NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
FACULTY OF APPLIED SCIENCE
COMPUTER SCIENCE DEPARTMENT
MAY EXAMINATIONS 2005

SUBJECT: DATA STRUCTURES AND ALGORITHMS
CODE: SCS2103

INSTRUCTION TO CANDIDATES

Answer any five questions. Paper contains Six questions.

Time: 3 hours

QUESTION ONE

Assuming the following definition:
typedef struct item
{ int num;
  struct item * left;
  struct item * right;
}node;

Write a function that will accept a binary search tree and a node and insert the
node in the appropriate location.   [20]

QUESTION TWO

Write a function exchange that will accept an array of integers and sort it using
the exchange sort then return the sorted array   [20]

QUESTION THREE

Explain the following algorithms using suitable examples:
  a) Greedy   [10]
  b) Divide and conquer   [10]

QUESTION FOUR

Write a function that will accept an integer n and generate a single linked list with n nodes. It should generate the list by always inserting a node at the center of the list. [20]

Assuming that the head of the list is position 1, then the following hold:

Current length of list	position to insert new node	new length of list
1	2	2
2	2	3
3	2	4
4	3	5
5	3	6
e.t.c		

i.e if int k represents the current length of list, then for k>2 insert at position k/2 +1

QUESTION FIVE

a) Why is it important to free dynamically allocated memory? [2]
b) Which function serves a similar purpose as the free( ) function but on a different data structure? [2]
c) What determines the size of a pointer variable? [2]
d) What performance attributes of a program are used to determine its efficiency? [2]
e) Why is it necessary to declare a variable before it is used? [2]
f) What is the advantage of double linked lists over single linked lists? [2]
g) Consider the 0/1 knapsack instance: n=4, w[1:4] = [20,25,15,35], p[1:4] = [40,49,25,60], and c = 62.
    i. Draw the solution space organization for 0/1 knpsack instances when n = 4. [4]
    ii. Trace the working of a backtracking algorithm on this organization on the above instance. Label the nodes in the order in which the backtrack algorithm first reaches them. [4]

QUESTION SIX

The file "names.dat" contains first names separated by a space. Your task is to arrange the names in the file in ascending order using a function that accepts and returns a file pointer only. [20]

END OF QUESTION PAPER