UNIVERSITY *of* LIMERICK

OLLSCOIL LUIMNIGH

COLLEGE *of* SCIENCE *and* ENGINEERING

Department of Computer Science
and Information Systems

End of Semester Assessment Paper

Academic Year:	2008/2009	Semester:	Spring
Module Title:	Intelligent Systems	Module Code:	CS4006
Duration of Exam:	2½ Hours	Percent of Total Marks:	80
Lecturer(s):	Dr. M. Eaton	Paper marked out of :	80

Instructions to Candidates:

- Answer any FOUR questions.
- All questions carry equal marks.
- 20% in-term assessment 80% this exam

Q1. a) Describe the three different types of artificial neural network learning paradigms- supervised, unsupervised, and reinforcement learning. Give the advantages, disadvantages, and potential application areas of each type of learning.

10 Marks

b) What is a genetic algorithm? What are the basic operators associated with genetic algorithms? Outline the mathematical foundations of the field of genetic algorithm research, demonstrating that short defining length, low order, above average schemata receive exponentially increasing trials as generations progress. What is this fundamental result known as?

10 Marks

Q2. a) Specify the components of the ***Threshold Logistic Unit***, and the components of a natural neuron that they model. Illustrate how a TLU can be used to compute the following Boolean Functions

1. P OR Q
2. NOT P
3. P XOR Q
4. (P OR Q) AND NOT R

12 Marks

b) Describe the POE model of bio-inspired intelligent systems explaining the function of each of the three axes in this model. Outline how POE axes can be combined in order to create novel bio-inspired systems.

8 Marks

Q3. a) Briefly describe the operation of the best-first search algorithm. Using best-first search and generating the values of f(n) for each state as specified below, perform a best-first search of the 8-puzzle graph going from the given start state to the goal state, showing the successive stages of open and closed states that generate this graph.

f(n) = g(n) + h(n) where

g(n) = level of the search tree
h(n) = number of tiles out of place

Start state:

2	8	3
1	6	4
7		5

Goal state:

1	2	3
8		4
7	6	5

14 Marks

b) Define the notion of an admissible algorithm.

Is the heuristic h(n) used in the previous section admissible? Why?

6 Marks

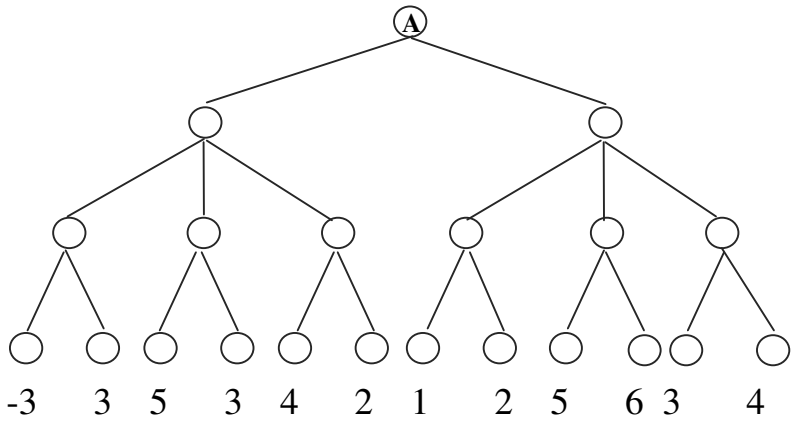
Q4 a) What is an Expert System? Outline and describe its components. Describe the ways in which inferences can be drawn in an Expert System, and how the designers of expert systems try to cope with *uncertainty* in the data and inference rules used by these systems.

10 marks

b) The following tree shows the evaluations for a set of possible moves in a game following on from your current position **A,** where it is your turn to play. Draw out the tree and *indicate on it* - using the principles of ***MiniMax*** search - which moves you would make in the tree (mark the nodes with an X) and which move your opponent would make (mark the node with a Y). Also indicate which levels are maximising and which levels are minimising levels relative to **A**.

Describe how you arrive at the choice, i.e. outline your application of ***MiniMax*** to the tree.

What are the limitations of MiniMax search and how can these limitations be addressed?



10 Marks

Q5 a) Specify in outline the procedure for Resolution.

10 Marks

b) Given the following sentence

when it is cold or it is icy it is winter and when it is hot it is summer

Now using:

I = it is icy

C = it is cold

H = it is hot

W = it is winter

S = it is summer

What does this sentence look like in clause form?

We are told that it is hot (H), now use resolution to prove that it is summer (S)

10 Marks