FINAL EXAMINATION 2005
BACHELOR OF TECHNOLOGY PROGRAM - COMPUTER ENGINEERING

ECU 4308   Knowledge Engineering   010

Date: 2nd May 2006   **Time:** 13.30 – 16.30

Answer <u>ONLY FIVE</u> *questions:*

1.   (a)   Describe two knowledge Representation formalisms: production systems and Frame
          systems. Use appropriate examples to illustrate your answer.   (10 marks)

     (b)   Compare the two formalisms, showing under what circumstances the use of each would
          be more appropriate.
          Hint : (Consider the unit of knowledge, inference engine, relation between inference
          engine and knowledge base, standard of user or developer, etc)   (8 marks)

     (c)   Briefly explain the use of inference engine in a production system.   (2 marks)

2.   (a) Represent the following sentences by a semantic Network.   (12 marks)
          (i)   War-ship Ocean liner is a ship, and Oil tanker is a ship
          (ii)   Ship has a hull, ship has an engine
          (iii)   War ship has a missile-launcher
          (iv)   'Athena' is a war-ship
          (v)   'Zorro' is an oil tanker

     (b) Consider the six-argument **ship_info** facts given below. To represent them in a semantic
network, we need to convert each to a set of two-argument facts. Explain how this could be done.
Assume that six-argument facts only record the most recent position of a ship.

        `Ship-info(Athena,15n25e,1200,23Mar06,gray,j_kirk).`

     The above means "The Athena is a ship that was at 15N25E at 12 noon on March 23, 2006, and
its color is gray, and its captain is J.Kirk.   (8 marks)

3.   (a) Compare and contrast **four** search methods from the list given below.   (16 marks)
       i. depth-first   ii breadth-first   iii Hill-climbing   iv A* search
       v best-first   vi least-cost

     (b) Explain when and why is it important in knowledge engineering to apply heuristics.
                                                     (4 marks)

4.   (a) What is resolution refutation? Briefly explain.   (4 marks)

(b) Read the following sentences and prove that *'Kamal wins the lottery'*. You should be able to deduce the final statement from others. First change the English sentences to predicates and then convert to Clause form. (16 marks)

1. Anyone passing his Botany exams and winning the lottery is happy
2. Anyone who studies or is lucky can pass all his exams.
3. Kamal did not study but he is lucky.
4. Anyone who is lucky wins the lottery.

Hint: Prolog clause P(X) :- Q (X,Y) is equivalent to the logical expression

$\forall x : \exists y : Q(x,y) \rightarrow P(x)$

$\forall x$ *– for all,* $\exists y$ *- there exists,* $\lor$ *- or,* $\land$ *- and,* $\rightarrow$ *- material implication*

5. (a) Consider a domain consisting of people, books, and copies of books (volumes). Let **L** be a sorted first-order language with "person", "book", and "volume", and with the following nonlogical symbols:

Constants: Sarith, Navya, Tolstoy, Dickens
Predicates:
Owns(p,v): Person p owns volume v
Author(p,b): Person p wrote book b
Copy(v,b): Volume v is a copy of book B.

Express each of the following as a sentence in **L**: (12 marks)

i. If Navya owns a copy of a book, then Sarith owns a copy of the same book.

ii. There is some book that Sarith owns but Navya doesn't.

iii. Every author owns a copy of each of his own books.

iv Sarith owns all the books written by Tolstoy.

(b) Write a Prolog procedure to find the summation of elements in a numeric list. (8 marks)

6. (a) Explain how machine learning differ from Expert Systems. (6 marks)

(b) In expert systems what strategies are used to resolve conflicts or the evaluation criteria that could be used to evaluate which rule to fire (conflict resolution). (8 marks)

(c) Briefly discuss "when (i.e. in what situations) is Expert System development possible and when is Expert System development justified" (6 marks)

7. (a) Briefly explain how facts are represented in a Prolog program. (4 marks)
(b) Which of the following facts is a better knowledge representation? Explain. ("Better" means less likely to confuse people.) (4 marks)
   Color (aircraft, brown)
   Size (aircraft, small)
(c) Give three major problems in Expert systems development. (6 marks)

(d) How do the topics of knowledge representation and problem solving techniques relate to each other? (6 marks)

8. (a) Why does the search in game-playing programs always proceed forward from the current position rather than backward from goal state? (4 marks)

(b) Illustrate the use of min-max algorithm with an example. (8 marks)

(c) Give two alternative algorithms for searching two-player game trees instead of min-max algorithm. (2 marks)

(d) Briefly explain alpha-beta pruning with an example. (6 marks)