

R228/406

DUBLIN INSTITUTE OF TECHNOLOGY  
KEVIN STREET, DUBLIN 8

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# **BSc (Hons) in Computer Science**

**Stage 4**

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**SUPPLEMENTAL EXAMINATIONS 2009**

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**ARTIFICIAL INTELLIGENCE 2**

Dr. John Kelleher  
Prof. B. O'Shea  
Dr. I. Arana

Duration: 2 Hours

Answer Question 1 (40 marks) **and**  
any 2 Other Questions (30 marks each).

1. (a) In the context of machine learning, explain what is meant by **overfitting** the training data.  
(5 marks)
- (b) In the context of inductive learning explain what is meant by a **consistent hypothesis**.  
(5 marks)
- (c) Distinguish between **classification learning** and **regression learning**.  
(5 marks)
- (d) Briefly describe the **performance element** of a Decision Tree.  
(5 marks)
- (e) In the context of inductive logic learning, what is meant by the **extension** of a hypothesis?  
(5 marks)
- (f) Distinguish between the **generalisation** and **specialization** of a logical predicate.  
(5 marks)
- (g) In the context of machine learning distinguish between **false negatives** and **false positives**.  
(5 marks)
- (h) Construct by hand a neural network that computes the XOR function of two inputs. Make sure to specify what sort of units you are using.  
(5 marks)

2. (a) Suppose we generate a training set from a decision tree and then apply decision-tree learning to the training set. Is it the case that the learning algorithm will eventually return the correct tree as the training set size goes to infinity? Why or why not?  
(5 marks)
- (b) In the context of inductive logic learning, what is meant by the **extension** of a hypothesis?  
(5 marks)
- (c) Distinguish between the **generalisation** and **specialization** of a logical predicate.  
(10 marks)
- (d) For some data sets it is possible to devise multiple hypotheses that are consistent with the data. Describe a heuristic for choosing among multiple consistent hypotheses and explain why your heuristic is reasonable.  
(10 marks)
3. (a) Explain why a linear threshold perceptrons can represent the AND and OR functions but not the XOR function.  
(10 marks)
- (b) Describe the perceptron training rule?  
(10 marks)
- (c) Why does the perceptron learning rule converge toward successful weight values?  
(10 marks)