

Ollscoil na hÉireann, Gaillimh
National University of Ireland, Galway

GX 1501

Semester II Examinations, 2003/2004

Exam Code(s)	<u>1IF1</u>
Exam(s)	<u>IF1 B.Sc. (Information Technology)</u>
Module Code(s)	<u>CT102</u>
Module(s)	<u>Algorithms & Information Systems</u>
Paper No.	<u>1</u>
Repeat Paper	<u>Special Paper</u>
External Examiner(s)	<u>Professor P. Nixon</u>
Internal Examiner(s)	<u>Professor G. Lyons</u>
	<u>Dr. M. Mc Gettrick</u>

Instructions

Answer 5 questions.
All questions will be marked equally.

Duration	<u>3hrs</u>
No. of Answer Books	<u>1</u>

Requirements

Handout	<u></u>
MCQ	<u></u>
Statistical Tables	<u></u>
Graph Paper	<u></u>
Log Graph Paper	<u></u>
Other Material	<u></u>

No. of Pages	<u>3</u>
Department(s)	<u></u>

1. Using each of the following methods, write down (step by step) the position of each letter in the string "basel" when sorted alphabetically using
 - (a) quick sort
 - (b) insertion sort
 - (c) bubble sort

2. (a) Draw a Binary Search Tree for the data

{Jaen, Pamplona, Cadiz, Madrid, Oviedo, Vigo, Bilbao, Murcia}.

State how many comparisons are necessary in a search of this tree to verify that *Granada* does not occur.

- (b) A Binary Tree of depth 7 has 64 data elements in level 7. Determine the minimum depth of a ternary tree that can store an equal amount of data elements.
3. (a) Rewrite the following pseudocode using FOR instead of REPEAT...UNTIL.


```

c ← 0
REPEAT
  c ← c+2
  OUT(c)
UNTIL (c>100)
      
```
 - (b) Two algorithms A1 and A2 are known to be $O(n^3)$ and $O(3^n)$ respectively. For an input of $n = 10$, both run in 5 milliseconds. Estimate the time each algorithm will take for $n = 11$.

4. The Fibonacci Numbers are given by the sequence

0, 1, 1, 2, 3, 5, 8, 13, 21, 34, ...

i.e. $f_0 = 0$, $f_1 = 1$ and $f_n = f_{n-1} + f_{n-2}$ for $n > 1$. Write (in pseudocode) two different algorithms to calculate the n th fibonacci number, one of which uses recursion and the other iteration. State the complexity (in "Big Oh" notation) of both algorithms, and which is more efficient.

5. (a) Explain the difference between the *Stack* and *Queue* Abstract Data Types (ADT).
- (b) Using Stack and Queue ADTs, write the pseudocode for an algorithm to determine whether or not a given word is a palindrome. (A palindrome is a word that reads the same when spelt backwards, e.g. KAYAK, POP, DEED.)

6.
 - (a) Explain what is meant by the *degree* of a relation and the *cardinality* of a (binary) relation.
 - (b) Give an example (using an Entity Relation Diagram) of how to decompose a ternary relation into binary relations.
 - (c) Explain how multi-valued attributes may be removed from an Entity Relation Diagram.

7. Explain the difference between
 - (a) Data and Information
 - (b) A database and a file based system
 - (c) A single-valued and a multi-valued attribute
 - (d) A unary and a binary relation

8. Explain what an Association Rule is in Data Mining. Define the *support* and *confidence* of an Association Rule and explain how they can be used to determine its validity.