

A08902

THIS IS NOT AN OPEN-BOOK
EXAMINATION - CANDIDATES MAY
NOT CONSULT ANY REFERENCE
MATERIAL DURING THE SITTING.

Calculators may be used in this examination
provided they are not capable of being used to
store alphabetical information other than
hexadecimal numbers.

THE UNIVERSITY OF BIRMINGHAM

Degree of B.Sc. with Honours
Bioinformatics. Second Examination
Computer Science. Second Examination
Computer Science/Software Engineering. Second Examination
Computer Science/Software Engineering with Business Studies. Second Examination

Degree of BEng/MEng with Honours
Computer Science/Software Engineering. Second Examination

Joint Degree of B.Sc. with Honours
Mathematics and Computer Science. Second Examination

Joint Degree of B.A. with Honours
Computer Studies/English. Second Examination

Degree of MSc in Computer Science

Occasional American Studies

06 08775

Introduction to Artificial Intelligence

Tuesday 28th May 2002 1400 - 1600

Turn over

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[Answer ALL Questions]

1. Given a two input Threshold Logic Unit where the threshold $h = 2$ and $\underline{w} = (0.1, 0.5)$.
- (a) Apply the perceptron learning procedure for each pattern in turn, until the entire training set has been presented once. What are the values of h and \underline{w} at that point? Use a learning rate $\alpha = 0.5$

Inputs		Desired output
x_1	x_2	t
0	0	1
1	0	1
0	1	1
1	1	0

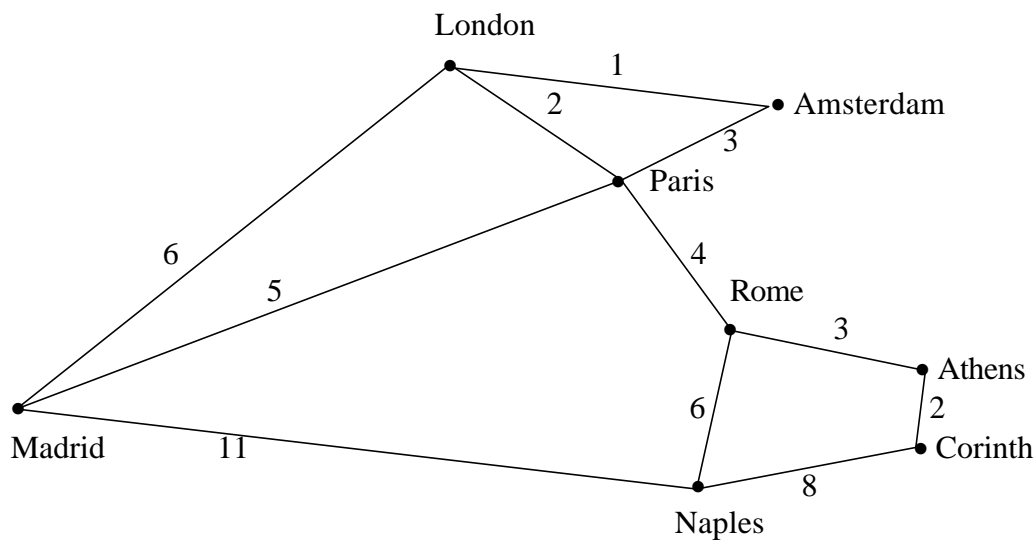
[12%]

- (b) Describe an alternative method for finding suitable weights to solve this problem and its likely effects. [7%]
- (c) Why are single neurons such as a Threshold Logic Unit not capable of learning to solve problems like the XOR function? Describe a way around this difficulty. [6%]

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2. In a travelling salesman problem your task is to find the quickest route that passes through all the cities in the map below. The times of travel between pairs of cities are marked on the map below:



You may not pass through cities more than once, but must start and finish in London (i.e. you must visit London exactly twice).

- Describe a heuristic estimate of the time left to travel given the set of cities that have been visited so far, and the current city. [6%]
- State whether or not your heuristic is admissible, and explain why. [7%]
- Use your heuristic to carry out the first six node expansions in A* search. [6%]
- Prove that A* search with an admissible heuristic of the cost to the goal will always return the shortest path. [6%]

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3. (a) Explain the meaning of the terms validity, satisfiability, inconsistency and entailment in propositional logic. [8%]

- (b) Use either resolution or resolution refutation, to show that the following sentence is a tautology.

$$((P \rightarrow R) \wedge (R \rightarrow Q)) \rightarrow (P \rightarrow Q) \quad [8\%]$$

- (c) Translate the following sentences into predicate logic.

- (i) All giraffes are tall
- (ii) Everyone is loved by someone
- (iii) Any block that is not on the table is on another block. [9%]

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4. Your company has been given data showing spending patterns for fraudulent (and non-fraudulent) credit card users. The data for each case is represented as five integer numbers indicating recent spending patterns, and three binary features indicating the types of purchases made. There are 1000 cases, 250 are positive and 750 are negative. All cases are labelled as either positive or negative.

Describe in detail how you would build a system capable of detecting fraudulent use. You should also describe your method for testing the system's reliability. You will receive credit for discussing the possible advantages and disadvantages of other techniques compared to yours (which need not be described in such detail as your chosen technique).

[25%]