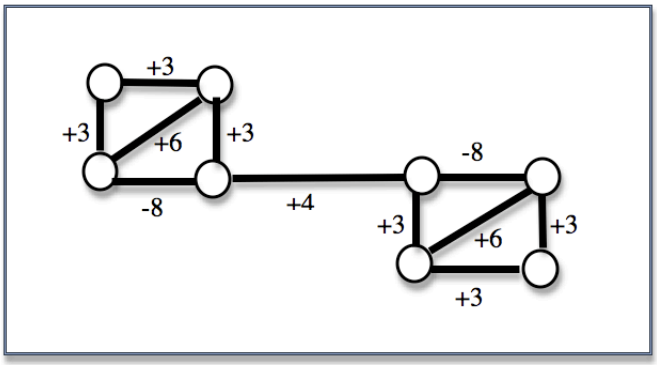
Question 14

What is the difference between the *bias* of an algorithm and the *variance* of an algorithm?
[6 marks]

Question 15



Given the Hopfield network above idicate the *stable state* on the network below?
[6 marks]



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Question 16

In Genetic Algorithms what is the *hypothesis space* and the *search bias*?
[6 marks]

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