# UNIVERSITY *of* LIMERICK

OLLSCOIL LUIMNIGH

COLLEGE *of* INFORMATICS *and* ELECTRONICS

Department of Computer Science
and Information Systems

**End of Semester Assessment Paper**

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| Academic Year: | 2006/2007 | Semester: | Spring |
| Module Title: | Artificial Intelligence/ Intelligent Systems | Module Code: | CS4816/4006 |
| 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 assessments 80% this exam

Q1. 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 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.

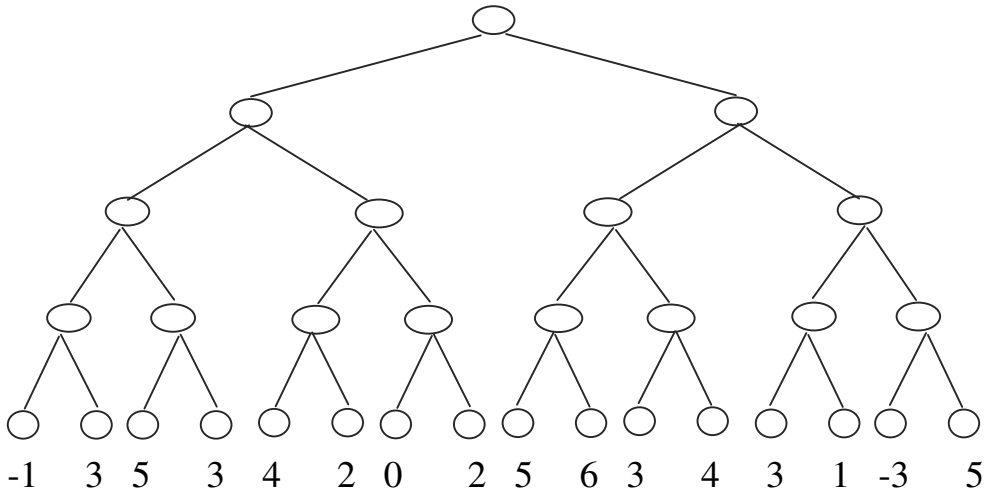
8 Marks

Q2 a) 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

b) The following tree shows the evaluations for a set of possible moves in a game following on from your current position **A**. Draw out the tree and <u>*indicate on it*</u> - using the principles of ***MiniMax*** search - which moves you would make in the tree (mark the node 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 very simply how you arrive at the choice, i.e. outline you application of ***MiniMax*** to the tree. What are the limitations of MiniMax search?




12 Marks

Q3. 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.

12 Marks

b) Given the facts

warm-blooded, lives in sea, large

And the following rules:

1. *warm-blooded* ***or*** *suckles young* ***mammal***
2. *lives in sea* ***aquatic***
3. *lives on ground* ***terrestrial***
4. *aquatic and mammal and large* ***whale***
5. *aquatic and mammal and small* ***dolphin***
6. *terrestrial and primate* ***baboon***
7. ***not*** *warm-blooded* ***and*** *lives in tree* ***tree frog***

Apply the production system inference mechanism in a forward fashion to establish the identity of the facts. Show the rules open to application and the chosen rule at each cycle and the contents of working memory.

8 Marks

Q4 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

Q5 a) Outline a set of design principles of design principles for embodied intelligent agents. Give some examples of the application of these principles in the design process.

8 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?

12 Marks