

Ollscoil na hÉireann, Gaillimh
National University of Ireland, Galway

GX 2240

Semester 1 Examinations, 2005

Exam Code(s)	1MF1, ISD1
Exam(s)	MSc in Software Design and Development Higher Diploma in Software Design and Development
Module Code(s)	CT518, CT853
Module(s)	Algorithms and logical methods
Paper No.	1
External Examiner(s)	Prof. S. McClean
Internal Examiner(s)	Dr. M. Madden Dr. Conn Mulvihill

Instructions: Answer any 3 questions.
All questions carry equal marks.

Duration	2 hrs
No. of Answer Books	1
No. of Pages	1
Department(s)	Information Technology

1.

- (a) Explain what is meant by the term 'steganography' (6 marks)
- (b) 'Simple approaches to hiding information in an image make use of least significant bits'. By considering a 24-bit image of size $M \times N$, $M, N > 0$, explain how this type of hiding works and estimate how much information could be hidden in a single image of this type using your approach (13 marks)
- (c) How might formatting commands be used to hide a simple message in a web page? (6 marks)

2.

- (a) Briefly explain the terms 'propositional logic' and 'first order logic' (8 marks)
- (b) Explain what is meant by the following terms: modus ponens, modus tollens (8 marks)
- (c) 'Arguments sometimes work by demonstrating that assuming the opposite leads to an absurdity. So if we want to prove p , we assume $\neg p$, show that $\neg p$ leads to q , and then show that q is false. Hence p is true' By considering the above statement, or otherwise, explain the connection between the deductive forms 'modus tollens' and 'reductio ad absurdum' (9 marks)

3.

- (a) What do you understand by the term 'data compression'? (5 marks)
- (b) Explain why fax machines make use of compression techniques? (8 marks)
- (c) By considering the string abbaabbaababb show how an LZ/dictionary approach to lossless compression works (12 marks)

4.

'Search algorithms are used in pathfinding applications. Sometimes uninformed approaches like depth-first or breadth-first search are employed.'

Consider the following information about nodes in a tree:

A is connected to B. A is connected to C.

B is connected to A. B is connected to D. B is connected to E.

C is connected to A. C is connected to F. C is connected to G.

D is connected to B. E is connected to B.

F is connected to C. G is connected to C.

- (a) Explain what is meant by a depth-first search and give the order for visiting nodes in a depth-first search of the above tree, beginning at A (8 marks)
- (b) Explain what is meant by a breadth-first search and give the order for visiting nodes in a breadth-first search of the above tree, beginning at A (8 marks)
- (c) Given the branching factor of 2, and considering A to be level 1, how many nodes exist at level 5 and at level 10 in this tree? (9 marks)

5. 'Iteration and recursion are powerful approaches to problem-solving.' Discuss this statement, explaining 'iteration' and 'recursion' in the course of your answer (25 marks)