

Ollscoil na hÉireann, Gaillimh
National University of Ireland, Galway

GX 1605

Semester II Examinations, 2002/2003

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 "hamburg" when sorted alphabetically using
 - (a) quick sort
 - (b) merge sort
 - (c) selection sort

2. On a certain street there are 6 businesses, all next to one another, for sale. We know that these businesses make profit/loss of 12, 1, -4, -2, 8, 7 KiloEuro per year. Ignoring the cost of obtaining the business, we want to buy a number of these businesses to maximize our yearly profit, subject to the rule that businesses bought must neighbor each other.
 - (a) Write a Brute Force algorithm that determines which businesses we should purchase.
 - (b) If we use the Greedy strategy, what answer do we obtain? Is this the best possible solution?

3. Write two (2) algorithms each (one must use iteration, the other recursion) for each of the following two problems:
 - (a) Calculation of x^n . x is any number, and n is a positive integer.
 - (b) Determination of whether or not a given input word is a palindrome. You should represent the (n letter) word as $w(1), w(2), \dots, w(n)$. A palindrome reads the same when spelt "backwards", e.g. deed, kayak, dad,...

4.
 - (a) Give the definition of "Big Oh" notation.
 - (b) State the complexities (in "Big Oh" notation) of the sorting algorithms in question 1. (if there is a difference, quote the "best case" and "worst case" behaviours).
 - (c) Two algorithms A1 and A2 are known to be $O(n^2)$ and $O(n!)$ respectively. For an input of $n = 20$, both run in 5 milliseconds. Estimate the time each algorithm will take for $n = 21$.

5.
 - (a) Explain the "Divide and Conquer" algorithm design strategy, and give an example of its use.
 - (b) For the Abstract Data Type (Ordered) List $L(i)$, with index i and operations `retrieve`, `insert`, `delete` simplify each of the following:
 - (i) `retrieve(insert(L,i,x),i+1)`
 - (ii) `retrieve(delete(L,i-1),i-1)`
 - (iii) `delete(insert(L,i,x),i)`

6. (a) For the List() Abstract Data Type (ADT), write pseudocode (using operations defined on List()) for a function Swap(L,i,j) which swaps the elements L(i) and L(j) in the list.
- (b) Distinguish between each of the following:
- (i) Stack and Queue
 - (ii) FIFO and LIFO
 - (iii) Push and Pop
7. Explain the following database terms/ideas:
- (a) 3 schema architecture
 - (b) Entity Relationship Diagram
 - (c) Single and Multivalued Attributes
 - (d) "One to one" and "one to many" relationships
 - (e) Record and Field
8. In different countries, records are kept on the car colors that are most popular. For countries C_1 to C_4 the most popular colors are given below.

C_1 : {blue, red, black, brown}

C_2 : {red, yellow, brown}

C_3 : {black, white, red}

C_4 : {red, green, black, brown}

Beginning with large 1-itemsets, list all large itemsets (that are above a threshold of 70%). Write down any Association Rules that arise from these large itemsets, and calculate associated support and confidence values to determine if the Rules are valid at our threshold level.