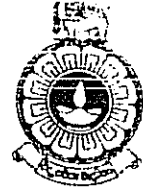


THE OPEN UNIVERSITY OF SRI LANKA
DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING



FINAL EXAMINATION 2005
BACHELOR OF TECHNOLOGY PROGRAM - COMPUTER ENGINEERING

ECX 6240 Knowledge Engineering

Date: 2nd May 2006

Time: 13.30 – 16.30

Answer ONLY FIVE questions:

1. (a) Describe two knowledge Representation formalism^s: 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) 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, \vee - or, \wedge - and, \rightarrow - material implication

4. (a) Select four search methods from the list given below and describe them by comparing and contrasting with each other. (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)
5. (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" Give examples to justify your answer. (6 marks)
6. (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) Suppose you want to store facts about when and where memos were sent in an organization. Which is the best Prolog format for such facts, and why? (6 marks)
- (i) $<date>(<name>, <author> <distribution>)$.
(ii) $Memo(<name>, <date>, <author>, <distribution>)$.
(iii) $Fact(memo, <name>, <date>, <author>, <distribution>)$.
- (d) Write a Prolog procedure to find the summation of elements in a numeric list. (6 marks)
7. (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)
8. (a) Compare and contrast expert systems and neural networks in terms of knowledge representation, knowledge acquisition and explanation ability. (7 marks)
- (b) Give three major problems in Expert systems development. (6 marks)
- (c) How do the topics of knowledge representation and problem solving techniques relate to each other? (7 marks)