KENYA METHODIST UNIVERSITY

END OF 2ND TRIMESTER 2010 EXAMINATIONS

SCHOOL   :   SCIENCE & TECHNOLOGY
DEPARTMENT   :   COMPUTER SCIENCE AND BUSINESS INFORMATION
UNIT CODE   :   CISY 212
UNIT TITLE   :   DATA STRUCTURES AND ALGORITHMS
TIME   :   2 HOURS

INSTRUCTIONS
**Answer question 1 and any other TWO from the four questions set
**Marks are awarded for clear and concise answers

Question 1[Compulsory]
(a)   List two basic ways of representing linear structures in memory   [2 marks]
(b)   List THREE most common types of graph representation   [3 marks]
(c)   Differentiate between functional, and data abstraction   [2 marks]
(d)   Suppose that STACK is allocated N=6 memory cells and initially STACK is empty, or in
        other words TOP: =0.Find the output of the following module. Show the logic
                                                                                 [4 marks]

1. Set AAA: =2 and BBB: =5
2. Call PUSH (STACK, AAA)
3. Call PUSH (STACK, BBB+2)
4. Call PUSH (STACK, 9)
5. Call PUSH (STACK, AAA+BBB)
6. REPEAT WHILE TOP<>O
      Call pop (STACK, ITEM)
      Display/Print (ITEM)
[End of Loop]
Return

(e)   Given a 25 * 4 matrix, DATA, such that Base (DATA) =200 and that there are 4 words per
        memory cell.
        (i)   Explain how matrices of the same category as DATA are represented in the
                computer's memory   [2 marks]
        (ii)   Assuming a programming language that uses;
                (a)   row-major order
                (b)   Column-major order
                 Compute the address of DATA [12, 3]   [6 Marks]

(f)   Information held about a student at the admissions office comprises the record.

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Give a STUCTURE type Definition that could be used to declare a variable STUDINFO, of type STUDREC, which holds the information of individual student   [3 marks]

(g)   Give a recursive function that accepts the base,p,and power,q,entered from the keyboard as its input and computes and displays p raised to $q(P^q)$ [6 marks]

(h)   What do you understand of the term hash function   [2 marks]

Question 2

(a)   Using the following weights, construct a Huffman tree {9, 4, 7, 2, 5, 14}   [8 marks]

(b)   Perform an heap sort on the list 35, 15, 77,60,22,41   [7 marks]

Question 3

(a)   (i)   Define a stack ADT   [2 marks]
        (ii)   Compare the sequential search with binary search   [2 marks]

(b)   Show how the following items; 40 50 30 can be implemented in stack ADT as an array   [2 marks]

(c)   Consider the algorithm below that finds mean of a set of n numbers stored in an array:

1.   Initialize the index variable, i, to 0
2.   Initialise the index variable, i, to 0
3.   When i<n do the following
4   (a)   increment i by 1
       (b)   Add x[i] to sum
5.   Calculate and return mean as sum/n

Using the 'big oh' notation, show that $T(n)=O(n)$ [4 marks]

(d)   Write pseudo code for a binary search tree. Assume the array is already sorted
                                                                        [5 marks]

Question 4

(a)   Write a code (any language preferably c++) to implement the POP and PUSH functions of STACK ADT [6 Marks]

(b)   Write down the adjacency matrix for the graph below   [6 marks]
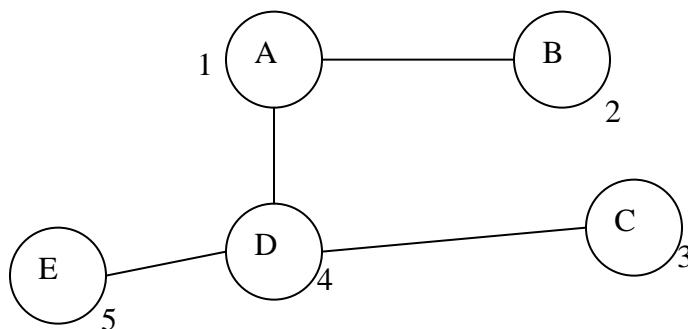
(c)   Define a binary tree and outline Two of its properties   [3 marks]