

W211C/405C, W228/405C, W8900/405C



DUBLIN INSTITUTE OF TECHNOLOGY

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**DT211C BSc. (Honours) Degree in Computer Science  
(Infrastructure)**

**Year 4**

**DT228 BSc. (Honours) Degree in Computer Science**

**Year 4**

**DT8900/1 International Pre Masters for MSc in  
Computing**

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**WINTER EXAMINATIONS 2015/2016**

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**ARTIFICIAL INTELLIGENCE 1 [CMPU4010]**

DR. JOHN GILLIGAN

FRIDAY 8<sup>TH</sup> JANUARY

9.30 A.M. – 11.30 A.M.

TWO HOURS

Answer Questions 1 and any two others.

Question 1 is worth 30 marks, all the rest are worth 35.

1:

The goal of work in artificial intelligence is to build machines that perform tasks normally requiring human intelligence. (Nilsson, Nils J. (1971), *Problem-Solving Methods in Artificial Intelligence* (New York: McGraw-Hill): vii.)

- a) Does the above statement capture the essence of Artificial Intelligence research?  
Give two reasons to support your answer.

(9 Marks)

- b) Describe two behaviours which, in your opinion, would be described as intelligent if performed by a human but which wouldn't be if carried out by a machine. In each case, give two reasons to support your choice.

(6 Marks)

- c) Define in your own words, what is meant by Artificial Intelligence?  
Outline three ways in which your definition improves on Nilsson's definition above.

(6 Marks)

- d) You have at your disposal the means to build the most intelligent computer system ever to perform any task of your choosing. To which task would you apply this system to and why? Your answer should include a description of the task, and describe four benefits that an intelligent system would bring to this task

(9 Marks)

2:

- a) Using the following set of clauses to prove  $a(X)$ , describe the process of resolution.

$$1: [a(X) \vee b(X)] \vee c(X)$$

$$2: \neg [c(X)] \vee d(X)$$

$$3: \neg [d(X)] \vee e(X)$$

$$4: \neg [e(X)] \vee \neg b(X)$$

(10 Marks)

Consider the following set of sentences.

**Everyone who is rich has a Rolls Royce**  
**Everyone who has a Rolls Royce has a big Garage**  
**Everyone is either Happy or Busy.**  
**All who are busy are either stressed or rich.**  
**Betty is not stressed and Betty has not got a Rolls Royce.**

- b) Convert these sentences to First Order Predicate Calculus. (7 marks)
- c) Convert the Predicate Calculus sentences of part b) to clause form. (9 marks)
- d) Use Resolution to determine whether or not Betty is happy (9 marks)

3:

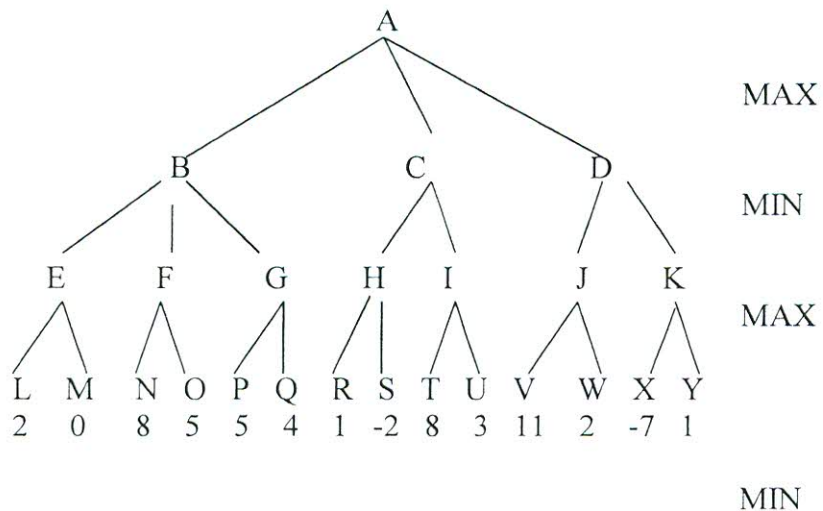
- a) Write an algorithm to perform unification of two expressions in list form. (10 marks)
- b) Why is there a need for an “occurs check” in your algorithm. Support your answer by tracing the execution of your algorithm with its occurs check suppressed, as it attempts to unify the following two clauses;  $p(X, f(X))$  and  $p(f(A), A)$  (9 marks)
- c) Unify if possible, each of the following pairs of expressions, or say that the expressions are not unifiable. (10 marks)
- i)  $p(g(f(V)), g(U))$  and  $p(X, X)$
  - ii)  $p(X, f(X))$  and  $p(Y, Y)$
  - iii)  $p(Y, Y, b)$  and  $p(Z, X, Z)$
  - iv)  $p(Y, g(a, b))$  and  $p(g(X, X), Y)$
- d) Demonstrate with an appropriate example, how unification can be used as the basis for a question/answering system. (6 marks)

4:

a) What briefly are we trying to achieve with MINIMAX searching?

(5 marks)

b) How would the MINIMAX algorithm evaluate the following tree?



Tree1

(13 marks)

c) Show how Alpha-Beta pruning could be applied to Tree 1 in part b) to reduce the search space. Also show how the effectiveness of Alpha-Beta Pruning is dependent on the order in which nodes are visited in the context of Tree 1.

(17 marks)