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

FINAL EXAMINATION 2011/2012
BACHELOR OF TECHNOLOGY PROGRAM - COMPUTER ENGINEERING

ECX 6240 Knowledge Engineering

Date: 24th March 2012 **Time: 9.30 – 12.30 hrs**

Answer ONLY FIVE *questions:*

1. (a) (i) What is meant by an AI technique and what are the properties that a good AI technique should have? (5 marks)

(ii) Compare and contrast rule based reasoning and case based reasoning by explaining situations where these two reasoning are suitable. (6 marks)

(b) (i) Express the following English sentence in First Order Logic (predicate logic), using the given notation: (5 marks)

Anything not at rest perséveres in motion unless acted upon by an external force.
(R(x): x is at rest; P(x): x perseveres in motion; F(x,y): x is an external force acting upon y)

(ii) How does one express in First Order Logic the sentence "Every baby in the world is loved by at least one person."? (4 marks)

2. (a) Briefly explain how you would formulate a real world problem using search techniques in AI. (5 marks)

(b) Simple exhaustive search strategies have problems when attempting to navigate areas in the search space where no progress seems to be possible. List two searching methods that can be used to address this kind of problems. (4 marks)

(c) Explain the simple hill climbing search algorithm. When will it fail to find a solution? (5 marks)

(d) Illustrate a problem for which breadth first search will be just as effective as the uniform cost search. (4 marks)

(e) When does A* search behave same as the uniform cost search? (2 marks)

3. (a) The MINIMAX algorithm cannot handle some games (even when augmented with alpha-beta pruning) because of the depth of the search trees involved. What is the general solution used to handle such games? (4 marks)

(b) Given the MINIMAX search tree with the leaf values shown below, complete the values for the nodes in the upper levels of the tree. What is the best value that the MAX player can obtain? Assume **N1** is a maximizing node. (11 marks)

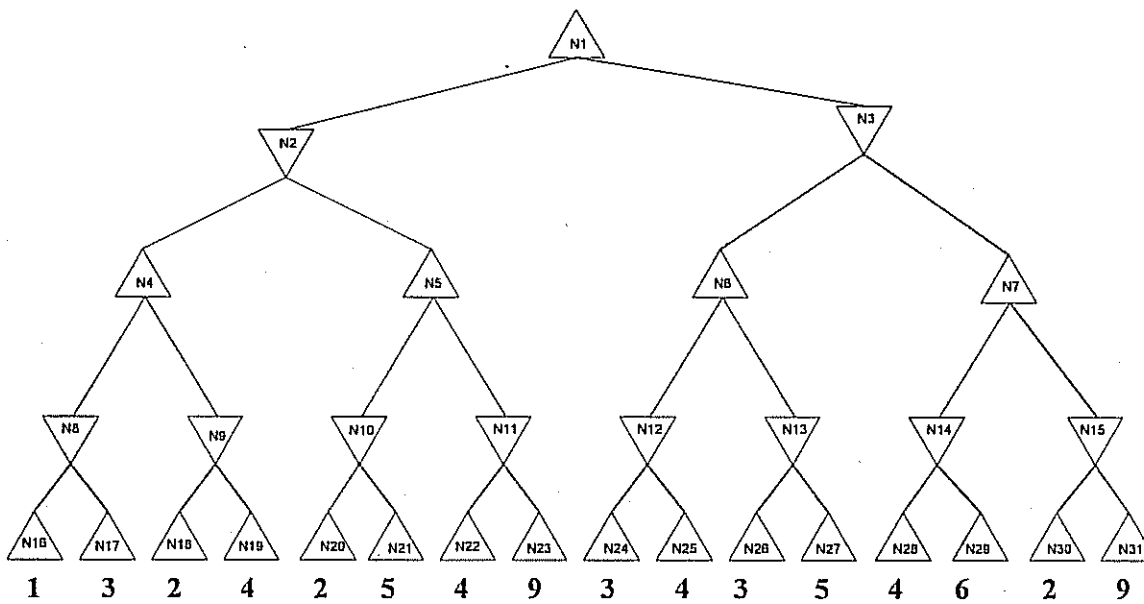


Figure 1

(c) In the MINMAX tree given as figure 1, specify which nodes would not be visited if the alpha-beta pruning method is used. (5 marks)

4. (a) What are the advantages in using expert systems to solve problems? Briefly describe 4. (4*2 marks)

(b) Not any problem can be modeled by an Expert System. Why would you use an expert system to solve a problem? List 5 reasons. (5 marks)

(c) Give an example of a problem you have encountered that you think would be suitable for **frame based representation.** (2 marks)
Briefly Explain what features make it so (3 marks)

(d) Name an important feature that should be in a language used for frame based representation. (2 marks)

5. (a) Translate the following English sentences into Prolog.

papaw, mango, pear, banana, orange are fruits.
Colour of banana is yellow.
Colour of pear and mango are green.
Ayuni likes all kinds of green fruits.
Ranuli likes all fruits that Ayuni likes.
All humans eat fruits.
Ayuni and Ranuli are humans. (7 marks)

(b) Write goals to extract the following information
What colour is mango?
What fruits are green?
What fruit has the same colour as pear?
Find two fruits that have the same colour. (8 marks)

(c) Write a predicate *myDelete* that deletes an element in position from a given list and returns the new list.
e.g. myDelete(3,[a,b,c,d,e,f,], L) should result in L = [a,b,c,e,f]. (5 marks)

6.

(a) Under which circumstances is the use of Genetic algorithms to solve a problem is beneficial? (4 marks)

(b) 'Cross over' is a critical feature of genetic algorithms. Briefly explain why it is so. (3 marks)

(c) Success of the solution to a problem solved by genetic algorithms largely depend on the fitness function applied. Do you agree with the statement? Justify your answer. (4 marks)

(d) With reference to the relevant concepts, explain why the following real world problems can be modeled by Genetic Algorithms (6 marks)
(i) Roster generation/work scheduling for TV stations, airports etc
(ii) Protein structure prediction

(e) Genetic algorithms can be used for designing neural networks. Can genetic algorithms be used for learning fuzzy rules from data? Justify your answer. (3 marks)

7.

(a) In each of the following cases, explain WHY Artificial Neural Networks (ANN) can be used for modeling the problem. Your answer must include relevant features of ANN that makes it most suitable.
(i) Recognition of handwritten characters
(ii) Stock market prediction
(iii) Pattern classification in a data set (2x3 marks)

(b) Briefly explain two approaches that can be used to train a set of data for supervised multilayer Artificial Neural Network. (Must write their learning rules) (6 marks)

(c) Write down the major steps in Backpropagation training algorithm to train a multilayer ANN in the supervised mode. (5 marks)

(d) Assume that after training an Artificial Neural Network, you find that it does not do data classification (or give output) as expected. List 3 reasons why it should happen so. (3 marks)

8. Consider the following part from an abstract of a published research paper on a "A Multi Agent Solution for Disaster Management"

"Problem solving in an environment where a disaster has occurred is difficult and dynamic, requiring rapid decisions before, during and after the event. So a disaster management system should cope with uncertainty, ambiguity and incompleteness given the dynamic and evolving nature of disasters. As the solution, a disaster management system based on agent technology has been implemented to provide proper management of resources and responsibilities for dealing with all aspects of disastrous situation, in particular preparedness, response and recovery in order to lessen the impact of disasters. The system is mainly consists of four agent swarms which are forces swarm, aid store swarm, hospitals swarm and information providers swarm. Each swarm consists of number of agents whose tasks are explicitly defined. Agent interaction is the source of generating the intelligence. Agent communication, coordination and negotiation capabilities provide the ways and means of handling the complex nature of the domain."

You may assume the type of natural disaster this system could be applied and answer the questions given below. Write your assumptions clearly.

(a) What properties in the proposed system make it a suitable application to develop with agent technology? (5 marks)

(b) Give a design for the system you propose for given (block diagram). (7 marks)

(c) What are the major attributes of a *Learning Agent?* (4 marks)

(d) From these attributes, which of these distinguish a learning agent from an ordinary agent? Briefly explain. (2 marks)

(e) What AI technique is frequently used to give the learning ability to learning agents? (2 marks)