

Ollscoil na hÉireann, Gaillimh
National University of Ireland, Galway

GX 1623

Semester II Examinations, 2002/2003

Exam Code(s)	4IF1, 4BS2
Exam(s)	B.Sc. in Information Technology B.Sc. (Hons.)
Module Code(s)	CT433
Module(s)	Advanced Studies in Information Technology
Paper No.	1
Repeat Paper	Special Paper
External Examiner(s)	Prof. P. Nixon
Internal Examiner(s)	Prof. G. Lyons, Mr S. Hill, Dr M. Schukat, Mr C. O'Riordan, Dr M. Madden

Instructions:

Answer questions from TWO sections only:

- Attempt Section A or Section B
- Attempt Section C or Section D

Use a separate answer book for each section.

Within a section, answer TWO questions.

All questions carry equal marks.

Duration	3 hrs
No. of Answer books	2

Requirements:

Handout	
MCQ	
Statistical Tables	
Graph Paper	
Log Graph Paper	
Other Material	

No. of Pages	5
Department(s)	Information Technology

Section A: Evolutionary Computation

NOTE: In this Section, answer Question 1 and one other question

1. (a) Outline using an example, how you would represent a state/action pair in a Learning Classifier System. (5)
- (b) With respect to Genetic Programming, explain the term “bloat” and outline briefly, the cause of bloat and three methods used to control bloat. (5)
- (c) When deciding whether or not to use a Genetic Algorithm, outline the factors which should be considered. (5)
- (d) The fitness function has been described as the hardest and most important concept of Genetic Programming. Describe, using a number of different problems, how you would decide upon the fitness. (5)
- (e) Outline the main differences between Evolutionary Programming and Evolutionary Strategies. (5)
2. Describe how a Genetic Algorithm works, outlining Holland's Schema Theorem and the Building Block Hypothesis. (25)
3. (a) With regard to Genetic Programming, describe the genetic process of reproduction between two parental programs, selected on the basis of fitness, to create new offspring. Use diagrams to illustrate your answer. (15)
- (b) Genetic Programming continues the trend of dealing with the problem of representation in Genetic Algorithms. Discuss. (10)

Section B: Mass Storage Technologies & Storage Area Networks

4. (a) Distinguish between the *interleave* and the *track skew* of a hard disk. (3)
- (b) Outline the principle of the recording methods *FM*, *MFM* and *RLL*. (6)
- (c) Distinguish between the *CHS* (Cylinder, Head, Sector) and *LBA* (Logical Block Access) scheme. What are the benefits of *LBA*? (5)
- (d) Outline some core features of a file system and make suggestions for their implementation. How can *I-nodes* be used to implement a file system? (11)
5. (a) Distinguish between the different mass storage device types and write an essay on the “state-of-the-art” of storage devices and storage device technology. Where do you think will mass storage technology stand in five years time? (13)
- (b) Write an essay on SCSI (Small Computer System Interface) outlining
- different hardware options and features,
 - the SCSI device model,
 - possible SCSI configurations,
 - the SCSI command model and CDB (Command Descriptor Block) structure
- Distinguish between a *simple SCSI data transfer* and a *data transfer using reselection through disconnection and reconnection of the target* giving an example for both. (12)
6. (a) What is a *NAS* (Network Attached Storage) *server*? Outline the advantages and disadvantages of this technology. (7)
- (b) What is a *SAN* (Storage Attached Network) and what are the benefits of this new storage paradigm? Give examples to illustrate your answer. (10)
- (c) Distinguish between the RAID levels *RAID 1* to *7* and *RAID 10*. (8)

Section C: Multi-Agent Systems

7. (a) The concept of an agent is usually defined by listing the properties that agents exhibit. Identify and explain the properties you would associate with the concept of an intelligent agent. (8)
- (b) "Multi agent systems represent a *new* and *powerful* approach to designing and deploying software systems." Discuss. (7)
- (c) The contract net protocol has been used as means to coordinate activity among a set of agents solving a task. Describe the contract net protocol and identify the types of problems that you consider suitable for the contract net protocol. (10)
8. (a) Define the *prisoner's dilemma* and the *iterated prisoner's dilemma*. Under what circumstances is it rational to cooperate in the *iterated prisoner's dilemma*. (10)
- (b) Discuss the advantages and disadvantages of adopting game-theoretic approaches to analysing, and reasoning about, agent interactions. (6)
- (c) Explain what is meant by "Speech Act Theory". Discuss the role of this theory in the design and development of agent communication languages. (9)
9. (a) Auctions and auction theory have been used as a means to allow agents reach an agreement. Identify the main type of auctions that can be used, discussing their relative strengths and weaknesses. (12)
- (b) Negotiation among a set of agents usually involves a negotiation protocol and a negotiation object. Explain the underlined terms. (4)
- (c) What are the minimum requirements agents should have to facilitate negotiation? What additions are usually required to ensure that negotiation occurs more efficiently? (9)

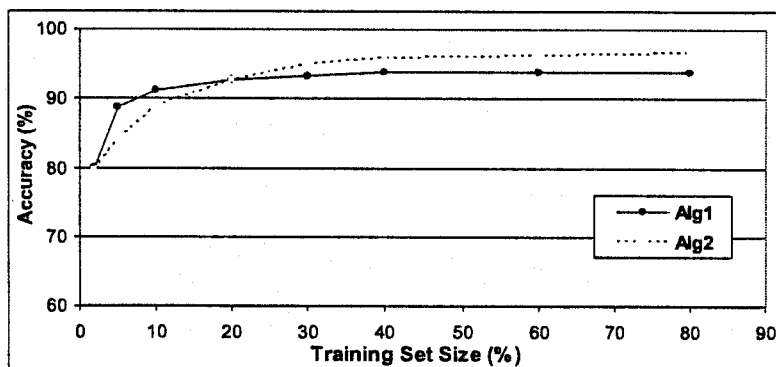
Section D: Machine Learning

10. (a) What functions can be represented using a feed-forward neural network? Explain. (5)
- (b) What are the back-propagation algorithm's main weaknesses and what steps can you take to overcome them? (5)
- (c) You have received the following email message from a medical consultant. Prepare a detailed response.

I want to be able to predict whether brown spots on a patient's skin are cancerous or not, based on past experience, and I'd like to be able to understand the basis for predictions. I have gathered a database of 500 cases, 100 of which were cancerous. In each case I have noted whether the size is small, medium or big, the darkness (on a scale of 1 to 5), whether the spot is regular or irregular, skin tone (fair, medium, dark) and patient details (gender, age group, occupation, etc.). I don't know if all of these are relevant. I have heard that neural networks are good for prediction. What would you recommend?

(15)

11. (a) Describe an algorithm for construction of decision trees from examples, including an explanation of the Information Gain measure. (8)
- (b) One characteristic of decision trees is potential instability. Discuss this. (7)
- (c) The figure below shows two learning curves that have been constructed by analysing the same dataset with two different learning algorithms. Comment on what information you can gather from studying the figure. (10)



12. (a) Discuss the different ways of measuring 'nearness' in the k-Nearest Neighbours algorithm. (5)
- (b) Distinguish, using examples, between lazy and eager learning. (4)
- (c) Explain what is meant by the "curse of dimensionality". Outline two approaches to dealing with it. (8)
- (d) Describe in detail the filter and wrapper approaches to feature subset selection. (8)